No. 142, Original

In the

Supreme Court of the United States

STATE OF FLORIDA,

Plaintiff,

v.

STATE OF GEORGIA,

Defendant.

Before the Special Master

Hon. Ralph I. Lancaster

STATE OF FLORIDA'S MOTION *IN LIMINE* TO PRECLUDE EXPERT TESTIMONY BY DR. SUAT IRMAK AND MEMORANDUM IN SUPPORT THEREOF

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September 16, 2016

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The State of Florida hereby moves *in limine* pursuant to Federal Rule of Evidence 702 to exclude proposed testimony by the State of Georgia's designated expert agricultural engineer, Dr. Suat Irmak, regarding three specific topics: (1) the "reasonableness" of Georgia's agricultural regulatory policies and procedures in the Apalachicola-Chattahoochee-Flint ("ACF") Basin; (2) the nature of the soil cultivated in southwest Georgia; and (3) the feasibility of reducing agricultural water consumption in that area. Dr. Irmak's proposed expert opinions on these three specific topics fail to satisfy the basic standards of Federal Rule 702, *Daubert v. Merrell Dow Pharmaceuticals, Inc.*, 509 U.S. 579 (1993), and related case law. The grounds and authority in support of this motion are set forth in the accompanying Memorandum in Support of Florida's Motion *In Limine*, and the exhibits thereto.

Dated: September 16, 2016

Respectfully submitted,

/s/ Phillip J. Perry

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INTRODUCTION

One of the central issues in this case is whether Georgia's agricultural irrigation practices in the Flint River Basin have substantially reduced the amount of water flowing to Florida's Apalachicola River, particularly in dry and drought years. Complaint ¶¶ 46-51. Florida will present evidence at trial demonstrating that this irrigation—which is fed both from surface water withdrawals and groundwater pumped from underground aquifers (principally the Upper Floridan Aquifer)—has grown exponentially since 1970. Since 1999, both Georgia's Flint River and Florida's Apalachicola River have experienced several years with lower river flows than at any prior time in recorded history. Severe low flows over that period, and particularly in 2011-12, were so bad that the key Spring Creek tributary in the Flint River Basin ran entirely dry over many miles of its length for months at a time. During this time, Georgia substantially exceeded its own "sustainability" criteria for groundwater irrigation pumping from the Floridan Aquifer and saw Flint River flows fall dramatically below Georgia's own, separate sustainability criteria for that river. Unfortunately, these severe impacts were entirely predictable. *Georgia's own internal documentation*, dating back nearly *20 years*, repeatedly acknowledges the significant potential impact of Georgia's irrigation:

> In southwest Georgia there are approximately 3000 wells in the Floridan aquifer which we believe can affect the flow of the Flint River in bad droughts. The big springs on the bottom of the Flint River from Albany on down to Bainbridge, which supply a substantial part of the base flow of the Flint River in this section, are all fed by the Floridan aquifer. When thousands of irrigation systems are operating during dry weather, such as we have been having this year [1999], one can see a significant reduction in Flint River flows.[1]

To address irrigation issues in this case, Georgia engaged as an expert witness an agricultural engineer from the University of Nebraska (Lincoln), Dr. Suat Irmak. Dr. Irmak's

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[1] *See* Attachment 1, Letter from H. Reheis, former Dir. of Ga. Envtl. Prot. Div. to J. Butler (June 1, 1999).

153-page expert report offers opinions on a wide range of issues. On one hand, Dr. Irmak estimates that surface and groundwater pumping for Georgia's agricultural irrigation resulted in a peak depletion of ***1407*** cubic feet per second ("cfs") in July 2012 of river flow to Florida; to put that in context, the remaining mean monthly flow of the Flint River that month was only ***1410*** cfs at its southernmost gage (Bainbridge).[2] *See* Attachment 2, Expert Report of Suat Irmak, Ph.D. at 31 (May 20, 2016) ("Report"). On the other hand, Dr. Irmak seeks to present dozens of opinions, all to support the proposition that ***Georgia should not be required to take any additional steps to reduce agricultural irrigation*** in the Flint Chattahoochee River Basins.

This motion in *limine* focuses narrowly on three specific opinions to be offered by Dr. Irmak. ***First***, Dr. Irmak offers an opinion—at pages 48-63 of his Report—that, as a whole, Georgia's regulatory "policies and procedures" for managing agricultural water use in the ACF Basin are "reasonabl[e]," "proactive," "responsible" and "progressive." Attachment 2 at 48, 63. Although Dr. Irmak lists and describes what he believes to be the relevant Georgia regulatory policies and requirements (often just paraphrasing publicly available Georgia documents), ***he does not compare Georgia policies to the standards applied in any other state, and offers no other standard, test or discernable criteria for assessing whether those listed policies and requirements are in fact "reasonable," "proactive," or "responsible," under the circumstances***. Dr. Irmak does not even explain how or why he reaches his conclusions, and he candidly admitted that he lacks the qualifications to perform any relevant comparative analysis. In these and other respects, Dr. Irmak's proposed testimony at pages 48-63 of his Report runs

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[2] In other words, even Georgia's own experts admit that agricultural irrigation is substantially depleting its Flint River Basin rivers, consuming nearly half their flow. Florida's experts will show that the peak impacts are even greater than Dr. Irmak's estimates. Georgia's agricultural water consumption is depleting Flint River Basin surface water flows in key months and causing flows to fall dramatically below Georgia's own sustainability criteria and Federal requirements and guidelines.

afoul of the fundamental tenets of Federal Rule of Evidence ("FRE") 702 and pertinent case law.

Second, Dr. Irmak reached the following conclusion at pages 12-13 of his Report: "Because southwest Georgia has extremely sandy soils (e.g. > 80-95% sand; 0.5 or less organic matter content), the soil-water holding capacity of ***most agricultural soils*** *in the Georgia portion of the ACF Basin* is also very low (*e.g.,* 0.5-0.7 inch per ft of soil layer or less)." Report at 12 (emphasis added). Based upon that conclusion, Dr. Irmak also opined that "[i]n the summer growing season, center pivot irrigation systems must be used frequently to ensure crop health, promote crop growth and sustain profitability." *Id*. But Dr. Irmak provided *no information of any kind* with his Report supporting his conclusion that "most agricultural soils in Georgia" have "0.5-0.7 inch per f[oo]t" of soil-water holding capacity. *Id.* At his deposition, Dr. Irmak suggested that he may have checked a U.S. Department of Agriculture ("USDA") website at some point in the past to obtain that information but he had *no records confirming that he did so or demonstrating what he found on the website*. Irmak Dep. 173:3-22, 193:16-25 (Attachment 15). In fact, an analysis of the data in that website demonstrates that *less than 10 percent* of cultivated Georgia soil in the Flint and Chattahoochee Basins—not "most" Georgia soil as Dr. Irmak concluded—is of the extremely sandy character he described (*i.e.* with 0.5-0.7 inches of water holding capacity). Because Dr. Irmak offered no support at all for his conclusions regarding Georgia soil types, he should not be permitted to give *any* testimony regarding or arising from his conclusions regarding their respective soil-water holding capacity.

Third (and relatedly), Dr. Irmak also opined that it would not be feasible for Georgia farmers to reduce or cap the amount of water they currently use to irrigate without suffering extensive crop losses. *See* Report at 18-19. But when Dr. Irmak was presented with a USDA study proving otherwise, he specifically admitted that he (1) *did not study* whether Georgia

farmers could feasibly *limit* the amount of irrigation water used during the growing season; and (2) was unaware that roughly half of Georgia ACF farms use no irrigation at all. Irmak Dep. 648:20-650:2, 765:16-766:6. Because Dr. Irmak did not evaluate these particular issues, he should not be allowed to testify on these topics.

BACKGROUND

A brief background of Georgia's regulatory history for ACF irrigation will help frame the issues presented by this motion. As an initial matter, Georgia (like Florida) is a riparian rights state, meaning that all users of water—including all agricultural users—are only entitled to "reasonable" uses of surface or ground water under the then-present circumstances:

> Georgia is a "regulated riparian[]" state which provides property owners with "reasonable use" of the waters flowing on, or past, or under their property. However, Georgia laws also demand that all potential users be guaranteed that use, meaning that a resource cannot be so over-allocated that legitimate, potential users (such as new farmers) do not have water for their needs.[3]

Georgia was aware that ground and surface water was over-allocated in the Flint Basin beginning early in the 1990s. *See* Attachment 3, Letter from H. Reheis, former Dir. of Ga. Envtl. Prot. Div. to W. Westermeyer, Senior Analyst, U.S. Congress at 1 ("Georgia has another area of potential groundwater overdraft that is in the southwestern corner of the state where there have been large withdrawals made in the last two decades for the irrigation of crops."). By the late 1990s, the issue reached a crisis point: so many irrigation permits had been granted that Georgia's modeling predicted that the entire Flint River could dry up in a bad drought. Attachment 1 at 3. In a series of 1999 letters, the director of Georgia's Environmental Protection Division ("EPD") explained how the problem developed:

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[3] Ga. Dept. of Nat. Res. Env. Prot. Div., *Flint River Basin Regional Water Development and Conservation Plan* at 43 (2006) ("FRB 2006 Plan"), *available at* https://epd.georgia.gov/sites/epd.georgia.gov/files/related_files/site_page/Plan22.pdf.

> The sections of the [Georgia] laws that require farmers to have permits (O.C.G.A. 12-5-31 and O.C.G.A. 12-5-105) are the weakest of all Georgia's environmental laws. The original bills were specifically written in a very loose manner to place the minimum amount of requirements on agricultural water uses, because the wisdom at the time was that the General Assembly would not accept more than that in regulating farmers. [Attachment 1 at 1.]
>
> You asked how it came that the Legislature ordered EPD to regulate agricultural wells 11 years ago, but never gave us money to do the job. First, it is not an unusual circumstance that the General Assembly would give EPD an unfunded mandate. It happens again and again Second, for the first several years of this 11 year time period, EPD was operating under the belief that we would not run out of water for farmers anywhere in south Georgia, and given that the law is extremely lenient with regard to agricultural permitting and water use, we essentially just issued permits for any farmer that requested them. Since we had so many applications and so few staff to handle them, we made it a simple paper exercise. …. But we also thought, incorrectly, that since there was so much groundwater, it was no great problem that we were understaffed. [Attachment 4, Letter from H. Reheis, former Dir. of Ga. Envtl. Prot. Div. to J. Butler at 1-2 (June 16, 1999).]

Likewise, in other contemporaneous internal EPD documents, high-ranking Georgia officials acknowledged that significant and proactive action was required to remedy the problem:

- "[W]e've already exceeded the 'safe' upper limit of permittable acreage in the lower Flint." [Attachment 5, Ga. EPD Talking Points at 3 (Mar. 22, 1999).]

- "I do believe that the state will need to put a cap on water depletions one of these days from the Floridan Aquifer to keep water flowing in the lower Flint River in drought years …." [Attachment 6, Reheis Statement for Sw. Ga. Summit at 1 (Apr. 16, 1999).]

- "If new irrigation uses are not limited effectively and soon, it will create a bigger Achilles' heel than we currently have." [Attachment 5 at 6.]

- "In Kansas v. Colorado, the Supreme Court found Colorado liable for violating the … River Water Compact because it had permitted so much ground water use for farmers that their usage reduced the river flowage into Kansas. Colorado is forced to buy out farmers' water rights (granted through state permits) . . . . This could happen to Georgia if we cannot deliver on an allocation formula commitment due to over-use by agriculture." [Attachment 5 at 6, referring to *Kansas v. Colorado*, 514 U.S. 673 (1995).]

- "My objective is a good, long-term plan to manage our water resources for *sustainable use*." [Attachment 6 at 3 (emphasis added).]

Although Georgia *did not* thereafter impose specific limits on the amount of irrigation water that could be applied per acre (as other states like Florida and Nebraska do), Georgia did eventually impose a *temporary moratorium* on additional new irrigation permits. FRB 2006 Plan at 31 (Technical Analysis). And EPD negotiated a new piece of state legislation with leaders of the Flint Basin farming community that would reduce the then-existing levels of irrigation by paying permitted farmers (most of whom had what was known as "grandfathered" permits) ***not to irrigate whenever the state predicted severe drought.*** The legislation was known as the Flint River Drought Protection Act ("FRDPA"), and mandated an "irrigation auction" in the Flint Basin whenever severe drought was predicted. Georgia's legislative history for the Act[4] explained that:

> The underlying driving force behind HB 1362 [the FRDPA] was, in large part, the litigation between Georgia, Florida and Alabama over water rights in the region. The litigation actually motivated the Georgia Environmental Protection Division (EPD) to examine the Flint River water flow. In its initial studies, the EPD discovered that high use of irrigation during times of severe drought had the potential of dramatically reducing the flow of the Flint River.… Prompted by the discussions between the EPD and Corps of Engineers, members of the Georgia House of Representatives met with the Georgia Farm Bureau, state agribusiness leaders, individual farmers in the region and environmental groups to develop a solution to the water flow problem. That solution took the form of HB 1362, a mechanism to take acreage out of irrigation production during times of severe drought.
>
> HB 1362 was viewed by many as a good faith effort by Georgia to reduce the amount of water consumption by farmers during times of drought, thus preserving the river flow into Florida.… HB 1362 was also seen as an environmental protection measure to preserve the ecology of the Flint River. *See* Attachment 7, Ga. Conservation and Nat'l Res. Law Review at 2-3. (footnotes omitted)

If Georgia had maintained its 1999 temporary permitting moratorium, fully funded and implemented the FRDPA auction process, and taken a number of other specific and reasonable

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[4] *See also Mannato v. SunTrust Banks, Inc.*, 708 S.E.2d 611, 612 n.1 (Ga. Ct. App. 2011) (noting that the Georgia State Legislative Summaries – known as the "Peach Sheets" – have been recognized as "legislative history" by the Georgia Supreme Court).

conservation measures (both in the Flint Basin and Metro Atlanta), Georgia and Florida might have avoided this dispute. Instead, Georgia decided in 2006 to lift major portions of its moratorium on irrigation permits in the Flint Basin. *See* FRB 2006 Plan at 23-24. Georgia did so despite explicitly recognizing that irrigation permits were causing significant problems:

> Since extensive development of irrigation in the lower Flint River Basin, drought year low flows are reached sooner and are lower than before irrigation became widespread. Furthermore, low-flow criteria established by the U.S. Fish and Wildlife Service designed to protect aquatic habitats are not met more frequently and for longer periods of time since development of irrigation. These data provide the clearest evidence that agricultural irrigation compounds the effect of climatic drought on stream flow in the Basin…. [*Id.* at 22.]

Georgia rationalized that it could attempt to offset these impacts by buying farmers' irrigation rights under the FRDPA in drought years. *Id* at 45. Unfortunately, the FRDPA's irrigation auction fund was depleted in 2001 and 2002, and was ***never again*** funded by Georgia's legislature, despite the fact that Georgia *continued* to grant yet more irrigation permits. Although the Flint Basin suffered severe droughts in 2007 and 2008, the FRDPA was never implemented in those years. The U.S. Fish and Wildlife Service, among others, was critical of Georgia's failure to do so:

> A measure not used was a provision of the Flint River Drought Protection Act to reduce irrigation withdrawals by 20 percent in sub-basins with greatest risks of experiencing low flows due to irrigation. This tool could have been utilized to keep flow in Spring Creek and other parts of the Flint River Basin… The [endangered] mussel populations in Spring Creek appear to be on a steep trajectory to extirpation. [Attachment 8, Letter from S. Tucker to C. Couch, Ga. Envtl. Prot. Div. at 1-2 (Dec. 8, 2008).]

By the 2011-12 drought, the need to implement the FRDPA was again critical. In January 2011, a Georgia hydrologist wrote to members of Georgia's Flint regional water counsel with an unmistakable warning:

> NOAA has released their climate forecasts for Winter-Spring 2011… To say that reflects "doom and gloom" for the SE Region may be an understatement… I am concerned that we are not hearing any discussion from GaEPD regarding pre-

> drought planning.…NOAA experts feel strongly that the drought will persist perhaps more than one year. Clearly the hydrologic and agricultural impacts on our region of Georgia will very likely be extreme. [Attachment 9, Email from W. Hicks to R. Royal et al. (Jan. 24, 2011).]

But EPD again *did not* declare a severe drought, did not implement the FRDPA irrigation auction, and did not take any other action to limit irrigation related-water use in the Flint Basin. Unsurprisingly, by September 2011, EPD personnel were noting the severe depletion of the Upper Floridan Aquifer and identifying record-setting low flows on the Flint River. Attachment 10, Memo. from W. Zeng to A. Barnes (Sept. 6, 2011) (identifying lowest Flint flows in history).

Also in September 2011, Georgia's Lower Flint-Ochlockonee Regional Water Planning Council released its Regional Water Plan (the "LFO Plan") demonstrating that agricultural water withdrawals from the Floridan Aquifer in the Dougherty Plain (*i.e.* the Lower Flint Basin) far exceeded "sustainable yield" limits for that aquifer—even when averaging in far less extreme "dry years" than 2011.

Table 3-3: Groundwater Results for Assessed Aquifers in Lower Flint-Ochlockonee Region – Current Conditions

Aquifer	Estimated Current Groundwater Withdrawal (mgd)*	Sustainable Yield of Individual Aquifer (Min/Max, mgd)
Claiborne Aquifer	123-148 (190-229 cfs)	140-635 (217-982 cfs)
South-Central Georgia Upper Floridan	282-366 (436-566 cfs)	622 – 836 (962-1293 cfs)
Upper Floridan Aquifer in the Dougherty Plain	450-587 (696-908 cfs)	237 – 328 (367-507 cfs)

Source: Georgia EPD, March 2010 Synopsis Report: Groundwater Availability Assessment and subsequent results updates provided by EPD.[11]

*The lower end of the range for withdrawals represents agricultural use in a moderate year, while the upper end represents agricultural use in a dry year.

That same Georgia report also reached the conclusion that Flint River flows were falling very significantly below Georgia's own "sustainability criteria" in dry and drought years.[5]

[5] LFO Plan at 3-6, 3-9 (see horizontal row for Bainbridge gage identifying 1376 cfs shortfall), *available at* http://www.flintochlockonee.org/documents/LFO_Adopted_RWP.pdf.

By early 2012, the ongoing drought combined with massive levels of 2011 agricultural withdrawals so significantly reduced the levels of the Floridan Aquifer that it ceased to feed the flow of the Flint River or Flint tributaries throughout portions of the Lower Flint Basin. Attachment 11, Kennedy's Modifications (18 Feb.) at 2.[6] Lacking any funding for the FRDPA, Georgia cynically (and incorrectly) concluded that there was no reason to invoke the FRDPA irrigation auction in 2012—because the Flint River's surface water and the Floridan Aquifer had already been so depleted that even more pumping could not further worsen river flows. *Id.* Georgia's new EPD Director confessed in a press release: "no funds are currently appropriated" for use of the FRDPA, and "[t]here is no doubt that we need a viable management tool to deal with drought in the Flint River basin." Attachment 12, Press Release, Ga. Dep't of Nat'l Res. at 1 (Mar. 1, 2012).

The impacts of agricultural irrigation were particularly extreme in 2011-12. According to data maintained by the U.S. Geological Survey (USGS) for nearly 100 years, Florida was receiving dramatically lower flows than at any time in a century of recorded history, and saw extreme low flows for an absolutely unprecedented eight *consecutive months* in 2012. *See* Attachment 13, USGS Surface-Water Monthly Statistics for Chattahoochee and Bainbridge. Likewise, USGS gages also recorded historically low flows on the Flint River during this time period. *Id.* Georgia's own metrics developed as part of the FRB 2006 Plan confirm the same problem. There, for a ***small subset of new surface water permits***, Georgia required that all irrigation stop (for environmental purposes, to protect aquatic health) when river or tributary source of irrigation water fell below the statistical level called the 25% Average Annual Discharge ("AAD"). *See, e.g.*, LFO Plan at 6-6. ***But since 2006, those 25% levels have been***

[6] Dr. James Kennedy was Georgia's state geologist at the time.

violated over and over again, in every dry and drought year. *See, e.g.* LFO Plan at 6-7, 6-8; Attachment 14, 25% AAD for three sample USGS gages.

In recent years, Georgia officials freely admit they need a "longer term solution" to address irrigation in these areas. Turner Dep. 239:17-256:1; 267:15-268:9 (Attachment 16); *see* also Attachment 18, Ga. EPD Drought Protection in the Lower Flint Basin Stakeholder Meeting Summary at 1-2 (Nov. 21, 2014). Although Georgia has been exploring possible solutions for much of the last decade, *see* LFO Plan at 6-7, very little progress has been made, and significant problems persist. *See* Turner Dep. 457:19-457:24; 183:20-24; 226:23-227:3; (much more action by Georgia is required to address irrigation related low flows in the Flint River Basin).

ARGUMENT

Under *Daubert*, expert testimony is not admissible unless it is both "relevant" and scientifically "reliable." *Daubert v. Merrell Dow Pharm., Inc.*, 509 U.S. 579, 589 (1993). This means that an expert cannot simply pronounce his conclusions without reference to any discernable scientific analysis, or any other appropriate standard for reaching a conclusion. *See, e.g., Gen. Elec. Co. v. Joiner*, 522 U.S. 136, 146 (1997); *United States v. Frazier*, 387 F.3d 1244, 1261 (11th Cir. 2004) ("If admissibility could be established merely by the *ipse dixit* of an admittedly qualified expert, the reliability prong would be, for all practical purposes, subsumed by the qualification prong."). In other words, an expert must "show his work." *See, e.g., Zenith Elecs. Corp. v. WH-TV Broad. Corp.*, 395 F.3d 416, 419 (7th Cir. 2005) ("A witness who invokes 'my expertise' rather than analytic strategies widely used by specialists is not an expert as Rule 702 defines that term."). And, of course, an expert must have actually familiarized himself with and evaluated the subject matter of his expert testimony. *See, e.g., Neb. Plastics, Inc. v. Holland Colors Ams., Inc.*, 408 F.3d 410, 416-417 (8th Cir. 2005) (exclusion of expert testimony appropriate where expert's calculation "failed to take into account a plethora of

specific facts" relevant to the case). As to at least three of his opinions, Dr. Irmak's proposed testimony flunks these bedrock principles.

A. Dr. Irmak's Opinion About The Reasonableness Of Georgia's Regulatory Framework Is Fundamentally Flawed In Multiple Respects

Against the historical background described above, it is difficult to understand how Georgia could take the position that its policies are "reasonable," "proactive," "responsible," and "progressive." But that is precisely what Dr. Irmak seeks to do. Report at 48, 63.

The first fundamental problem is that Dr. Irmak conducted literally *no* analysis to support his conclusion. An expert must provide a basis for his opinion; he cannot merely invoke his expertise. *Zenith Elecs. Corp.*, 395 F.3d at 419. Dr. Irmak's Report sets forth his opinion in an introductory paragraph on page 48 and a conclusion on page 63. But in between, where an analysis would typically appear, is simply a descriptive list providing "examples" and summaries of Georgia's current programs. Report at 48-63. During his deposition, Dr. Irmak confirmed that his list of examples was provided for illustrative purposes only, not as any sort of analysis:

> *These are some of the examples*, some of the examples that I wanted to highlight that State of Georgia has invested in water resources, planning, management, implementation, signature programs. *That was the sole purpose of my section of the report here*. [Irmak Dep. 586:7-17 (emphases added).]

And Dr. Irmak admits he may not have even written all the text on pages 48-63. Irmak Dep. Tr. 452:21-453:7. Dr. Irmak's descriptive list of Georgia's regulations and policies is not an expert analysis; his conclusory opinion must be excluded. *Zenith Elecs. Corp.* 395 F.3d at 419.

Second, even assuming *arguendo* that Dr. Irmak had provided more than simply a descriptive list, an opinion that a set of policies is "reasonable," "proactive," "responsible" and "progressive" *by definition* requires ***a comparison to something else.*** *See, e.g.*, *Calhoun v. Yamaha Motor Corp.*, 350 F.3d 316, 323 (3d Cir. 2003) (excluding expert testimony because the expert did not provide scientific, statistical, or other evidence evaluating the *relative* safety of the

subject matter); *see also Cruz v. Beto*, 405 U.S. 319, 322 (1972) (reasonableness must be examined in *comparison* to other circumstances); Black's Law Dictionary 1456 (10th ed. 2014) (defining reasonable as "[f]air, proper, or moderate *under the circumstances*" (emphasis added)). Yet Dr. Irmak's Report does not even purport to conduct any comparative analysis.

One appropriate method of comparison might be to compare Georgia's policies against the policies of other states, as Florida's expert did. But Dr. Irmak expressly disclaimed any intent to conduct that sort of analysis, admitting that he would not even be qualified to do so:

> *Q: So the question is, did you compare those specific investments or the activity of the State of Georgia to the activities of any other state in the United States where the same issues of agriculture and water use are presented.*
>
> *A: In my mind, maybe there's an implicit comparison, but I certainly would not compare Georgia to Iowa, the example you used, because there is no irrigation in Iowa.*
>
> *Q: How about California?*
>
> *A: California and Georgia, I—to be able to make that comparison in terms of financial, economical, and related aspects, that will go into an economist. And I am not an economist. I would not even start doing this. There are some of the examples, some of the examples that I wanted to highlight that State of Georgia has invested in water resources, planning, management, implementation, signature programs. That was the sole purpose of my section of the report here. It wasn't designed to say, well, what portion of the total state budget is invested because I would not even know how to make that analogy or comparison...*[7] [Irmak Dep. 585:15-586:17.]

Nor did he even *examine* in any detail Florida's own irrigation efficiency programs for Florida's part of the ACF Basin. Irmak Dep. 289:19-291:3.

Another possible basis for comparison would have been to analyze Georgia's irrigation water use policies by reference to an environmental goal for the Flint River Basin or on the

[7] While Dr. Irmak stated that "*maybe* there's an implicit comparison" to other states involved in his opinion, that is insufficient. To support an opinion, a comparison must establish the methods for comparison and set out some sort of analytical strategy or framework. *See Burns Philip Food, Inc. v. Cavalea Cont'l Freight, Inc.*, 135 F.3d 526, 530-31 (7th Cir. 1998); *Zenith Elecs. Corp.*, 395 F.3d at 419.

Apalachicola River. Again, he conducted no such analysis. The problem goes beyond a lack of evaluation, however. Dr. Irmak was not even *aware* of many of the relevant and undisputed facts. It is well established that an expert cannot offer an opinion where he has "failed to take into account a plethora of specific facts" relevant to the case. *Neb. Plastics, Inc.*, 408 F.3d at 416-417. That is exactly the case here.

For example, even Georgia witnesses concede that irrigation in the Flint River Basin impacts streamflow and the environment. Caldwell Dep. 37:15-25 (Attachment 17) ("I can only conclude that the estimated current use of groundwater from the upper Floridan aquifer in the Dougherty plain is incongruent with the sustainable yield as determined by the sustainable yield criteria used in the groundwater assessment."). Yet Dr. Irmak admits that he never evaluated environmental impacts:

> *Q:* *Your report did not evaluate whether the State of Georgia's regulations and agricultural policies were reasonable and proactive in relation to environmental issues in the Flint River Basin?*
>
> *A:* *No, sir.* [Irmak Dep. 484:12-17.]

Dr. Irmak was also unaware that Georgia is regularly violating its own sustainability standards for the Lower Flint River Basin:

> I have no idea what—how this flow regime target corresponding to the maximum shortfall, even what that means. I don't know the percent of time flow is below the sustainability criteria, how that was determined …. [Irmak Dep. 478:14-19.]
>
> I don't know what sustainable yield of individual aquifer means. I know what the word "sustainable" means, but how it was determined, what assumptions went into it, have they been determined by measurements, modeling… [Irmak Dep. 464:14-19.]

Similarly, although his Report (at 54) lists as one of its examples low-flow protections incorporated in surface water permits that take effect when discharges at the withdrawal location fall below 25% of the average annual discharge, Dr. Irmak conducted no analysis to determine whether Georgia was even complying with that requirement (it is not, *supra* at 10):

Q: So your opinions in this case don't reflect any review of the actual flows and whether they did or didn't meet 25 percent AAD.

A: That would be – that would be accurate, sir. [Irmak Dep. 554:13-17.]

Further, Dr. Irmak was not aware that most surface water permits are "grandfathered" and do not contain the protections he describes. Irmak Dep. 497:22-498:4 ("I wouldn't know that.").

Likewise, Dr. Irmak highlights the 2011 LFO Plan—part of Georgia's regional water planning efforts, *supra* at 8-9—as an example of the "considerable amount of time and effort focused on demand and supply management practices related to agricultural water use." Report at 57-60. That plan did identify critical management strategies, labeled "***High Priority Management Practices***," but Dr. Irmak did not determine whether *any* had even been implemented. Irmak Dep. 473:14-476:6, 479:5-24, 480:5-17.

Similarly, Dr. Irmak provides an overview of the FRDPA, but never actually evaluated its impact. *See supra* at 6-8. He admitted he did not even know whether the FRDPA was ever funded, or whether Georgia even implemented the Act in the severe drought years of 2007-08 or 2011-12. Irmak Dep. 530:6-23; *see also* Irmak Dep. 272:9-273:4 (admitted he did not determine the percentage of Georgia center pivots that use the efficiency devices noted in the Report).

Even if Dr. Irmak had attempted these sorts of analyses or comparisons, he readily admits he would be unqualified to do so. He could not evaluate the reasonableness of Georgia's policies and programs relative to those of other states because he is "not an economist." Irmak Dep. 583:17-584:3. Nor could he evaluate their reasonableness by comparison to any environmental standard, or outcome because he did not "know what environmental health means," did not "feel comfortable getting into health of ecology," and he is not a hydrologist. Irmak Dep. 329:2-12; *see also* Irmak Dep. 329:23-331:13 ("You know, environmental science – there is environmental science, as you know. I am not an environmental scientist."); Irmak Dep. 465:2-11.

Perhaps most problematic, for someone offering a scientific opinion that Georgia's irrigation policies are "reasonable," Dr. Irmak could not evaluate whether it would be reasonable or feasible for Georgia to expand the policies and programs described in his Report. Irmak Dep. 381:17-22 ("I will leave that to my economist colleagues. I wouldn't even start doing this as an engineer."). When pressed to offer an opinion on the reasonableness of a policy during his deposition—for example, the reasonableness of expanding an existing irrigation efficiency program that he opined was reasonable and proactive—he refused to answer, and instead asserted that he was unable to make any policy recommendations whatsoever.

- "My role is not—has not been to recommend policies and related things to the government." [Irmak Dep. 309:18-310:14.]
- "I'm not trying to be difficult, but when you ask me those questions that go into—into policy making by a given state, I honestly, I'm having a hard time to answer those because I don't see my role as telling or suggesting any given state, well, you need to do that, you need to do that." [Irmak Dep. 379:11-381:11.]
- I "try to stay away from suggesting a policy." [Irmak Dep. 291:4-18.]
- "[M]y role as a scientist and researcher and educator is to help people make best decisions …. I don't make a recommendations for policies." [Irmak Dep. 292:8-22.]
- "But I am not sure if I can speak to that policy recommendation. But I can tell you, is all I'm saying is this program is useful." [Irmak Dep. 293:14-294:6.]

Before an expert witness may offer an opinion, "he must first be qualified by virtue of specialized expertise." *Elcock v. Kmart Corp*., 233 F.3d 734, 741 (3d Cir. 2000); *see also Ancho v. Pentek Corp*., 157 F.3d 512, 518 (7th Cir. 1998) ("An expert's opinion is helpful only to the extent the expert draws on some special skill, knowledge, or experience to formulate that opinion."). Florida has no doubt that Dr. Irmak is an accomplished engineer with specialized expertise regarding particular irrigation equipment. But Georgia asked Dr. Irmak to opine on the reasonableness a wide range of their governmental *water use policies spanning multiple decades*,

with specific impacts on the environmental health of the ACF Basin. In his own words, Dr. Irmak did not conduct, and is not qualified to conduct, this sort of analysis or offer an opinion.

B. Dr. Irmak's Opinion Regarding Soil Types in Georgia's ACF Basin Is Similarly Unsound

In one of the principal initial analyses in his Report, Dr. Irmak concludes that most agricultural soils in the Georgia ACF Basin are "extremely sandy," and therefore have minimal soil-water holding capacity—a conclusion that is integral to a number of opinions in his Report. Report at 12-13. This issue is relevant because Dr. Irmak uses it as the basis for his opinion that Georgia farmers must irrigate frequently to avoid crop loss and the associated economic harm and, as a result, agricultural water consumption cannot reasonably be reduced in the Flint River Basin as Florida's expert Dr. Sunding argues. Report at 12-13; 17-19.

Dr. Irmak's Report, however, contains no information, methodology, records, or basis of any kind to support his conclusion regarding soil types—a bedrock principle of Rule 702's reliability requirement. *See Daubert*, 509 U.S. at 590-93; *Heller v. Shaw Indus.*, 167 F.3d 146, 153 (3d Cir. 1999) ("[A] district court must examine the expert's conclusions in order to determine whether they could reliably follow from the facts known to the expert and the methodology used."). At his deposition (but not in his Report, its "Materials Considered" appendix, or any documents produced with the Report), Dr. Irmak stated that the basis for his soil type conclusion was the "couple of hours" he spent reviewing the USDA Natural Resource Conservation Service's Web Soil Survey website nearly a year prior to his deposition. Irmak Dep. 173:3-22, 193:16-25. From that, he apparently derived an "average" number for the sandy soil water holding capacity. Irmak Dep. 188:18-189:17. But Dr. Irmak neither kept nor produced any records, notes, or materials reviewed from the website, and could not explain at his deposition or in the Report the methodology, equations or assumptions used to determine that

"average." Irmak Dep. 192:3-21, 193:10-14, 194:2-9. Because he failed to disclose any such analysis, Dr. Irmak should not be permitted to give *any* testimony relating to soil types in Georgia.

Finally, although Dr. Irmak did not disclose his supposed analysis of soil types, Florida's experts performed a verifiable statistical analysis of cultivated soil throughout the ACF Basin using that same website data and concluded that (1) ***only five to ten percent of soil in Georgia is of the type Dr. Irmak suggests,*** and (2) the vast majority of the soils in the agricultural regions of the Georgia ACF have a much greater soil-water holding capacity. While experts can and do disagree, when one expert's opinion is based on no discernable methodology, it fails *Daubert*.

C. Dr. Irmak Did Not Appropriately Analyze Whether Georgia Farmers Could Limit Irrigation Water Application

Another key issue in this case will be whether Georgia can limit how much irrigation water is applied per acre in the Flint River Basin. Florida's expert, Dr. Sunding, will testify that Georgia can put reasonable limits on that irrigation (as other states like Nebraska and Florida already do). Dr. Irmak attacked that conclusion at pages 18-19 of his Report, suggesting instead that reducing irrigation amounts is not feasible for Georgia farmers. But at Dr. Irmak's deposition, it became very clear that he was not actually opining about whether less irrigation water could be used per acre. Instead, his opinion was based on his misunderstanding of Dr. Sunding's use of the term "deficit irrigation." Dr. Irmak incorrectly understood Dr. Sunding to be referring to a much more narrow and specialized practice than simply limiting the volume of irrigation water per acre.[8] Because Dr. Irmak admits he analyzed a different practice than Dr. Sunding, he cannot opine that Dr. Sunding's opinion is incorrect.

[8] Dr. Irmak's testimony on "deficit irrigation" makes clear that he understood the term to mean a highly specialized irrigation practice requiring the precise scheduling of irrigation at specific crop growth and development stages. Irmak Dep. 618:12-621:10.

Specifically, when presented with a USDA study (the "Shellman" study) indicating that Georgia farmers could *limit* irrigation in the ACF Basin without crop loss, Dr. Irmak admitted that he had not actually evaluated that topic:

> *Q:* *That's very helpful, sir, because I think part of your report criticizes Dr. Sunding for using the term "deficit irrigation," but as far as I know, from the Shellman material, it's just the application of less water.*
>
> *A:* *That's limited irrigation.…*
>
> *Q:* *So is it your position that limited irrigation is not possible in the state of Georgia?*
>
> *A:* *It will be challenging.*
>
> *Q:* *But not impossible.*
>
> *A:* *I really have to study that, sir.* …. [Irmak Dep. 647:20-649:2.]

In order words, Dr. Irmak did not perform even a cursory analysis of the issue on which Dr. Sunding opined—whether it was possible for Georgia farmers to limit their water use for irrigation:

> *Q:* *Okay, sir. So let me just make sure I understand. So nothing in your report offers an opinion about limited irrigation. It's about deficit irrigation.*
>
> *A:* *I am scanning my report through my brain now, see if I – I cannot remember exactly if I mentioned limited. I know I talk about deficit. I don't' think limited irrigation was mentioned in my report in these kind of context.* [Irmak Dep. 650:3-12.]

Dr. Irmak's opinion could only be relevant is if it is allowed to stand for the proposition that Georgia farmers cannot *limit* their use of irrigation water. However, allowing his testimony for this purpose would run afoul of the requirement that he provide an appropriate basis for such an opinion. *Zenith Elecs. Corp.* 395 F.3d at 419 ("A witness who invokes 'my expertise' rather than analytic strategies widely used by specialists is not an expert as Rule 702 defines that term."). Indeed, because he was not studying the feasibility of "limited irrigation," Dr. Irmak did not even attempt to determine the percentage of Georgia farms that are actually irrigated. Irmak

Dep. 765:16-766:6. In fact, a very significant percentage of farmers in the region farm with no irrigation whatsoever.[9] Dr. Irmak should be barred at trial from testifying that "limited irrigation" is not feasible because he did not conduct *any* analysis or cite any support for such an opinion. *E.g. Hatfield v. Wal-Mart Stores, Inc.*, 335 F. App'x 796, 800 (10th Cir. 2009) (expert testimony excluded because expert failed to do any testing or cite any publication to articulate an industry standard before opining).

CONCLUSION

For the foregoing reasons, the identified opinions of Dr. Irmak's opinions do not meet the standards set forth in *Daubert* and its progeny and should be excluded.

[9] *See* USDA 2012 Agriculture Census Vol. 1, Ch. 2 – Tables 9 and 10, *available at* https://www.agcensus.usda.gov/Publications/2012/Full_Report/Volume_1%2c_Chapter_2_County_Level/Georgia/.

Dated: September 16, 2016

Respectfully submitted,

/s/

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No. 142, Original

In the
Supreme Court of the United States

STATE OF FLORIDA,

Plaintiff,

v.

STATE OF GEORGIA,

Defendant.

Before the Special Master

Hon. Ralph I. Lancaster

CERTIFICATE OF SERVICE

This is to certify that the STATE OF FLORIDA'S MOTION *IN LIMINE* TO PRECLUDE EXPERT TESTIMONY BY DR. SUAT IRMAK AND MEMORANDUM IN SUPPORT THEREOF has been served on this 16th day of September 2016, in the manner specified below:

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ATTACHMENTS TO THE STATE OF FLORIDA'S MOTION *IN LIMINE* TO PRECLUDE EXPERT TESTIMONY BY DR. SUAT IRMAK AND MEMORANDUM IN SUPPORT THEREOF

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September 16, 2016

ATTORNEYS FOR THE STATE OF FLORIDA

INDEX OF ATTACHMENTS TO THE STATE OF FLORIDA'S MOTION *IN LIMINE* TO PRECLUDE EXPERT TESTIMONY BY DR. SUAT IRMAK

Attachment 16: Excerpts from the Deposition Transcript of Judson Turner (Feb. 10-11, 2016)

Attachment 17: Excerpts from the Deposition Transcript of Napoleon Caldwell (Feb. 24-25, 2016)

ATTACHMENT 1

Letter from H. Reheis, former Director of Georgia Environmental Protection Division, to J. Butler(June 1, 1999)

bc: Alan Hallum
Nolton Johnson
Bob Kerr
David Word
NapC. / B. Frechette

EXHIBIT
4
Huseby.com
SH
1-28-16

Georgia Department of Natural Resources
205 Butler St. S.E. , East Floyd Tower, Atlanta, Georgia 30334
Lonice C. Barrett, Commissioner
Harold F. Reheis, Director
Environmental Protection Division
404/656-4713

June 1, 1999

Mr. James E. Butler, Jr.
Butler, Wooten, Overby, Pearson, Fryhofer
and Daughtery
Post Office Box 2766
Columbus, Georgia 31902

Dear Jim:

I apologize for the tardy reply to your letter of May 18, 1999 to me regarding agricultural wells in the Flint River Basin in southwest Georgia. The following is some general information. After that, I'll try to answer your specific questions.

In general, there are something on the order of 19,000 irrigation systems using groundwater or surface water in Georgia. About two-thirds of these were for irrigation systems that were in place as of July 1, 1988, so they were grandfathered. That was the effective date of the amendments to Georgia's environmental laws that required agricultural water users to get permits if they have, or want, the capacity to use more than 100,000 gallons a day. The sections of the laws that require farmers to have permits (O.C.G.A. 12-5-31 and O.C.G.A. 12-5-105) are the weakest of all Georgia's environmental laws. The original bills were specifically written in a very loose manner to place the minimum amount of requirements on agricultural water users, because the wisdom at that time was that the General Assembly would not accept more than that in regulating farmers.

EPD was given no new money or personnel with which to operate the permit program, so we have done it on a shoestring for years. We basically have had one professional assigned to review applications and issue permits.

It took EPD several years just to issue the backlog of grandfathered permits, but subsequent to that, we have only rarely denied permits for agricultural use anywhere in Georgia. For years, we thought there was plenty of water for agriculture. We have now found that is no longer the case in southwest Georgia, from technical tools that have been developed under the comprehensive studies conducted jointly over the last seven years by Alabama, Florida, Georgia, and the Corps of Engineers.

In the Flint River Basin, there are about 4500 irrigation systems that have permits. We are also aware that there are still a few hundred irrigation systems that do not have permits. In addition, there is some indeterminant number of situations where a farmer applied for and received a permit, but never drilled a well. Since we have historically only had one person assigned to this program, we have not had the ability to go out and field-verify the applications and the permits to see what was actually happening.

In southwest Georgia there are approximately 3000 wells in the Floridan aquifer which we believe can affect the flow of the Flint River during bad droughts. The big springs on the bottom of the Flint River from Albany on down to Bainbridge which supply a substantial part of the base flow of the Flint River in this section, are all fed by the Floridan aquifer. When thousands of irrigation systems are operating during dry weather, such as we have been having this year, one can see a significant reduction in Flint River flows. Our computer models that predict what will happen under bad droughts (like those of 1986 and 1988) indicate that if EPD continues to issue permits to new applicants who desire them, we will soon over-allocate the aquifer. In a bad drought the model indicates that the Flint River could dry up. Obviously we do not want this to happen, so we are developing a strategy to see that it does not. I will be bringing proposed strategies to the Board in this regard when we get them firmed up. I do believe that some of the actions we need to take must be done after, and as a result of, a rule-making.

Now, let me answer your specific questions in the order in which you asked them.

Since when are permits required? Since July 1, 1988.

How has that worked? It has worked well for the farmers. I don't think it has worked very well for the water resources, at least in southwest Georgia. The farmers don't have to report or measure their usage and the law is written so vaguely so as to imply that virtually no farmer can be denied a permit.

Are all those drilling wells getting their required permits? No.

What is being done to catch those who don't?

Nothing at this point. We are developing our strategy under a law that really doesn't work very well, and our meager resources are being spent on that, and on measuring the impacts of the current drought, as opposed to trying to catch folks who may be drilling without permits.

What enforcement capacity does EPD really have in terms of who is available to go into the field and act? I have about two and a quarter work years of effort assigned to this right now, not counting the time of Dr. Bill McLemore, and managers Napoleon Caldwell, Nolton Johnson and myself who also work on these issues. We definitely do not have the bodies to go out into the field and take enforcement action and at this point, none is being done. Again, all of that will be firmed up and as many of the holes as we can fill will be filled by the strategy that we are developing. I will keep you posted as it goes forward.

Amendments to the law are definitely needed and I will be working with some key legislators to put something together during the interim for action in the Year 2000 General Assembly session. Please contact me if you have other questions.

Sincerely,

Harold F. Reheis
Director

HFR:ypf

cc: Lonice Barrett
DNR Board Members

** Transmit Conf. Report **

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Georgia Department of Natural Resources

205 Butler St. S.E., East Floyd Tower, Atlanta, Georgia 30334
Lonice C. Barrett, Commissioner
Harold F. Reheis, Director
Environmental Protection Division
404/656-4713

June 1, 1999

Mr. James E. Butler, Jr.
Butler, Wooten, Overby, Pearson, Fryhofer
and Daughtery
Post Office Box 2766
Columbus, Georgia 31902

Dear Jim:

I apologize for the tardy reply to your letter of May 18, 1999 to me regarding agricultural wells in the Flint River Basin in southwest Georgia. The following is some general information. After that, I'll try to answer your specific questions.

In general, there are something on the order of 19,000 irrigation systems using groundwater or surface water in Georgia. About two-thirds of these were for irrigation systems that were in place as of July 1, 1988, so they were grandfathered. That was the effective date of the amendments to Georgia's environmental laws that required agricultural water users to get permits if they have, or want, the capacity to use more than 100,000 gallons a day. The sections of the laws that require farmers to have permits (O.C.G.A. 12-5-31 and O.C.G.A. 12-5-105) are the weakest of all Georgia's environmental laws. The original bills were specifically written in a very loose manner to place the minimum amount of requirements on agricultural water users, because the wisdom at that time was that the General Assembly would not accept more than that in regulating farmers.

EPD was given no new money or personnel with which to operate the permit program, so we have done it on a shoestring for years. We basically have had one professional assigned to review applications and issue permits.

It took EPD several years just to issue the backlog of grandfathered permits, but subsequent to that, we have only rarely denied a permit for a [illegible]

Butler, Wooten, Overby, Pearson, Fryhofer & Daughtery

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FAX #: 404-651-5778

DIRECT DIAL #:

FROM: Jim Butler

DATE: May 18, 1999

Total Pages (including cover sheet): 3 Sent By: Susie

SUBJECT: DNR

MESSAGE:

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May 18, 1999

Mr. Harold F. Reheis
Mr. Allan Hallum
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205 Butler Street, SW
East Floyd Tower
Atlanta, GA 30334

Dear Harold and Allan:

Either by letter or in conversation Harold has noted the anticipated need to put some limits on farm wells in the Flint River basin in Southwest Georgia. I'd like more information on that issue, generally. I understand that permits are required now. Since when? How has that worked? Are all those drilling wells getting the required permits? What's being done to "catch" those who don't? I've heard that some folks are drilling deep wells and then capping them off, and that well drillers in the area (Dooly County was mentioned in particular) are real busy drilling as many wells as possible, in anticipation or pursuant to some EPD directive. I'm curious about that.

That segues into the long-term issue about enforcement generally. What enforcement capacity does EPD really have (in terms of who is available to go into the field and act)? What's been done in terms of enforcement, if anything, of limits or permitting requirements for agricultural wells?

Sincerely,

BUTLER, WOOTEN, OVERBY, PEARSON,
FRYHOFER & DAUGHTERY

James E. Butler, Jr.

JEB:shw

cc: Tom Wheeler
Sara Clark

ATTACHMENT 2

Excerpts from the Expert Report of Suat Irmak, Ph.D. (May 20, 2016)

State of Florida v. State of Georgia,
No. 142, Original

Expert Report of
SUAT IRMAK, PH.D.

Prepared for:
The State of Georgia

Suat Irmak, Ph.D.
Harold W. Eberhard Distinguished Professor
Soil & Water Resources and Irrigation Engineering;
Water Management; Crop Water Productivity;
Energy Balance and Evapotranspiration;
Land Surface-Microclimate Interactions.

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I. QUALIFICATIONS & CREDENTIALS

I am an agricultural and soil and water resources engineer and one of the nation's leading researchers in the fields of irrigation engineering and efficiency, agricultural water management, and crop water use. Since 2003, I have served as Harold W. Eberhard Distinguished Professor of Biological Systems Engineering at the University of Nebraska-Lincoln's (UNL) Institute of Agriculture and Natural Resources.

I have a Ph.D. (2002) in Agricultural and Biological Engineering, with an emphasis on Land, Soil, and Water Resources, from the University of Florida. I have an M.S. (1996) in Soil and Water Resources and Irrigation Engineering from Mediterranean University in Antalya, Turkey. I have a B.Sc. (1993) in Agricultural Structures and Irrigation Engineering from Çukurova University in Adana, Turkey, which is one of the top agricultural and irrigation engineering universities in Europe.

I have 28 years of experience in the fields of soil and water resources and irrigation engineering, agricultural water management, and soil and water conservation. I have 25 years of experience in measuring and modeling water use efficiency (crop water productivity) of agro-systems, including evapotranspiration (ET), or the loss of water from vegetation communities and soil surface to the atmosphere, and other aspects of soil-moisture dynamics and soil physical properties. As an irrigation engineer, I have extensive experience on installation and maintenance of irrigation systems, including center pivots, surface and subsurface drip irrigation systems, and low-pressure irrigation systems. I have significant experience implementing technologies to enhance crop water use efficiency.

My research also focuses on soil physical properties, crop physiology, crop productivity, and crop responses to water use and climatic conditions. I have significant experience quantifying crop water use and crop ET for a large number of crops. My expertise also includes understanding how different irrigation practices and agricultural water management approaches affect crop water use and crop productivity.

I have been involved in research, education, and hands-on application of irrigation technologies and practices for my entire life. I teach graduate (M.S. and Ph.D.) courses on Soil & Water Resources and Irrigation Engineering, Water Management, Crop Water Use Efficiency, Energy Balance and Evapotranspiration, and Land Surface-Microclimate Interactions. I conduct research and educational programs focused on the application of engineering and scientific principles in soil and water resources engineering, irrigation engineering, and crop water use to water resources management and agro-ecosystem productivity. I am highly active in university Extension programs, which apply scientific research to agricultural practices. My research and education activities in soil and water resources engineering have been adopted and implemented nationally by the U.S. Department of Agriculture's Natural Resource Conservation Service (USDA-NRCS).

I am the founder and leader of the Nebraska Agricultural Water Management Network (NAWMN). The Network, which is composed of over 1,400 farmer cooperators, is the

largest and most comprehensive agricultural water management network in the USA, and focuses on enhancing agricultural water use efficiency. Since the beginning of the NAWMN, over 10,000 producers, crop consultants, and agricultural industry personnel have been reached and educated, and since 2005, over $80 million in associated energy savings have been achieved due to reduction in irrigation water withdrawals.

I am one of the founders of UNL's South Central Agricultural Laboratory Irrigation Engineering and Water Management Research Facilities, which is widely regarded as one of the state-of-the art environmental research facilities in the USA.

My experience not only covers irrigation management, irrigation efficiency, and soil and water conservation, but also the impact of policies, rules, and regulations on the agricultural industry and irrigation practices. I have developed expertise and understanding of how governmental policies can influence on-farm irrigation practices and other aspects of day-to-day agricultural water use and management. I have chaired national committees on irrigation management, ET, and consumptive water use. I have also chaired a task committee on crop coefficients.

During my 8 years of research at the University of Florida for my Ph.D. program, I studied the soil and water resource characteristics of the humid/sub-humid climatic conditions of the Apalachicola-Chattahoochee-Flint (ACF) River Basin. I participated in numerous field research projects in Georgia and Florida (from south Florida to the Panhandle), and developed familiarity with the agricultural industry in both states. I also conducted analyses of soil physical properties and evaluated soil moisture sensors from soil samples in the ACF Basin in Alabama. Throughout this work, I developed familiarity with sandy-loam and sandy soils, which are typical soils found in southwest Georgia and northwest Florida.

I have published over 125 refereed journal articles in prestigious journals, 2 book chapters, 30 professional society conference technical papers, and 23 peer-reviewed extension and outreach articles. I am currently serving as a technical reviewer for numerous national and international refereed journals on agricultural water management, evapotranspiration and surface energy balance, irrigation engineering, hydrology, water resources research, agronomy, and soil science.

I have received 60 national, international, and regional awards for my research and education programs. I was honored to be named the youngest Gold Medal award winner in the history of the American Society of Agricultural and Biological Engineers (ASABE), which is one of the highest honors bestowed by the Society and is granted to at most one person each year "for exceptional, meritorious engineering achievement in agriculture." I am also the youngest recipient of the ASABE's Heermann Sprinkler Irrigation Award, which I received in 2014 for my "significant contributions to the improvement of efficient and effective sprinkler irrigation." In granting the Gold Medal award, the ASABE wrote of me:

> Irmak is an internationally recognized servant leader, researcher, and educator who has made significant contributions to the soil and water resources engineering profession. He is well recognized for his exemplary

> accomplishments in the application of science- and research-based information to educate farmers, crop consultants, and state and federal personnel in enhancing the efficiency of sprinkler irrigation practices to improve crop water productivity, minimize losses, and reduce water and energy use in agriculture.[1]

I have also received the New Holland Outstanding Young Researcher and Outstanding Extension Professional Awards from the ASABE, and I hold the honor, to date, of being the first and only scientist and researcher who received both awards in the history of the ASABE, which was founded in 1907.

Additional details about my background and accomplishments are provided in my CV in Appendix A.

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[1] ASABE, "Gold Medal Winners Honored," July 21, 2014, http://www.asabe.org/news-public-affairs/july-2014/gold-medal-winners-honored.aspx.

minimum monthly rate of 49 cfs in September 1970 and a maximum monthly rate of 2,722 cfs in July 2012. Because groundwater withdrawals (the majority of agricultural withdrawals) do not directly impact surface flows, streamflow reductions resulting from agricultural consumptive use in Georgia's ACF Basin have averaged below 1,500 cfs in every month on record, and on average 668 cfs for the agricultural growing season over the entire period of record).

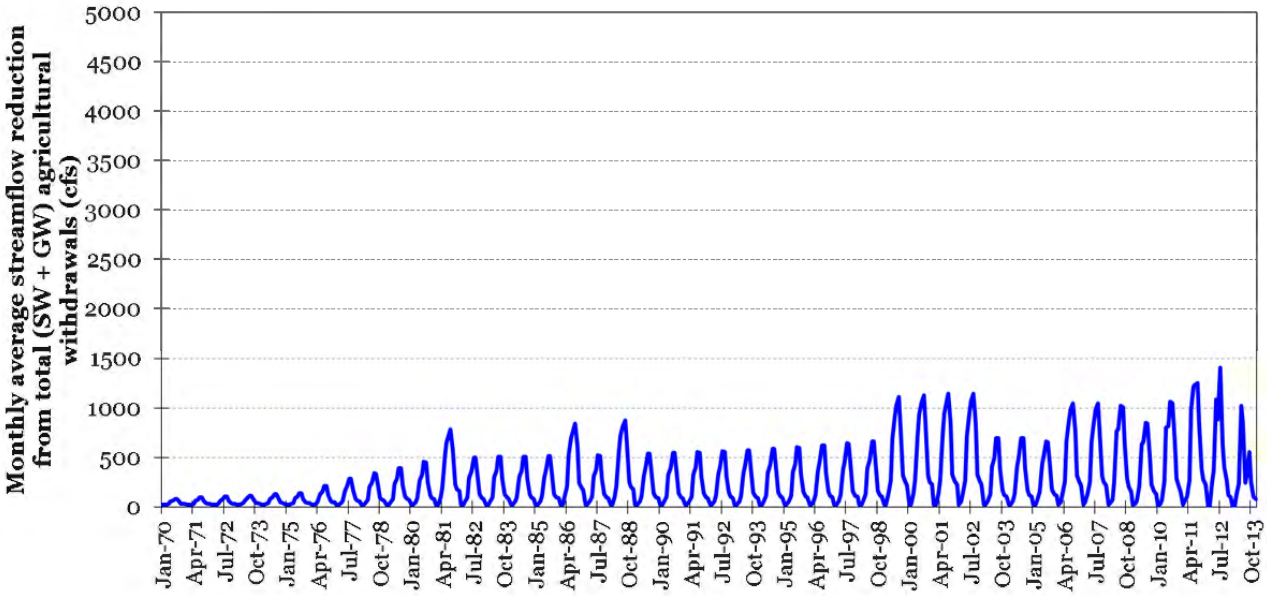

Figure 1. Monthly average streamflow reduction due to surface and groundwater (Upper Floridan Aquifer) agricultural withdrawals in Georgia's ACF Basin from 1970 to 2013 (Source: Figure 1_Monthly average streamflow reduction from total (SW + GW) agricultural withdrawals.xlsx).

- **Dr. Flewelling's estimates of agricultural consumptive use are inflated and based on a scientifically unfounded methodology.** Dr. Flewelling's estimates of agricultural consumptive use in Georgia's ACF Basin is inflated by 2.5 to 3.5 times in certain months and years (and overall on the order of 35-45%). This is primarily due to (i) his reliance on a flawed "ET deficit" concept; (ii) his inclusion of acreage irrigated from aquifers that are not hydrologically connected to the surface stream system; and (iii) his assumption of a constant increasing trend in wetted acreage. Because Dr. Flewelling's agricultural water use estimates are incorrect and highly inflated, any associated water saving scenarios that are based on these estimates—and any expert analyses that rely on these highly inflated values—are inaccurate and misleading. Because Dr. Flewelling's estimates are highly inflated, Dr. Sunding's proposal to achieve 1,000 cfs in additional flows during peak months by reducing Georgia's consumptive use is far from achievable, and likely impossible.

- **Overall, agricultural water resources in the Georgia portion of the ACF Basin are being used reasonably and efficiently, contrary to Florida's claims.** Georgia has demonstrated a strong commitment to

responsible stewardship and conservation of agricultural water resources in the ACF Basin, and there is substantial evidence that Georgia is putting its water resources to reasonable, good, and efficient use.

- **Contrary to Florida's claims, Georgia has instituted significant regulatory and policy initiatives to promote soil and water conservation in the ACF Basin, and has taken a proactive, responsible, and conscientious approach to agricultural water use challenges.** There is significant evidence of wide-ranging, large-scale, and proactive efforts by the State of Georgia to study, enhance, and implement scientific and technical advancements for reducing consumptive agricultural water use, improve irrigation efficiency, and enhance conservation of surface and groundwater resources in the ACF Basin. These regulatory and policy efforts include, but are not limited to, (i) the institution of permitting moratoriums on agricultural withdrawals in key watersheds in the ACF Basin; (ii) significant investments in "sound science" and statewide and regional water planning for responsibly managing surface and groundwater resources; (iii) significant investments in agricultural withdrawal data collection, including the statewide Agricultural Water Metering Program and detailed mapping of irrigated acreage. These policy initiatives, in my judgment, are evidence of progressive and responsible management of water resources that should serve as examples to other states.

- **Dr. Sunding overlooks numerous state-led programs, initiatives, research, and outreach relating to soil and water conservation that have resulted in better on-farm stewardship of agricultural water resources.** Dr. Sunding's recommended "conservation scenarios" ignore the substantial investments to date by Georgia to enhance agricultural water use efficiency and promote soil and water conservation in the ACF Basin. These large-scale water conservation efforts include high-efficiency center pivot retrofits, irrigation system uniformity improvements, end-gun shutoffs, variable rate irrigation, subsurface drip irrigation, and soil moisture monitoring. In addition to improving agricultural water use efficiency, these efforts have also been successful in transferring knowledge and technology to Georgia farmers in the ACF Basin, thereby enhancing farm-level management and stewardship of water resources. Furthermore, since 1999, Georgia has limited permitting of new agricultural withdrawals in areas that the best available science indicates have the most significant impact to surface streamflow. Over the same time period, irrigated acreage in the Florida portion of the ACF has increased dramatically. For example, Jackson County, Florida has seen a 142% increase in irrigated acreage since 2002 (FSAID Final Report).[2]

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[2] Irrigated acres in Jackson County, Florida (2002): 13,374; 2015: 32,378. Florida Statewide Agricultural Irrigation Demand (FSAID) – Final Report. Table A-4. Pg 54.

generations. In some cases, irrigation can increase yield productivity up to 400% as compared to dryland or rain-fed farming.[6]

A. Efficient Center Pivot Irrigation Technology Is Widespread in Southwest Georgia

Since the 1970s, Georgia irrigators have primarily utilized center-pivot irrigation systems, which are one of the most efficient irrigation methods in the nation today. Center-pivot irrigation is a method of irrigation in which the system rotates around a pivot point and crops are irrigated with impact sprinklers, low pressure sprinklers/emmitters, or low pressure drop nozzles. Center pivots apply the irrigation water uniformly to the field with minimum surface runoff when operated properly.

Based on my extensive experience with irrigation practices in numerous states and my review of irrigation survey data reported by the USDA, Georgia irrigators have been exemplary in their rate of adoption of center pivot irrigation and have likely done so at a greater rate than most other states (when the number of center pivots installed per unit area is considered from 1970 to 2013[7]). When coupled with other water management programs, center pivot irrigation systems have proven to be reasonable in terms of utilizing water resources efficiently. Furthermore, as discussed later in this report, effort has been made to convert high-pressure impact sprinklers to more efficient low-pressure drop nozzles to further enhance the irrigation uniformity and efficiency of center pivot irrigation. Advances in nozzle technology have also enabled minimizing water losses from drift evaporation during irrigation. From the 1970s to 2014, about 8,900 center pivot irrigation systems have been installed in the Georgia portion of the ACF Basin. The vast majority of these systems employ low pressure or other advanced delivery practices to minimize non-beneficial water use.[8]

B. Soil Characteristics of Southwest Georgia Render Irrigation Necessary for Ensuring Crop Productivity

Because southwest Georgia has extremely sandy soils (e.g., >80-95% sand; 0.5% or less organic matter content), the soil-water holding capacity of most agricultural soils in the Georgia portion of the ACF Basin is also very low (e.g., 0.5-0.7 inch per ft of soil layer or less). Those types of soil require more frequent irrigation applications than silty, silty-clay, or silty loam soils in which soil-water holding capacity can be as high as 2.2 inch per ft of soil layer. In the summer growing season, center pivot irrigation systems must be used frequently to ensure crop health, promote crop growth, and sustain profitability. During peak atmospheric demand months (e.g., July and August), high evaporative

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6 FAO Fact Sheet 1-Unlocking the Potential of Agriculture; and FAO Fact Sheet 2-Water and Food Security.

7 USDA Farm and Irrigation Surveys from 1970 to 2013.

8 See Table 4.

losses mean that sustaining crop productivity requires irrigation multiple times a day. Even during the rainy periods, climatic conditions can still result in fast evaporation rates of soil moisture from sandy soils, and in many cases irrigation can be necessary even a day or two after precipitation events.

Sandy soils have very high saturated hydraulic conductivity values due to large pore sizes as compared to the silt-loam or similar fine-textured soils. For example, agricultural soils in the Midwestern and western USA have hydraulic conductivity values ranging from 0.05 inch/hr to 1.5 inch/hr whereas soils with 85% sand content has a 4.5 inch/hr saturated hydraulic conductivity value. After a precipitation event, the water would infiltrate into sandy soils and percolate below the crop root zone in a much faster time than water in silt-loam soils. Thus, the crop may not have the ability or opportunity to uptake precipitation water due to very low water holding capacity, thus requiring additional irrigation applications even between two close precipitation events. Florida's claims about the reasonableness and efficiency of Georgia's irrigation practices must be considered in light of these soil conditions.

C. The Highly Productive Floridan Aquifer System Is a Vital Resource to Irrigators in the Lower ACF Basin

The Floridan Aquifer system, one of the most productive groundwater sources in the USA, underlies the entire state of Florida and parts of Georgia, Alabama and South Carolina. The Floridan Aquifer, particularly the Upper Floridan Aquifer (UFA), is an important source of water because of its abundant quantity of stored water, its proximity to the surface,[9] its good quality water, its very high hydraulic conductivity, and its relatively fast rechargeability rate.[10]

Unlike most other aquifer systems in the world, the Floridan Aquifer is a "karst system," which means the carbonate rocks of the aquifer system are readily dissolved where they are exposed at land surface or are overlain by only a thin layer of confining material. This karst system can have a significant effect on water movement. The karst system means that the Upper Floridan Aquifer is highly permeable in most places. As a result, water is able to enter, move through, and discharge from the Floridan Aquifer system more readily and rapidly where it is unconfined or where the upper confining unit is thin. As a result, the Upper Floridan Aquifer is quickly rechargeable with precipitation events, unlike other slow recharging aquifer systems that take hundreds of years to recharge. Given the Upper Floridan Aquifer's significant rechargeability, even large

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[9] The thickness of the aquifer ranges from 250 ft. in south central Georgia to 3,000 ft. in southern Florida.

[10] FL USGS/DNR, 1990. Transmissivity and Well Yields of the Upper Floridan Aquifer in Florida. ISSN 0085-0624. For more detailed discussion of groundwater in the ACF Basin, see the Expert Report of Sorab Panday, Ph.D. (May 20, 2016).

fast under deficit irrigation. Thus, the success of deficit irrigation is usually greater in fine-textured soils than in coarse-textured soils under the same climatic conditions.

To quantitatively demonstrate the impact of deficit irrigation strategies in fine- and coarse-textured soils, I created Figure 5. Figure 5 shows two soil types: sandy soil (typical of soils found in southwest Georgia) and fine-textured soil (typical of soils found in the Midwest). The sandy soil has about 0.6 inch/ft soil-water holding capacity, whereas silt-loam soil has 2.2 inch/ft. Thus, early in the growing season, considering root-zone depth for typical corn production of 4 ft, the silt-loam soil will have 8.8 inch/4 ft of soil-water, whereas the sandy soil will have 2.4 inch/4 ft of total soil-water in the soil profile. In general, 50% of the total water is available for crop uptake, known as "plant-available water." Thus, silt-loam and sandy soils have 4.4 inch/4ft and 1.2 inch/4ft plant-available water. Assuming that in mid-summer, the crop water use is about 0.25 inch/day in southwest Georgia, the soil-water will be depleted at a rate of 0.25 inch/day. Corn, for instance, could survive for as long as 18 days with 4.4 inch of water in silt-loam soil before the next irrigation is applied (in the absence of precipitation), whereas corn grown in sandy soil can last for a maximum of only 5 days before the crop needs to be irrigated again (in the absence of precipitation). If, for some reason, corn is not irrigated within 5 days in the sandy soil, crops will be exposed to severe water stress and irreversible damage will occur to plant physiological functions.

As this data shows, the irrigation timing in deficit irrigation must be determined with exceptional accuracy in sandy soils, whereas there is more flexibility for potential error in determining the irrigation timing in silt-loam soils. Therefore, practicing deficit irrigation strategy in very sandy soils (as those found in the Georgia portion of the ACF basin) is extremely difficult and, in most cases, would not be feasible or profitable.

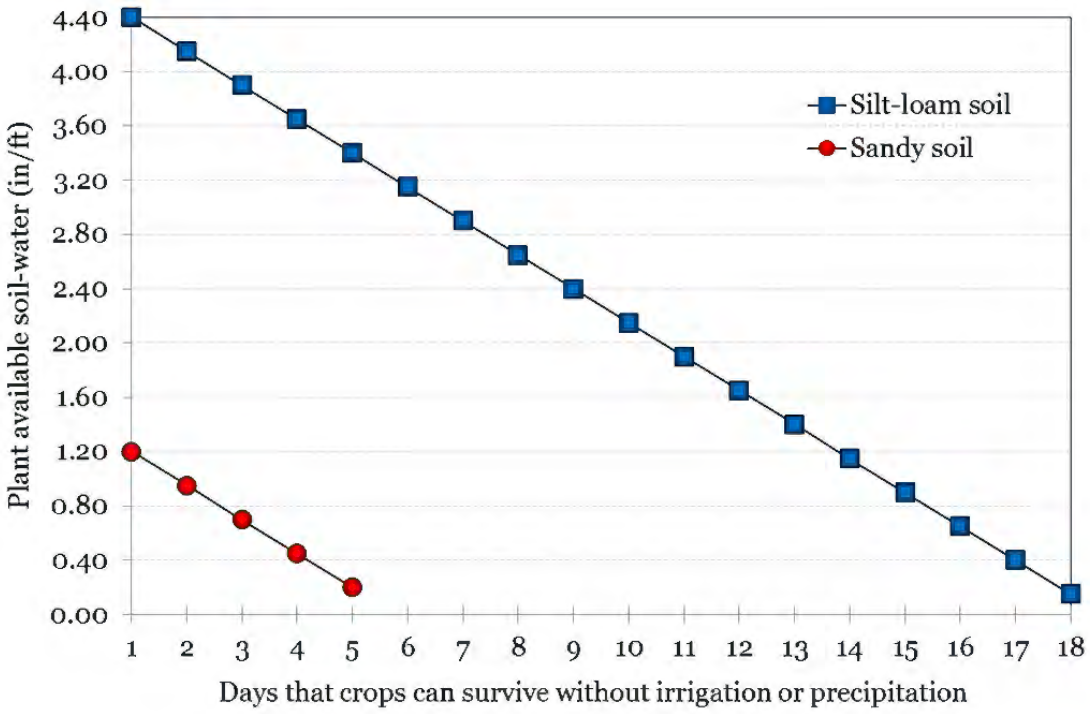

Figure 5. Demonstration of practicability of application of deficit irrigation practices in and silt-loam soils (fine-textured) and unfeasibility of extremely sandy soils (coarse-textured).

It has been reported that even a single water stress event during the critical growth stages of various crops can result in a 30 to 40% yield reduction in a dry year in silt-loam soils and the yield reduction can be up to 100% in sandy soils. For example, if water stress occurs during the critical time period for corn, the following may result: delay in silk growth or elongation, drying of silks, and delay in tassel emergence, which can all lead to reduced pollination and substantially reduced or no yield, depending on the severity of the water stress. In addition, water stress can lead to kernel abortion; which is most susceptible within two weeks following pollination. This time period also usually coincides with rapid nutrient (e.g., nitrogen) uptake. With the exception of fertigation through sub-surface drip irrigation systems, nitrogen (N) fertilizer is applied at the surface, which typically dries up first during periods of water stress, which can result in combined water and N stress if water and N are unavailable lower in the soil profile.

Dr. Sunding's opinions regarding deficit irrigation do not account for any of the real-world implications and difficulties of implementing this highly specialized practice in southwest Georgia. Given the reasons outlined above, implementation of deficit irrigation strategies would not be practically possible or feasible in Georgia, and such strategies would be very detrimental to the Georgia agriculture and the broader economy of Georgia.

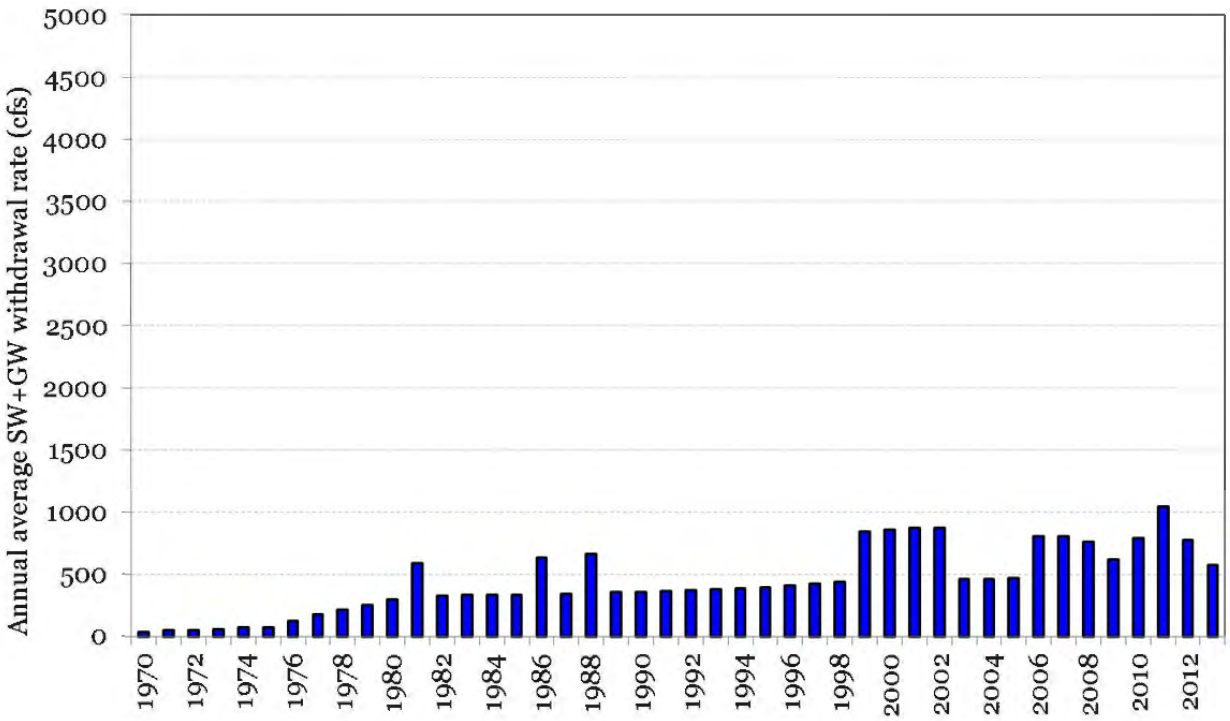

Figure 12. Annual average total (SW + GW) agricultural withdrawals from 1970 to 2013 in the Georgia portion of the ACF Basin.

- ***Annual average SW and GW withdrawals* (Figure 10, Figure 11, and Figure 12)** Long-term, annual average SW and GW withdrawals were 118 and 335 cfs, respectively. Long-term, annual SW+GW withdrawals ranged from 42 cfs in 1970 to 1,401 cfs in 2011 with an average of 453 cfs.

As these figures show, water withdrawals for irrigation and other agricultural uses fluctuate on both a monthly and annual basis, primarily as a function of precipitation trends and in conjunction with the changing requirement of commodity crops during a given growing season.

2. Long-Term Streamflow Reduction Resulting from Agricultural Consumptive Water Use

As noted, total consumptive use in terms of net withdrawals does not accurately reflect the impact of Georgia's consumptive use on streamflow. Groundwater withdrawals do not result in one-to-one reductions in streamflow, but instead indirectly influence streamflow through aquifer-stream interactions. Thus, groundwater withdrawals (the majority of agricultural use) must be translated to surface water reductions in order to fully understand the true impact of Georgia's consumptive use on streamflow in the ACF Basin. Dr. Panday and Georgia EPD have performed hydrogeologic modeling using the

Jones-Torak USGS model to translate groundwater withdrawals to streamflow reductions. The basis for those calculations is presented in detail in Dr. Panday's expert report.[25] Figure 13 and Figure 14 show total streamflow reductions resulting from Georgia's agricultural consumptive use in the ACF Basin on a monthly and annual average basis, respectively.

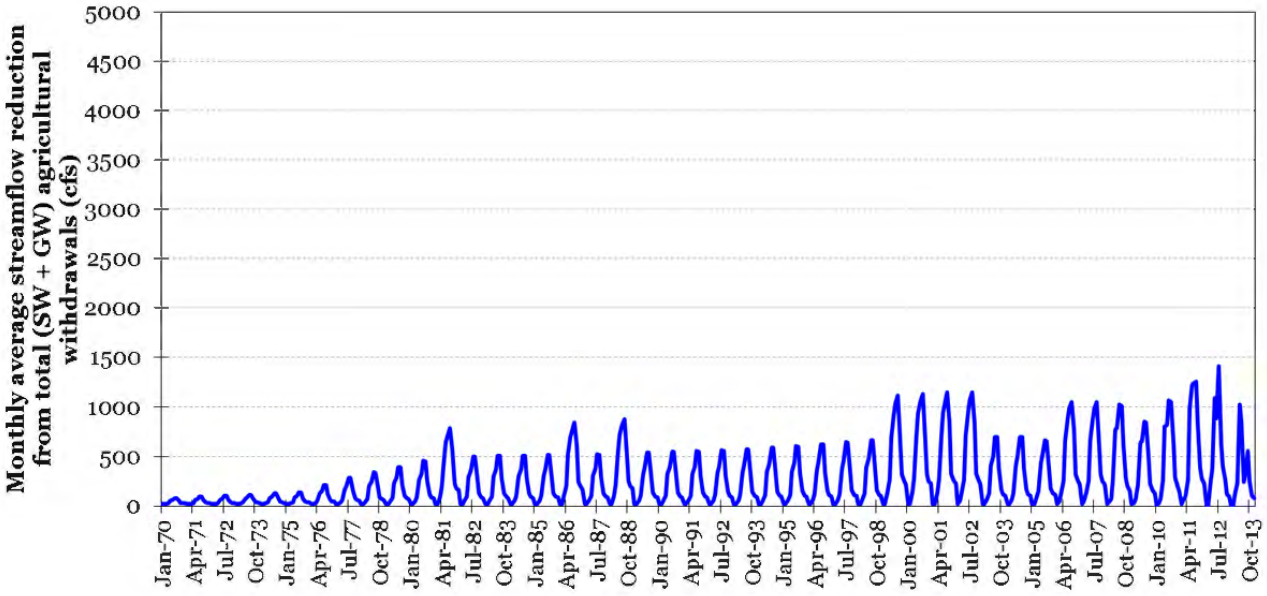

Figure 13. Monthly average streamflow reduction due to surface and groundwater (Upper Floridan Aquifer) agricultural withdrawals in Georgia's ACF Basin from 1970 to 2013.

[25] See Expert Report of Sorab Panday, Ph.D. (May 20, 2016).

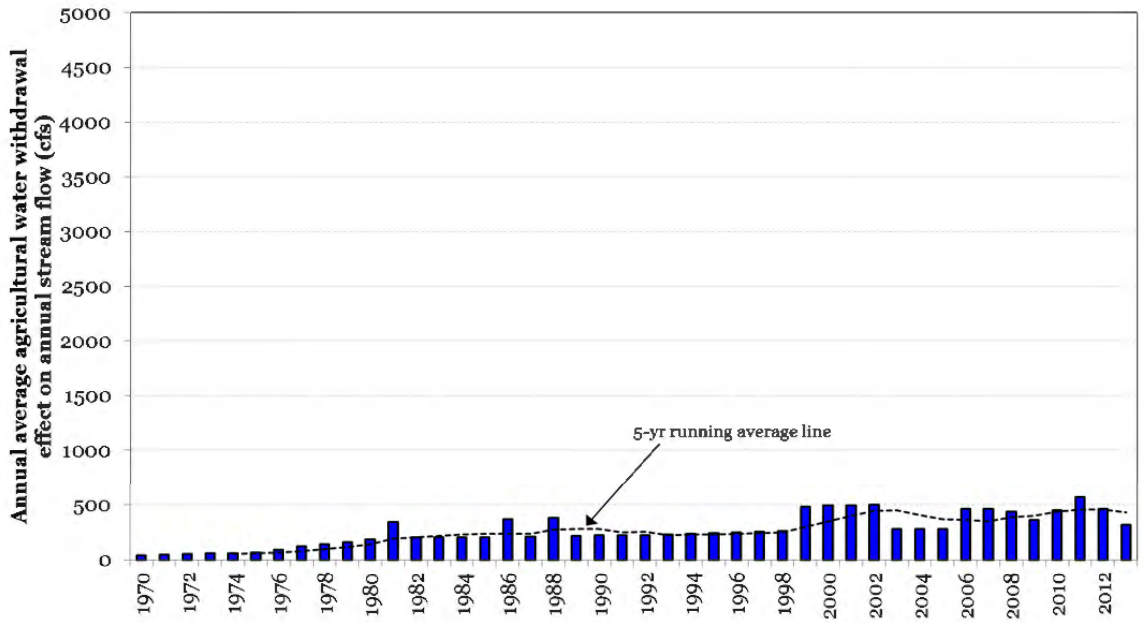

Figure 14. Annual average streamflow reduction due to surface and groundwater agricultural withdrawals in Georgia's ACF Basin from 1970 to 2013.

- ***Monthly average streamflow reduction*** **(Figure 13)** due to agricultural irrigation ranged from 22 cfs in winter months in 1970 to 1,407 cfs in July 2012 with a long-term average of 270 cfs. While streamflow reductions show an increasing trend over time, from 1999 to 2013, the reduction in streamflow remained relatively stable or even exhibited a slight decrease (y = -0.0002x + 431.91; where y = reduction in streamflow (cfs) and x = year).

- ***Annual average streamflow reduction*** **(Figure 14)** due to irrigation in the ACF Basin from 1970 to 2013 ranged from 45 cfs in 1970 to 572 cfs in 2011 with a long-term average of 270 cfs and standard deviation of 145 cfs. While the reduction in streamflow due to irrigation withdrawal did not seem to change significantly in the last two decades, further investigation of the trend line post-irrigation development indicates that the reduction in streamflow due to irrigation has actually declined since 1999 [y = -1.3758x + 433.31; where y = reduction in streamflow (cfs) and x = year].

3. Long-Term (1970–2013) Temporal Distribution of Monthly Total Water Withdrawals and Standard Deviations

To gauge the long-term temporal distribution of monthly total (SW + GW) withdrawals during the growing season, I present monthly data from March through November in Figure 15. While the growing season in Georgia is generally considered to be from March through November, data in Figure 15 shows peak agricultural irrigation withdrawals in May, June, July, and August and some in September. Withdrawals in March, April, October, and November are relatively small.

I. THE STATE OF GEORGIA'S REGULATORY AND POLICY INITIATIVES (1972–2014)

A review of the policies and procedures that govern agricultural water use in the ACF Basin demonstrate that Georgia has acted reasonably and proactively in the management of water used for agricultural purposes, contrary to Florida's assertions. Over the past three decades, Georgia has invested in data collection and technical analyses, initiation and support of planning processes, and implementation of effective management strategies based on sound science. In the sections that follow, I discuss statewide and ACF-specific policies and projects geared toward agricultural water use conservation and efficiency.

A. Permitting

The Groundwater Use Act (O.C.G.A 12-5-90) was adopted by the Georgia Legislature in 1972. Rules for Groundwater Use were subsequently developed and adopted by the Department of Natural Resources (DNR) pursuant to the Act (Rules for Groundwater Use 391-3-2). Parallel provisions were adopted for surface water in 1972 amendments to the Water Quality Control Act (O.C.G.A. 12-5-20) and in rules adopted pursuant to that Act (Surface Water Withdrawals Rules 391-3-6-.07). Together, these statutes established statewide management parameters for water resources. In essence, a permitting program for groundwater and surface water withdrawals was established. In 1988, the Georgia Legislature adopted amendments to these statutes to incorporate withdrawals for farm use.

A permit is required for agricultural withdrawals capable of exceeding 100,000 gallons per day on a monthly average. With the exception of specific language concerning irrigation of recreational turf in certain counties, Georgia law defines agricultural use as follows:

> "Farm uses" means irrigation of any land used for general farming, forage, aquaculture, pasture, turf production, orchards, or tree and ornamental nurseries; provisions of water supply for farm animals, poultry farming, or any other activity conducted in the course of a farming operation. Farm uses shall also include the processing of perishable agricultural products and the irrigation of recreational turf . . . . (O.C.G.A. 12-5-92)

A step-by-step summary of the permitting process may be found in the Flint River Regional Water Development and Conservation Plan (Flint Plan) adopted by Georgia EPD in 2006 and discussed in detail below. For purposes of this section, some important points to note concerning Georgia's permitting system are as follows:

- Requests for agricultural withdrawal permits require completion of a detailed application form specifying withdrawal source, estimated withdrawal capacity, acreage to be irrigated, type of irrigation system to be installed, precise withdrawal location for entry in a Geographic Information System (GIS) database

and anticipated well construction information (proposed depth of well, depth of casing and pump, etc) for groundwater applications.

- An evaluation of each application is completed by Georgia EPD staff at the Agricultural Permitting Unit, utilizing a suite of database and modeling tools developed by Georgia EPD, to ensure compliance of the proposed withdrawal with current permitting policies. In the event that a proposed withdrawal meets the specified criteria, a Letter of Concurrence (e.g. approval to proceed with installation of the withdrawal) is issued to the applicant.

- Following installation of the withdrawal, permit applicants must submit to Georgia EPD certain documentation in order to complete the formal permitting process. This documentation includes, among other things, evidence that the acreage to be irrigated by the new withdrawal does not exceed that noted on the application, the withdrawal was completed according to Georgia EPD specifications, the withdrawal is properly metered according to state policy, and the mandatory conservation measures and efficiencies are in place.

- Since July 1, 1991, all applications for agricultural surface water withdrawals are evaluated to determine the need for a low-flow protection or drought contingency plan in order to protect permitted downstream withdrawals and compliance with the state's In-stream Flow Policy;

- Certain permitting policies and practices that apply specifically to the Flint Basin include:

    - A $250 permit application fee;

    - Permits issued after March 2006 are subject to evaluation and renewal after 25 years;

    - Specific conservation measures are mandatory for permits within certain regions of the Flint River Basin;

    - There has been a suspension of consideration for new agricultural withdrawals in a large portion of the ACF Basin.

B. Permitting Moratoriums in the Flint River Basin

In 1999, Georgia placed a moratorium on new agricultural groundwater withdrawal permits from the Floridan Aquifer in the Flint River Basin and on all agricultural surface water withdrawal permits for the Flint River Basin. At the same time, Georgia initiated an extensive planning process to better understand and manage agricultural water resources in the Flint River Basin. The moratorium and the planning process were prompted in part by a prolonged drought, an increase of agricultural irrigation in southwest Georgia since the late 1970s, and studies that suggested potential impacts on streamflows in the Flint River Basin due to withdrawals from area streams and the Floridan Aquifer.

The 1999 moratorium, and the planning process it precipitated, lasted until 2006. From 1999 to 2006, Georgia conducted a seven-year sound science process where technical experts and regional stakeholders developed a set of management recommendations to govern water use in the Flint Basin. That process resulted in the adoption of the Flint River Basin Plan and the lifting of the agricultural permit moratorium in certain portions of the Flint River Basin.

In 2012, Georgia EPD again suspended consideration of agricultural withdrawal permit applications in portions of the Lower Flint and neighboring river Basins. The suspension, still in place, applies to new applications for groundwater withdrawal from the Floridan Aquifer in Subarea 4 (a region defined by USGS that is reflective of an area where pumping from the Floridan Aquifer is considered to have an impact on streamflow), as well as applications for surface water pumping in the Spring Creek, Ichawaynochaway Creek, Kinchafoonee-Muckalee Creek, and Lower Flint River Sub-Basins (Figure 21). The suspension also applies to any applications to modify existing permits to increase withdrawals or increase the number of irrigated acres associated with an existing withdrawal in these areas. In November of each year, Georgia EPD has the option of evaluating the existing moratorium and implementing any changes to the policy deemed appropriate.

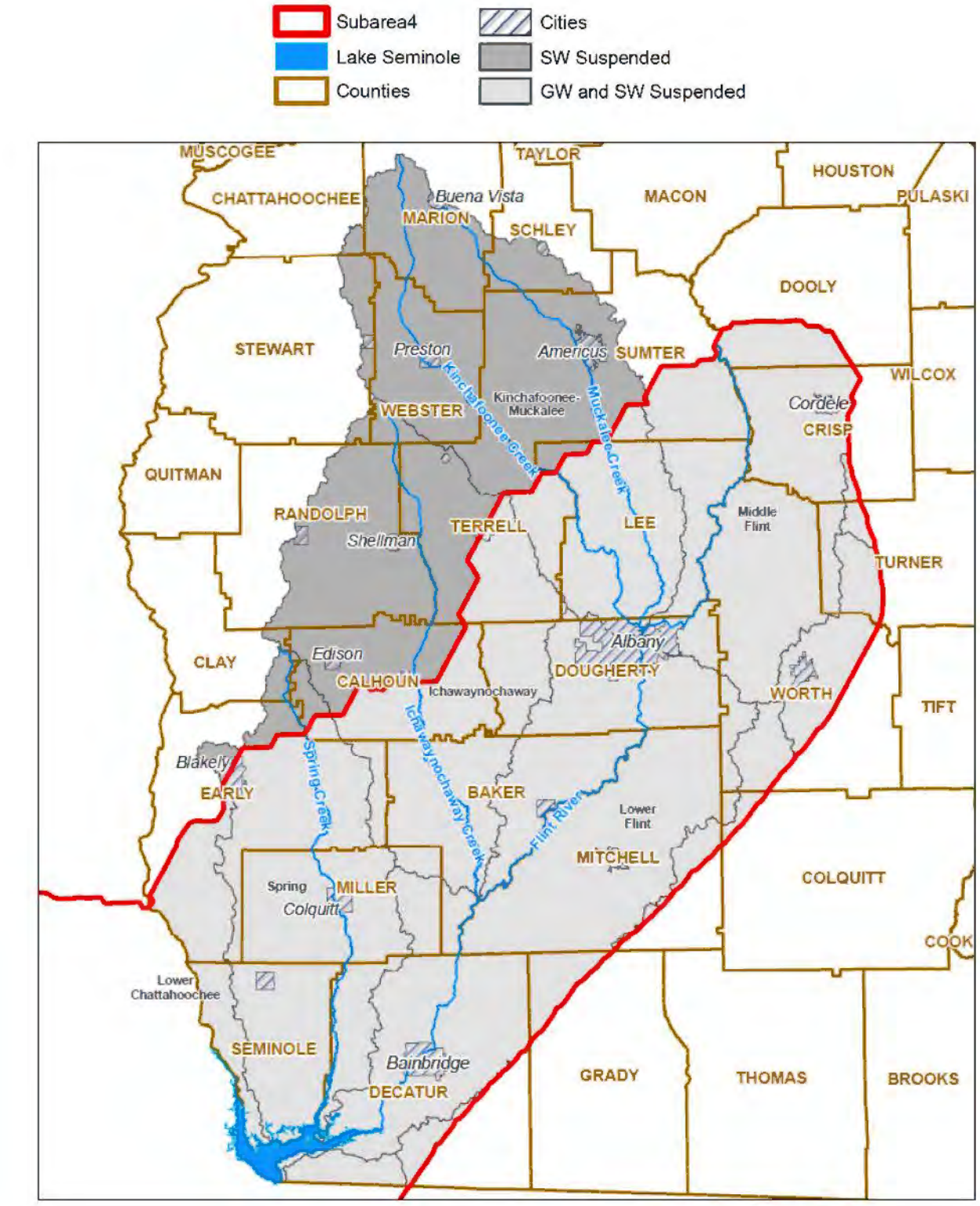

Figure 21. Agricultural Water Use Permitting Moratorium (Source: Georgia EPD)

C. Investments in Planning

In this section, I discuss a number of efforts related to state and regional water planning that have led to the implementation of a host of meaningful water conservation and management strategies, particularly in the Flint River Basin.

1. Flint River Regional Water Development and Conservation Plan (1999–2006)

The first of these efforts was the previously mentioned Flint River Regional Water Development and Conservation Plan. The Flint Plan was initiated in October 1999 by Georgia EPD under the authority of the Groundwater Use and Water Quality Control Acts and was announced at or around the time of the 1999 agricultural permit moratorium discussed above. This process involved compiling the best available data on water use and returns, information on stream ecology and flow regimes, technical modeling of ground and surface water resources and a thorough review of existing Georgia regulations relevant to water resource management. A team of facilitators assisted Georgia EPD in a multi-year process of engaging a Stakeholder Advisory Committee comprised of representatives from agricultural, industrial, municipal and ecological interests. This group was supported by a Technical Advisory Committee appointed by Georgia EPD with expertise in agricultural water use, aquatic habitat, ground and surface water modeling and wildlife biology. The result of this seven-year planning process was a suite of permitting recommendations and management practices, ultimately approved by EPD, which significantly changed how agricultural water use was managed in the Flint River Basin.

A primary outcome of the Flint Plan was categorizing smaller watersheds (HUC-12) in the lower Flint River region as Capacity, Restricted, or Conservation Use Areas. The criteria for designation was slightly different depending on the location of the watershed but, in general, is reflective of the impact pumping from the Floridan Aquifer has on streamflow. That is, for those watersheds designated as Capacity Use Areas, modeling suggested that agricultural water use from the Floridan Aquifer was at maximum capacity based on the impact to streamflow. Watersheds assigned a Restricted Use classification were those in which modeling suggested additional withdrawals from the Floridan Aquifer would have to be restricted to prevent the watershed from becoming a Capacity Use Area. Finally, watersheds deemed Conservation Use Areas were a product of modeling that suggested a minimal, if any, impact to streamflow from Floridan Aquifer withdrawals. A map showing the Capacity, Restricted and Conservation Use Area designations is shown in Figure 22.

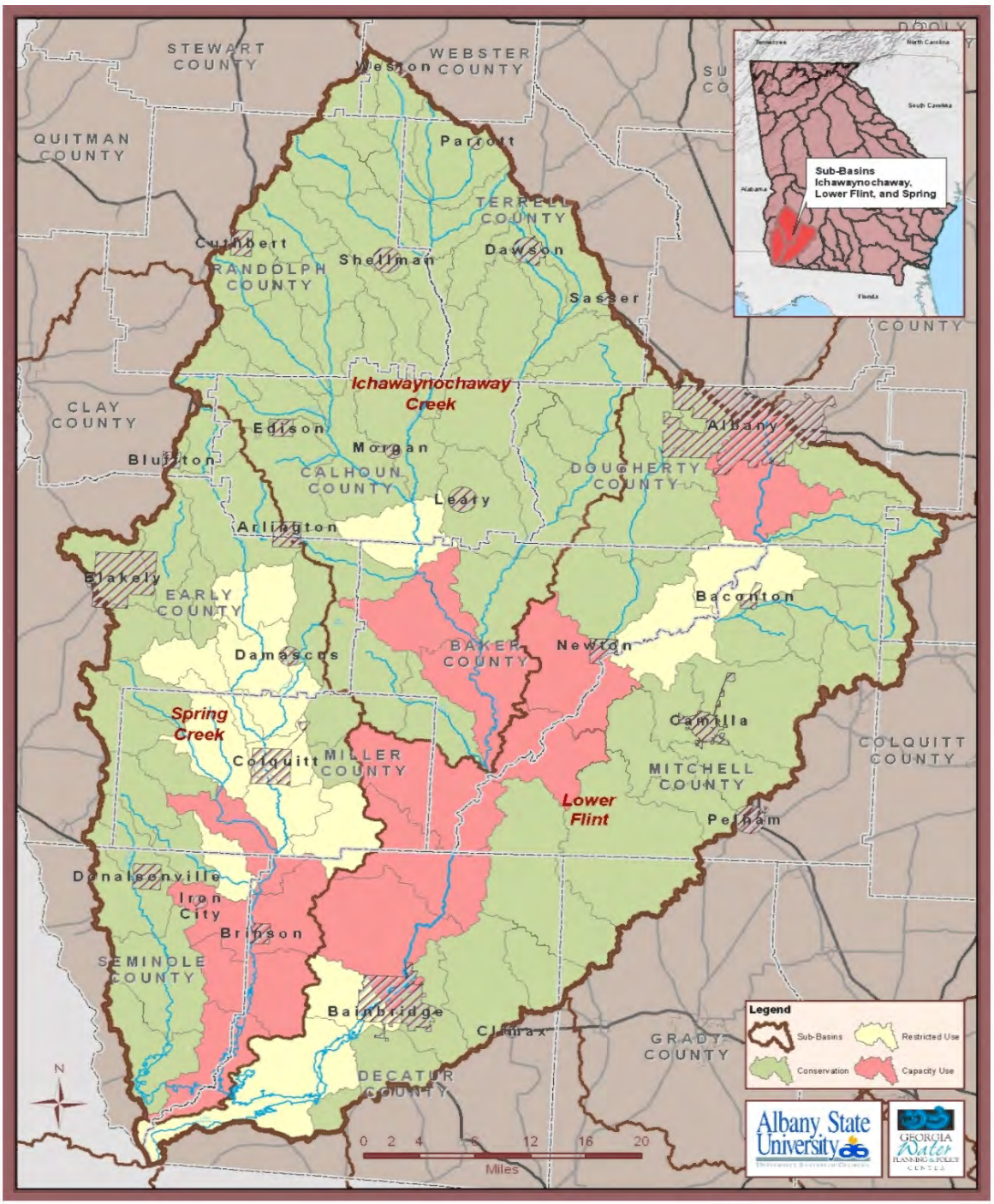

Figure 22. Capacity, Restricted, and Conservation Use Areas from Flint River Basin Plan (2006) (Source: GWPPC)

The Plan also included the following permitting recommendations:

- ***No new permits in Capacity Use Areas*** – The Flint Plan recommended no new permits be issued for Floridan Aquifer withdrawals in Capacity Use Areas (e.g. a continuation of the moratorium that was implemented in 1999). The one

exception to this policy was in regards to backlogged permit applications. These applications were permitted under the revised permitting policy subject to the conservation measures required elsewhere in the Flint Plan, although many of the backlogged permits were determined to be duplicates or speculative.[29]

- ***Permits issued in Restricted and Conservation Use Areas*** – The Flint Plan allows issuance of permits in Restricted Use and Conservation Use Areas, but these new permits are subject to various restrictions and conservation measures described below.

- ***Conservation requirements*** – All new or modified permits issued after March 1, 2006 in Capacity Use or Restricted Use Areas must have the following conservation protections: (1) end-gun shut off switches to prevent irrigation of non-cropped areas; (2) maintenance to prevent and repair leaks; (3) pump-safety shutdown switches that stop water delivery in the event of a malfunction; and (4) rain-gage shut-off switches. Permits in Conservation Use Areas are required to have end-gun shut off switches and maintenance to prevent and repair leaks.

- ***Proximity to nearby users*** – Permits would no longer be issued for proposed Floridan Aquifer irrigation wells that are within 0.25 miles of another user's well (unless hydrogeologic evaluation indicated that the proposed well would not cause excessive drawdown in the other's well).

- ***Proximity to streams and springs*** – The Flint Plan required all proposed Floridan Aquifer wells be evaluated for their effect on nearby streams and springs. Proposed irrigation wells that would draw from the Floridan Aquifer within 0.5 miles of an in-channel spring or stream exhibiting a demonstrable connection with the Floridan Aquifer would not be permitted if evaluation indicates that, for the stream reach closest to the proposed well, the well would lower the Floridan Aquifer water level to the below the average stream condition or decrease the discharge of the spring.

- ***Low flow protection for surface water permits*** – The Flint Plan required that all newly issued surface water withdrawal permits in Spring Creek and Ichawaynochaway Sub-Basins have low-flow protection plans. These low-flow protection plans required a complete cessation of irrigation when discharge at the withdrawal location falls below 25% of the average annual discharge as calculated at the point based on the period of record for the nearest downstream continuous flow gage, plus a prorated portion of the permitted amount of downstream users. The Plan states that affected individuals will be notified by Georgia EPD when these conditions exist, and also requires that the permit conditions be followed regardless of whether the permittee has been contacted by Georgia EPD or not.

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[29] Flint River Regional Water Development and Conservation Plan. GAEPD March 20, 2006. p. 32.

- ***Revocation –*** As a result of inspection by Georgia EPD, all permits found to be duplicates will be revoked. Any permits for which initial use has not commenced will also be considered null and revoked.

- ***Application Fee –*** All new applications for agricultural ground or surface water withdrawals in the Flint River Basin must submit a $250 application fee.

2. Statewide and Regional Water Planning (2004–Present)

In 2004, the Georgia Legislature passed the Comprehensive Statewide Water Management Planning Act, which mandated the development of the Georgia Comprehensive Statewide Water Management Plan ("State Water Plan") so as to "manage water resources in a sustainable manner to support the state's economy, to protect public health and natural systems, and to enhance the quality of life for all citizens" (O.C.G.A. 12-5-522(a)). The State Water Plan was formally adopted in 2008.

Among other things, the State Water Plan established Regional Water Planning Councils (RWPCs) and required development of Regional Water Plans to help the State evaluate current and future water use, and conduct effective water planning. The RWPC process involves engaging appointed stakeholder leaders in a cyclical process of:

(i) Water resource assessments and monitoring;

(ii) Forecasting needs for water demand and assimilative capacity;

(iii) Identifying management practices to meet needs and protect water resources;

(iv) Implementation and evaluation of management practices.

The first round of planning (2009–2011) involved a significant investment from the State of Georgia on data collection, modeling, resource assessments and RWPC technical support. A sample of these investments includes:

- **$800,000** for Forecasting Water and Wastewater Needs

- **$11.5 million** for Regional Water Planning

    - Georgia EPD, with support from other State agencies, provided guidance and technical assistance to the Water Planning Councils through direct and contracted services

    - Coordination among Councils and the Metropolitan North Georgia Water Planning District on shared water resources

- **$6.4 million** for Field Assessments and Data Information Management

- Developed consistent water use and baseline flow information for all watersheds across the State including comprehensive estimates of current and forecast demand for agricultural, municipal and industrial water use

- Increased stream gages by 42, increasing installed gages from 51 to 93

- Increased water quality monitoring sites by 89 from 190 sites to 279 sites, also conducting monitoring each year rather than on a five-year rotation

- **$2 million** for Groundwater Availability Resource Assessments

  - Compiled the best available data

  - Developed models for seven aquifers or parts of aquifers, with more complex models done for aquifers in South Georgia including the Claiborne and Clayton. These aquifers hold potential promise as replacement sources for certain surface water withdrawals in the Flint Basin.

  - Models used to assess effects of groundwater withdrawals on aquifer levels, aquifer storage, and stream flows

- **$3.6 million** for Surface Water Availability Resource Assessments

  - Developed basin-specific River Basin Planning Tool models and/or reservoir operation models for each of the State's river basins

  - Models used to quantify the availability of surface water resources to meet instream and off-stream needs

  - Compiled the best available data on water use, water returns, historical flows, and meteorological data to support assessments

- **$5 million for** Surface Water Quality Resource Assessments

  - Steady-state modeling of dissolved oxygen in streams and estuaries that receive treated wastewater discharges

  - Hydrodynamic modeling of dissolved oxygen in six of the state's largest rivers

  - Watershed modeling of nutrients and dissolved oxygen from both point and non-point sources

  - Modeling used to assess future water quality conditions and the capacity of surface waters to assimilate both point and non-point sources.

The most relevant RWPCs concerning agricultural water use in the ACF Basin as discussed in this report are the Lower Flint-Ochlockonee, Upper Flint and Middle

Chattahoochee Regional Water Planning Councils. A review of the Plans adopted by each of these three Councils in 2011 demonstrates a considerable amount of time and effort focused on demand and supply management practices related to agricultural water use. Table 2, for example, provides a partial summary of the recommended practices specific to agricultural water use from the Lower Flint-Ochlockonee RWPC 2011 Plan and a current "status" with respect to implementation.

Table 2. Lower Flint Ochlockonee Regional Water Planning Council's Recommend Practices & Current Status

DEMAND MANAGEMENT		
Practice	**Detailed Recommendations**	**Status**
Continue to improve agricultural water use efficiency through innovation	• Irrigation efficiency has greatly improved over the past several decades as a result of innovations in equipment and practices. • This trend is expected to continue and economic, environmental, and regulatory pressures drive further innovation in water conservation for agriculture. • While the benefits of specific innovations cannot be predicted at this time, the Council expects that the future benefits of innovation will be substantial.	Baseline conservation assessment completed on large percentage of acreage in the LF-Och RWPC area; See Section below for specific research/outreach efforts on efficiency improvement.
Implement Tier 1 and 2 agricultural water conservation practices in the region	Tier 1 and 2 water Conservation practices required by existing law or anticipated in upcoming state rule-making: • Implementation of conservation requirements under the Flint River Basin Water Development and Conservation Plan (2006) • Compliance with forthcoming requirement (established by Water Stewardship Act of 2010, OCGA §12-5-31) regarding active, inactive, and unused permits	Georgia EPD permitting remains in compliance with 2006 Flint Plan, Water Stewardship Act and 2014 amendments to the Flint River Drought Protection Act as discussed below.
Implement Tier 3 and 4 agricultural water conservation practices in the region with the support of incentive programs	• Incentive funding is available from the Soil and Water Conservation Districts and the Georgia Soil and Water Conservation Commission. • The Council endorses the following benchmark for this practice:	Various water conservation districts and the GSWCC remain primary vehicles for incentive funding related to agricultural water

	By January 2012, all new, and by January 2020, all existing agricultural irrigation systems should have application efficiencies of 80% or greater. • A focus on a desired performance outcome will support increased conservation while allowing farmers to select what practices will work best for their own operations. • Practices that farmers can use to attain this benchmark include low-pressure/full-drop nozzle irrigation systems, Variable Rate Irrigation, conservation tillage, irrigation scheduling, drip irrigation, as well as other conservation measures not listed here that best suit an individual farmer's operation.	conservation; Council recommendation to mandate application efficiencies adopted by Georgia Legislature in 2014 via amendments to the Flint River Drought Protection Act and implemented by DNR Rules pursuant to that Act.
Manage new agricultural water withdrawal permits in the region according to the 2006 Flint River Basin Water Development and Conservation Plan	The 2006 Flint River Basin Water Development and Conservation Plan limits new agricultural withdrawal permits based on expected impact on nearby wells and streams. Under the 2006 plan, the following requirements apply to new agricultural water withdrawal permits in the Flint River Basin: • New permits require mandatory conservation measures, such as end-gun shut off switches and leak prevention and repair, as a condition of the permit. • New surface water permits in Ichawaynochaway and Spring Creek sub-basins must suspend use when streamflow drops below 25% Average Annual Discharge instead of 7Q10. • New permits in the Flint River Basin have a $250 application fee.	All conservation requirements related to irrigation as adopted in the 2006 Flint Plan remain in force and continue to guide Georgia EPD permitting practices.

SUPPLY MANAGEMENT AND FLOW AUGMENTATION		
Practice	**Detailed Recommendations**	**Status**
Replace surface water withdrawals with groundwater withdrawals, where site specific evaluation indicates that this practice is practical and will not harm environmental resources	• This practice could support increased in-stream flows in some places in the region. • The Council recommends that this practice be implemented with incentives. • The practice should only be used where it will not adversely impact other environmental resources, especially groundwater. • The Council recommends that for permittees that implement this practice, the affected permits will maintain their status prior to conversion; grandfathered surface water withdrawal permits would be converted to groundwater withdrawal permits with the same regulatory status as before conversion with respect to conservation requirements, seniority, and potential interruption.	GAEPD has invested in internal modeling to evaluate conversion of surface water withdrawals to groundwater in certain regions of the Flint Basin; the Georgia Water Planning & Policy Center is currently investigating the possibility of source conversion specific to the Ichaway Sub-Basin through a grant from Georgia EPD.
Evaluate streamflow augmentation via direct pumping from aquifers in order to support in-stream flows in dry periods	• In dry periods, streamflow might be augmented through direct pumping of groundwater into surface water streams. • Several factors could limit the potential use of this practice, including: groundwater yields, water quality, cost, aquifer impacts, and streamflow impacts of aquifer pumping. • Implementation of this practice could be beneficial, but requires thorough evaluation to ensure that adverse environmental impacts are avoided and implementation is cost-effective.	Georgia EPD provided funding to complete and currently provides operational funding of a streamflow augmentation project in the Spring Creek Sub-Basin ; the State also conducted a detailed evaluation of the project through DNR (see below)
Use Aquifer Storage and Recovery (ASR) as needed for future water supplies in the region, with thorough evaluation	• ASR could be used in the region to withdraw and store surface water during periods of high flow and provide augmentation for flows or supply in dry periods. • The feasibility of an ASR projects can	$5.1 million from the Water Supply Program was used for a pilot ASR project in the Ichaway Sub-

of potential impacts	vary greatly depending on location, condition of the receiving aquifer and water quality considerations. • ASR is probably best suited to provide water supply storage; its capability to provide for in-stream flow augmentation has not been directly evaluated. • The Council recognizes the need for further evaluation of specific proposals for ASR in the region on a case-by-case basis. • The Council recommends that any ASR proposal be thoroughly evaluated for its environmental and other impacts.	Basin

The work of the RWPCs did not end upon adoption of the 2011 Plans. Funding provided by the State of Georgia allowed Georgia EPD to continue to support the Councils to develop reports on Plan implementation and prioritize items for discussion as part of the 5-year Review and Revision process now underway. Georgia EPD is now leading the effort to compile updated information on water use, including a revised assessment of current and forecast agricultural water demand, update the resource assessments based on surface and groundwater modeling and provide technical assistance to the RWPCs to revise their Plans as needed. This effort is scheduled to be complete in 2017.

D. Investments in Data and Information

Prior sections of this report have briefly mentioned occasions where the State acknowledged a need for additional data and information and responded with an appropriate commitment of funding and coordinated effort. The following section offers additional detail on two important data collection projects that have improved the State's ability to measure, and manage, its water resources.

1. Agricultural Metering

In 2003, the Georgia General Assembly passed legislation to establish the Agricultural Water Use Measurement Program (Agricultural Metering Program), an effort designed to measure use of permitted agricultural water withdrawals statewide. While metering of agricultural withdrawals exists in other states, I am not aware of any state making a commitment to capturing agricultural water use comparable to that of Georgia. Since

2004, the State has invested more than $22 million in deploying, maintaining and managing data collection on over 12,000 meters statewide.[30] Initial flowmeter installations during 2004–2007 were concentrated on agricultural irrigation in southwest Georgia. By the end of 2009, the Commission monitored agricultural withdrawals from a network of 6,985 meters.

Table 3. Water Meter Installations in the Middle and Lower Chattahoochee and Flint River Basins in Georgia (Source: USGS)

Source	Meter Type	
	Annually Reported	Telemetry
Middle and Lower Chattahoochee and Flint River Basins		
Groundwater	3,609	46
Surfacewater	748	35
Subtotal	4,357	81
Coastal Region		
Groundwater	679	20
Surfacewater	378	16
Subtotal	1,507	36
Central south Georgia		
Groundwater	912	15
Surfacewater	659	16
Subtotal	1,571	31
Grand total	6,985	148

Administered by the Georgia Soil and Water Conservation Commission (GSWCC), the Metering Program captures annual data on permitted withdrawals throughout the State. Meters are read each year between October 1 and December 31 which, when compared to the previous year's reading, provides a use generally corresponding to the growing season for most crops. At the time of reading, GSWCC personnel or their contracted support staff also record the crop grown during the previous year and perform a visual inspection of the meter. All meters receive a comprehensive inspection on a three-year rotating basis. Further, approximately 1% of meters are read on a monthly basis as a sample to provide additional information on timing and use patterns during the growing season.

2. Irrigated Acreage

Along with capturing data on agricultural withdrawals through the Metering Program, the State has invested heavily in compiling a database of irrigated acreage. These ongoing efforts, funded primarily through Georgia EPD and GSWCC, are completed under contract to the Georgia Water Planning and Policy Center (GWPPC) at Albany

[30] Interview with David Eigenberg, GSWCC, Dawson, GA (September 22, 2015).

State University. While also statewide in scope, detailed assessments of irrigated acreage began and have largely focused on the Flint River Basin. Since 2013, GWPPC personnel have visited and performed a detailed, on-farm assessment of over 88% of the irrigated acreage in the lower Flint River region.[31] An evaluation of all irrigated acreage in selected HUC 12 watersheds has been completed as well as an evaluation all surface water withdrawals in the remaining portions of three sub-basins. These assessments involve capturing exact withdrawal locations and source information, precise acreage irrigated by a particular source, acreage associated with each flowmeter, irrigation system type, installed conservation measures, and a series of other useful, site-specific information. The data collected as part of this mapping program was used to develop a statewide database of irrigated acreage.

E. Additional Policies

In 2000, the Georgia Legislature passed the Flint River Drought Protection Act (FRDPA). The purpose of the FRDPA was to provide the State of Georgia a mechanism for reducing irrigated acreage in the Flint River Basin during periods of severe drought, should the best available information indicate existing use could result in unreasonable impacts to surface water flows in the Basin. It is worth noting that adoption of the FRDPA followed closely Georgia EPD's implementation of the 1999 agricultural permit moratorium. Under the original statutory provisions of the FRDPA, a "severe drought" declaration by the Director of Georgia EPD would trigger a series of steps including an auction to voluntarily remove land from irrigated production, in exchange for a per acre payment, for the balance of the calendar year.

Following severe drought declarations by the Georgia EPD Director, an auction process consistent with provisions in the FRDPA resulted in retiring a total of 33,101 acres of irrigated land from production in 2001 and 40,894 acres in 2002. The State invested a total of approximately $10 million in the 2001 and 2002 auctions. The auctions were not without certain inefficiencies. In the 2001 auction, a number of participants were paid for very marginal land, or for land that was permitted but not typically irrigated. This "loophole" was closed for the 2002 auction such that only those permit holders who had irrigated in the previous three years could participate.

Following adoption of the 2006 Flint Plan and, significantly, action by the Georgia General Assembly in 2014, a set of amendments to the FRDPA established additional conservation mandates and enhanced Georgia's ability to manage water use within the Flint Basin. A summary of the amendments is as follows:

- ***Inclusion of groundwater*** – The original FRDPA applied only to irrigated acreage sourced by surface water. Amendments to the FRDPA Rules following

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[31] Defined as the Lower Flint (HUC 03130008), Ichawaynochaway (HUC 03130009) and Spring Creek (HUC 03130010) Sub-basins.

the 2006 Flint Plan expanded the acreage that could participate under the FRDPA to include groundwater within certain regions based on proximity to streams.

- ***Targeting of watersheds*** – Refinements to the FRDPA now allow Georgia EPD to target certain HUC 8 watersheds with FRDPA implementation rather than the entire Flint River Basin.

- ***Demonstration of use (meters)*** – In order to be eligible for the auction, a permittee must demonstrate that the land in question is actively irrigated and metered.

- ***Flexibility of auction*** – Clarification of the original FRDPA language provided GAEPD additional flexibility regarding auction implementation following a severe drought declaration.

- ***Protection of augmented flows*** – Language was included to protect flows that may be augmented by the State of Georgia (e.g. prohibits pumping water for irrigation use that comes from a state-sponsored stream augmentation project).

- ***Conservation mandates*** – Building on the framework established in the 2006 Flint Plan, a set of conservation efficiency mandates for *all* permitted withdrawals in the Flint Basin was adopted including:

    - A minimum 80% efficiency for center pivots (60% for mobile and solid set sprinklers) was required for permits issued after January 1, 2006 as of January 1, 2016;

    - For agricultural permits issued between 1991 and 2005, the efficiency requirements must be met by January 1, 2018;

    - For agricultural permits issued prior to 1991, the efficiency requirements must be met by January 1, 2020.

F. Conclusion

Based on my analysis of Georgia's policy and regulatory initiatives, I conclude that the State has been responsible, proactive, and progressive in its management of agricultural water resources and responsive to water resource challenges in the ACF Basin, especially the Lower Flint River Basin. These programs, policies, and initiatives by the State demonstrate good and responsible stewardship of agricultural water resources, and indicate that the State has taken a proactive and approach to agricultural water resource challenges.

ATTACHMENT 3

Letter from H. Reheis, former Director of Georgia Environmental Protection Division, to W. Westermeyer (May 25, 1992)

Georgia Department of Natural Resources
205 Butler Street, S.E., East Floyd Tower, Atlanta, Georgia 30334
Joe D. Tanner, Commissioner
Harold F. Reheis, Director
Environmental Protection Division

May 25, 1992

Mr. William E. Westermeyer
Senior Analyst
Office of Technology Assessment
Congress of the United States
Washington, D.C. 20510-8025

Dear Mr. Westermeyer:

Your letter of April 27, 1992 to Joe Tanner, Commissioner of the Department of Natural Resources, has been referred to me for a reply.

You asked that we: (1) identify regions of our state which, in the current climate, are susceptible to a variety of water-related problems; (2) provide information about innovative programs we have to relieve the stresses, and (3) share with you any thoughts we have regarding planning for climate change in Georgia.

First, we do have a few areas with specific water susceptibilities. In the counties of Georgia along our Atlantic coast, we have had some significant drawdowns of the water level in the Floridan aquifer as the result of heavy industrial and municipal water withdrawals. These water withdrawals, combined with others in the coastal area of South Carolina, have created a potential for saltwater encroachment into the aquifer in the vicinity of Hilton Head Island, South Carolina and Savannah, Georgia. The two states are jointly working on solutions to the saltwater encroachment issue. It is possible that if global climate change occurs, causing a sea level rise, this saltwater intrusion problem could be exacerbated.

Georgia has another area of potential groundwater overdraft and that is in the southwestern corner of the state where there have been large withdrawals made in the last two decades for the irrigation of crops.

Georgia is not particularly susceptible to droughts, having an average annual rainfall of about 50 inches per year. However, there are high growth areas of the state where surface water resources must be carefully managed to assure adequate supplies during times of dry weather for the municipal and industrial needs in our urbanized areas, as well as for other environmental and economic needs downstream.

EXHIBIT
3

1-28-16

We have a strong and comprehensive set of environmental laws in the state and have worked diligently to enforce them for water resource management for a number of years; therefore, the other types of problems listed in your letter are not so significant as to justify discussion or consideration herein.

Second, Georgia has undertaken several innovative programs to better steward our water resources and move toward the goal of sustainability. The Georgia Environmental Protection Division regulates all water withdrawals from ground or surface sources that exceed 100,000 gallons a day through the process of issuing permits. We require large users to develop water conservation plans which can be initiated during times of water shortage or drought. This program has been particularly successful in helping Georgia get through droughts that occurred in the southeast in 1986 and 1988. In addition to that, we have a statewide statute which requires water conserving plumbing devices to be installed in all newly constructed buildings or reconstructed existing buildings. That law has been on the books for over a dozen years and has recently been strengthened. We expect it can help to reduce domestic water use by at least 10 percent.

Again, through our water withdrawal permitting programs, we assure adequate water for downstream uses. We do not approve new surface water intakes nor expansions of existing surface water intakes unless a certain statistical flow (the 7-day, 10-year minimum flow) plus flow for any downstream water intakes is provided past the new or expanded water intake. We call this non-depletable flow. It is achieved by the construction of storage reservoirs either on-stream or off-stream by the proposing water withdrawer.

We are particularly proud of another aspect of water management and that is our strong emphasis on land disposal of treated wastewater and wastewater sludges in Georgia. For more than a decade, we have interpreted the requirements of the federal Clean Water Act (which call for best available treatment for industrial and private water sources) to mean "no discharge to streams." Therefore, for all new industrial facilities that want to have their own wastewater treatment plant, all private facilities, such as subdivisions or mobile home parks or resort developments, and all municipalities which do not already have sewers, we require that the owner install a land application system for the treated wastewater. As a result, Georgia has more than a 140 cities, industries and private developments disposing almost all of their wastewater on land after

appropriate treatment. This has kept about 90 million gallons per day of treated wastewater out of streams and has recycled that water back to the land. We believe that no state east of the Mississippi River has more land application systems for wastewater and sludge. We believe this is pollution prevention at its highest and best.

Finally, we have not given any thought to a plan for dealing with climate change within Georgia. More water conservation, more reuse of water, and an improved management of water withdrawal and discharges through our laws and permitting systems will help in this regard, but we do not have a specific plan for responding to or anticipating the impacts of global climate change.

If we can be of further assistance, please contact me. I would appreciate the opportunity of receiving a copy of your report when it has been completed.

Sincerely,

Harold F. Reheis
Director

HFR:ypf

cc: Joe D. Tanner
David Word
Nolton Johnson

ATTACHMENT 4

Letter from H. Reheis, former Director of Georgia Environmental Protection Division, to J. Butler (June 16, 1999)

bc: David Word

Georgia Department of Natural Resources

205 Butler St. S.E. , East Floyd Tower, Atlanta, Georgia 30334
Lonice C. Barrett, Commissioner
Harold F. Reheis, Director
Environmental Protection Division
404/656-4713

June 16, 1999

Mr. James E. Butler, Jr.
Butler, Wooten, Overby, Pearson, Fryhofer
and Daughtery
Post Office Box 2766
Columbus, Georgia 31902

Dear Jim:

This is in response to your letter of June 8 regarding issues of irrigation in south Georgia. I appreciate your offer for the Board to help us attain stronger legislation regarding agricultural water use. That is needed and I will take advantage of your offer. I will be working with my staff and the Law Department to draft appropriate changes to our water laws in the coming weeks and will keep the Board advised of what we intend in that regard.

Yes, EPD has a number of unfunded mandates and as we prepare our budget requests for FY 2001, we will be listing unfunded mandates and discussing what the needs are, relative to those and how we propose to fill those needs.

We hear that farmers are having wells drilled without permits, and that a lot of that is happening. We have done very little to check it out because of the crush of other business EPD's water resources staff have had this year. Rumor is that well drilling has accelerated during this drought year.

You asked whether EPD monitors well drillers at all. We do somewhat. We have a very modest program of regulating well drillers; it is mainly a licensing function. I agree with you that there are a lot fewer drillers than there are farmers, probably on the order of 300 licensed drilling companies in the state. I will discuss with staff whether EPD can get a better handle on the drilling of agricultural wells by taking some different approach with well drillers.

You asked how it came that the Legislature ordered EPD to regulate agricultural wells 11 years ago, but never gave us money to do the job. First, it is not an unusual circumstance that the General Assembly would give EPD an unfunded mandate. It happens again and again. Second, for the first several years of this 11-year time period, EPD was operating under the belief that we would not run out of water for farmers anywhere in south Georgia, and given that the law is extremely lenient with regard to agricultural permitting and water use, we essentially just issued permits for any farmer that requested them. Since we had so many applications and so few staff to handle them, we made it a simple paper exercise. We had no resources to go to the

field and verify what the farmer claimed in his application, was so. But we also thought, incorrectly, that since there was so much groundwater, it was no great problem that we were understaffed.

Third, during much of this time period, my predecessor, Leonard Ledbetter and subsequently myself, were operating under the philosophy of trying to keep EPD lean and frugal. We did not make budget requests for significant growth in personnel. Our growth mainly has occurred in fee-funded programs, such as the Underground Storage Tank Program, Hazardous Site Response (State Superfund) Program, Scrap Tire Program, and under air quality permit fees and federal grants. In retrospect, we should have been asking for and making a case for more people out of the state appropriated budget, but we didn't. Further, as you are aware, in each of the last four years, state agencies have been directed to reduce our budgets by up to five percent each year, and EPD has done its part of reducing the DNR budget. We can no longer afford to do that, and, as I pointed out before, we know now that we were wrong in assuming that we would never run out of water. We, in fact, can run out of water in some areas, and we need more budget and more people to manage agricultural water use activities in a much more thorough and better manner, going forward from here.

You asked since farmers don't have to report or measure their usage, and we are not certain that we are catching all farmers that drill wells in our data base, how do we know how many wells there are, how much water is being used, and how are we able to predict that the Flint River could dry up? Those are perfectly good questions, and a lot of study has been done on them in southwest Georgia over the last several years. As part of the Comprehensive Study conducted by Georgia, Alabama, Florida and the Corps of Engineers, we knew that agricultural water use in southwest Georgia could affect the flows in the Flint River. We contracted with the U.S. Department of Agriculture (USDA) to provide best estimates or measurements in Georgia, Alabama and Florida of the amounts of irrigation being done.

We know about how many acres are being irrigated in Georgia, but that figure is probably plus or minus ten percent. We are doing some very accurate updating of those figures this year, through a contract with the Geography Department of the University of Georgia. The weak link in the chain is how much water farmers are using. Irrigation experts from the University of Georgia, from the Cooperative Extension Service, and from USDA, have estimated that the long-term average use of irrigation by an irrigated farm, considering all crop types that are done, is about 9 inches a year per acre, and that this can go up as high as 18 inches a year during a severe drought year such as we are experiencing now. In our computer models, we assume average cases as well as worst cases. We know approximately when the growing season starts and ends and how water use changes during the growing season. Our geologic studies

have shown us how groundwater and surface water in the Flint River interrelate. All of that is put into the model, and we come up with our best estimates.

Obviously, this can be improved, and we have several programs underway to reduce the uncertainties of our estimates of how much water is being used, how many acres are actually being irrigated, other internal uncertainties, and how geohydrology is represented by our computer models. We have reasonable confidence in the models now, but I want to have much better confidence so that we are able to manage the water resource to keep the Flint River or any other surface stream from running dry. Additional studies in science are needed for us to make our model better, and I will be making requests in our FY 2001 budget request to do some of this additional work.

Thanks again for your interest in these subjects.

Sincerely,

Harold F. Reheis
Director

HFR:ypf

cc: DNR Board Members
Lonice Barrett

ATTACHMENT 5

Talking Points – Future Agriculture Water Use In Southwest Georgia, Georgia Environmental Protection Division (Mar. 22, 1999)

- TALKING POINTS -
FUTURE AGRICULTURAL WATER USE IN SOUTHWEST GEORGIA

(Georgia Environmental Protection Division - 3/22/99)

I. UNCERTAINTIES

A. **How many acres in Southwest Georgia are actually being irrigated?**

1. We know how many acres for which we've issued permits, but we don't know if all those systems were actually installed (our best estimate is approximately 470,000 acres are under irrigation in the lower Flint basin).

2. We don't know how many acres are being irrigated that are not covered by water withdrawal permits. More than 50% of the applications currently on file at EPD (covering some 13,617 acres) are from farmers who have already installed and are using wells, but did not previously apply for or receive withdrawal permits.

B. **How much water is actually used by irrigators?**

1. Farmers aren't required to meter water usage (although some do) or to report it, so EPD has to depend upon best estimates. These estimates could be high or low by a wide range.

2. The General Assembly is funding a 5-year study whereby EPD contracts with the Cooperative Extension Service to meter irrigation use of volunteer farmers, then produces better estimates of irrigation water use statewide. We are only one year into that study.

C. **How accurate are EPD's computer models which predict the effects on the Flint River of ground water use in Southwest Georgia?**

1. The models are the best thing we have, but there are differences of opinion among the geologists and engineers of Georgia and Florida as to accuracy.

2. It is very difficult to verify the models given the present uncertainties associated with questions A and B above.

3. EPD thinks the models are conservative in favor of the Flint River, but they may not be.

D. **What are the true effects of surface water withdrawals?**

1. More than 20% of the irrigation permits in Southwest Georgia claim surface water as the source. EPD does not know how many irrigation systems pump directly out of a flowing stream, and how many pump from runoff ponds.

2. EPD does not know how much effect the use of runoff ponds has on reducing stream flows, especially during droughts.

E. **Are all current irrigation permit applications actually needed, or are some applicants trying to speculatively tie up water rights?**

1. Based on the large increase in applications received by EPD in the last two months, it appears that a water grab is in progress.

2. If a water grab is happening, or is likely to happen, EPD must determine which applications are legitimate and how to fairly allocate the limited water resources.

II. WHY FOCUS ON AGRICULTURAL WATER USE?

A. **Agriculture is permitted to use much more water than all other users.**

1. In the Flint River basin south of Lake Blackshear, farmers hold permits for more than **800** million gallons per day (mgd) of surface and ground water withdrawal; municipalities hold 17 permits for ~ **42** mgd (City of Albany is 52% of this); and industries hold 14 permits for ~ **27** mgd (Merck and Proctor & Gamble combined are 69% of this).

2. While agricultural use is not constant year round, like most municipal and industrial water use is, EPD's best estimates are that lower Flint River basin farmers use approximately **600** mgd of groundwater on an annual average; and **1200** mgd of groundwater during the April - September growing season of any hot, dry year.

B. **Agriculture's consumption of water is much more than all other users.**

1. Consumption is water which is withdrawn from a source and not returned. In Georgia, agricultural experts contend that irrigation water use is 100% consumptive (i.e., whatever is pumped from ground water or surface water to irrigate crops is essentially all used by the crops). Some water may pass the root zone and trickle back to the ground water, but that takes weeks or months and does not return to the source as usable water during the growing season.

2. Municipal and industrial water use is much less consumptive than agricultural water use, because much water will return to a river or stream as properly treated sewage or industrial wastewater. Municipal water consumption is primarily lawn watering and wastewater that goes into septic tanks instead of city sewers. As an example, the Miller Brewing Company in Albany consumes almost **1.4** mgd (~ 40%) of the approximately **3.4** mgd of the water it uses. That is less water than a single **215 acre** field will consume when irrigated on a hot, dry summer day during a drought.

3. Total current municipal and industrial water consumption from the lower Flint River basin is estimated about **25** mgd. Total current permitted agriculture consumption during the growing season of a hot, dry year is an estimated **1600** mgd of groundwater and surface water.

III. CONSEQUENCES OF WATER OVER-USE

A. **Status quo in issuing new irrigation permits will lead to an over-commitment of water resources, and over-use of the resource.**

1. Agricultural experts have projected that up to **69,000** additional acres could go into irrigation in lower Flint basin in Southwest Georgia between now and 2050, assuming there is sufficient water.

2. EPD has received 230 plus applications from July 1998 through March 1 1999, for more than **24,000** acres of additional irrigation permits.

3. EPD's ground and surface water models predict that (*nothing yet from Dave Hawkins on this quantity; none of his modelers recall having generated this information; from information provided by Steve Whitlock, we've already exceeded the "safe" upper limit of permitable acreage in the lower Flint*) acres of additional irrigation, beyond what is presently permitted, will cause the Flint River to go dry upstream of Bainbridge in droughts comparable to those experienced in 1986 and 1988.

B. **Over-use could hurt many existing farmers who already have irrigation permits.**

1. While EPD's models predict reduced flows in the Flint River with more acreage under irrigation, the models were not developed to determine the maximum amount of additional water that can be withdrawn without hurting other groundwater users.

2. If too much additional groundwater is withdrawn, farmers who have been safely using the Floridan aquifer for years may not have sufficient water in their wells for use during a severe drought.

C. **Over-use will cause severe impacts on fish and other aquatic life in the Flint River and its tributaries.**

1. Striped bass use the big springs on the Flint River and its tributaries as refuges from the heat of summer. Over-use of the aquifer can cause the springs to stop flowing, which could decimate the striped bass population.

2. If the river itself dries up, virtually all fish and other aquatic species may die. Recovery of various species after such an event could take years. Rare or endangered species may never recover. This will almost certainly lead to actions against Georgia by the US Fish and Wildlife Service (USFWS) under the Endangered Species Act.

3. EPD needs to avoid issuing so many permits that these things could occur.

D. **If EPD does not limit additional irrigation use soon, Georgia's negotiators in the Apalachicola-Chattahoochee-Flint (ACF) River Basin Compact will not be able to negotiate an allocation formula with Florida and Alabama.**

1. Without limiting additional permits soon, Georgia's negotiators will not be able to commit Georgia to deliver any Flint River flow to the state line during droughts.

2. Zero flow in the Flint River during droughts will not be any more acceptable to

Florida or Alabama than it will be to Georgia EPD or to Georgia stakeholders like fishermen, conservationists, boaters, users of barge navigation, and others. The compact will dissolve.

3. The federal Compact Commissioner, who is advised by federal agencies like USEPA and USFWS will never concur with a plan that dries up a major river. Again, the compact will dissolve.

E. **Federal overview of all water use in the entire Flint River basin will be severe, causing difficulties for users far from Southwest Georgia.**

1. If they perceive that Georgia will allow the Flint River to dry up in droughts, and allow low flows to occur more frequently due to over-use, Federal agencies will exert their authorities any way they can.

2. Cities and industries seeking additional water for growth will face a long, arduous road for permits. This is already happening in Griffin-Spalding County. It will also affect high growth areas in the basin like Fayette and Coweta counties. Expect Section 404 permits for reservoirs and water intakes to be vetoed.

3. In the worst case of federal overview, expect USFWS or USEPA to take EPD to federal court to prohibit issuance of additional irrigation permits.

F. **Higher wastewater treatment costs will result in Southwest Georgia.**

1. Over-use of the aquifer will cause lower river and tributary flows more frequently. Water quality will suffer if there is less natural flow of water to assimilate treated wastewater.

2. Cities like Albany, Bainbridge, Camilla, and Leesburg, and industries like Miller Brewing and Merck can expect to have to upgrade wastewater treatment, costing millions of dollars.

G. **It will hurt Georgia's chances in federal court if we let irrigation deplete the river.**

1. If the three states do not agree on a water allocation formula this year, Georgia will end up in court sooner or later.

2. While Georgia's overall case is strong, our weakest element is the fact that farmers do not have to report water use, and basically can use any amount of water they want, and the state has no effective enforcement capability for agricultural water

use.

3. If new irrigation uses are not limited effectively and soon, it will create a bigger Achilles' heel than we currently have.

H. **In the worst case, state government would have to buy back water rights from farmers.**

1. In Kansas vs. Colorado, the Supreme Court found Colorado liable for violating the _____ River Water Compact because it had permitted so much ground water use for farmers that their usage reduced the river flowage into Kansas. Colorado is forced to buy out farmers' water rights (granted through state permits) in order to comply with its state line delivery commitments in the Compact, at a cost of $_____ million. This could happen to Georgia if we cannot deliver on an allocation formula commitment due to over-use by agriculture.

2. Presumably, if Georgia users dry up the Flint in droughts, then Florida, or federal agencies, or other Georgia stakeholders could also take the state to court and perhaps compel the buy-back of farmers' water permits.

IV. INTERIM SOUTHWEST GEORGIA WATER MANAGEMENT PROCEDURES

A. **Because of the uncertainties, the need to focus on agriculture, and the adverse consequences of over-using water as described above, it is necessary for EPD to impose a temporary moratorium on issuing certain additional irrigation permits in Southwest Georgia.**

All of these facts have become known over the course of 1998. It is now necessary to act on them.

B. **EPD will temporarily suspend issuance of any additional agricultural water withdrawal permits, as follows:**

1. Given the concerns described above, EPD will temporarily suspend the issuance of any additional agricultural groundwater withdrawal permits which use the Floridan aquifer in the all or part of the following 14 (or 17) counties:

a) All of the area of the following counties:
Baker, Calhoun, Dougherty, Early, Lee, Miller, Seminole, Sumter and Terrell

b) and in portions of the following counties:
Crisp, Decatur, Dooly, Mitchell, and Worth (and potentially portions of Grady, Colquitt and Turner counties).

2. Water sources affected are from the Floridan aquifer and any flowing surface water streams (rivers and creeks) in the designated area. Sources not affected are the groundwater users in the Providence aquifer, the Claiborne aquifer and any surface ponds not on flowing streams that only catch surface runoff.

3. No application received after February 28, 1999 will be processed until EPD's field verification and model verification work has been completed. Applications received prior to March 1, 1999 will be processed. Permits will also be issued for irrigation systems which were installed and in use as the 1998 growing season, subject to EPD receiving applications for such systems and verifying them. ***(Harold, we need to further discuss this bullet before we finalize the document. It could very well be that we have to say we can't issue ANY MORE PERMITS, REGARDLESS OF WHEN THE APPLICATIONS WERE SUBMITTED.)***

4. Land owners having wells drilled or having irrigation systems installed who have not received a permit or letter of concurrence from EPD will be subject to enforcement action under the Groundwater Use Act or the Water Quality Control Act.

5. This suspension will remain in place until EPD can scientifically determine whether natural water resources of the Floridan aquifer and surface streams in the affected counties can safely accommodate additional irrigation withdrawals, while protecting minimum flows in the Flint River and preventing unreasonable impacts on existing ground water users.

C. **Field verification of withdrawal permit data will be done by EPD to minimize uncertainties.**

1. EPD will coordinate with existing entities to verify the numbers, types, and locations of irrigation systems, the capacities of pumps, and the acres of irrigated by a combination of direct inspection, interviews of irrigation system owners, use of aerial photography, and any other appropriate means.

2. EPD will put as many people as it can on this task and it will continue until it is completed. A time schedule and budget will be developed by June 30, 1999.

D. **Verification of the ground water and surface water models for Southwest Georgia will be done by EPD to minimize uncertainties.**

1. EPD staff will work with other experts from U.S. Geological Survey and elsewhere to verify the models.

2. EPD will put as many people as it can on this task and it will continue until it is completed. A time schedule and budget will be developed by June 30, 1999.

E. **The project currently underway by EPD and CES to estimate reliably the amounts of water being used by farmers for irrigation must be completed to minimize uncertainties.**

1. The results of this project and of the field verification of Task C above are essential inputs to Task D above.

2. If funding continues as planned, this project will be completed by September 30, 2003.

F. **Once Tasks C, D, and E above are completed, EPD will collaborate with the farming community and other stakeholders to develop a long-term sustainable water management plan for Southwest Georgia.**

1. All future permitting will follow that plan.

NOTE ONLY TO GEORGIA TEAM: The following information is confidential and not to be discussed outside the Team until notified by Reheis. Blanks need to be filled in by the Team, and Reheis and Kerr must brief key individuals before final release (Commissioners of DNR and Agriculture, Governor, Lt. Governor, Speaker, DNR Board and Chairs of Natural Resources and Ag. Committees in Senate and House).

ATTACHMENT 6

Reheis Statement For Southwest Georgia Summit (Apr. 16, 1999)

Rev. 4-15-99

REHEIS STATEMENT FOR SOUTHWEST GEORGIA SUMMIT
APRIL 16, 1999

Rumor has it there is going to be a moratorium on ag permits.

Bob Kerr and I are the ones who started it last week.

We met with some Southwest Georgia agribusiness representatives, who we had been talking with for months. We left them with the impression that it was time for EPD to declare a moratorium on issuing new ag permits in portions of the Floridan aquifer that affect the Flint River downstream of Lake Blackshear. That was our thinking, subject to working out details. After much additional thought, and discussions with numerous people including our legal advisors, we decided to keep looking at the issue. It is probably more appropriate to institute a cap through a formal rulemaking process, rather than as an administrative decision by EPD Director.

I do believe that the state will need to put a cap on water depletions one of these days from the Floridan aquifer to keep water flowing in the lower Flint River in drought years, but EPD will continue to evaluate options for the best way to limit aquifer depletions, and we will not institute a moratorium at this time.

Here is why we are concerned:

- Ag permits issued/acres/ estimated average and dry year consumptive use in 35 counties /lower Flint.
- M & I permits issued/average consumption in 35 counties/lower Flint.
- Important water resource management principles:
    - plan for drought - not average conditions
    - human consumption first, ag second, but don't forget environment (fish and wildlife, water quality)
    - don't run out of water

This applies everywhere - not just the Flint but all 5(?) basins in these 35 counties. Flint, Chattahoochee, Ochlocknee, Withlacoochee, Alapaha. Applies not only in these 5, but all over Georgia.

EPD must do responsible water management - it's our job, it's the right thing to do.

The job is easier with surface water and with M & I - we can see it and measure it; and M & I users must measure and report usage. We can periodically adjust their permits if there is good cause - permits expire and have to be renewed.

The job is harder with ground water and with agricultural users. Can't see ground water; can measure ground water levels but very difficult to measure flow. Ag users have different requirements under Georgia law: Don't have to measure or report how much they use or when. Their permits never expire once issued and once use is begun.

The law can be interpreted to mean that if there's not enough water to support permits for farmers who want new irrigation permits, EPD must reduce permits of existing farmers to "make room" in the available resource for the new farmers.

EPD has never exercised that power of the law. It would be very difficult if we had to do it: If a farmer wants a new 1000 gpm pump and pivot, and EPD has determined there's not enough water for him or her, do we take 100 gpm off the permits of each of the 10 nearest other farmers so we can give him a total of 1000 gpm? That seems to be what our law says. If so, it doesn't match one original intent of the law, which was to protect farmers' water rights.

We have to deal with several uncertainties:

- How many acres are actually irrigated? (We've taken applications at face value - there are so many of them, and we have so few people, we never have gone to field for ground truthing).

- How much water is actually used in an average year? In a dry year? Nobody has to report, so we must estimate - how good are our estimates?

- How good is our computer model of ground water and its effect on surface water streams in dry years? It's the best we have, we had good objective scientists develop it on best available data. But it can always be made better, more accurate, with more data, and for the lower Flint Basin, we need high confidence that it is right. We need to ground-truth that model, but can't do it until next bad drought, and can't even do that right without more accurate estimates of actual water use by farmers.

EPD is working on reducing these uncertainties, but that will take some time.

We will get to point that EPD is no longer comfortable issuing new irrigation permits in some parts of Southwest Georgia, bearing in mind that:

  - we have to plan for drought

- we have to take care of human consumption first, but we can't forget about fish and wildlife and water quality.
- we don't want to run any resource - aquifers or surface streams and rivers - out of water.

We have been holding, and not processing permit applications for new irrigation systems in the lower Flint basin since the middle of 1998, while we gathered facts and pondered all this.

EPD will now, rather than declare a moratorium, start working on that backlog of permit applications. We will make a field inspection at each applicant's site before we make a decision on that application. We will be able to issue some permits; I expect we will need to deny some applications. We will do our best with what we have and what we know.

The Southwest Georgia Summit is important. This region of Georgia needs a good, long-term plan so the resources can be managed for sustainable water use.

EPD and DNR want to participate with everybody who is interested to figure out how best to get there.

I encourage you all to think and talk about how best to get there, in the workshops today, and beyond this meeting. We need a plan that is workable and realistic and on solid ground technically. I know EPD needs more facts, and more time and money to get those facts. Do we also need changes in our water law? What would work best?

My objective is a good, long-term plan to manage our water resources for sustainable use. Getting that plan and implementing it, will put us all on the side of the angels.

ATTACHMENT 7

Georgia Conservation and Natural Resources Law Review – "Peach Sheet" for the Legislation Enacting the Flint River Drought Protection Act

Water Resources: Enact Flint River Drought Protection Act; Create Drought Protection Program; Require the Board of Natural Resources To Establish a Drought Protection Program; Require Cooperation with the Georgia Environmental Facilities Authority

CODE SECTIONS:	O.C.G.A. §§ 12-5-134 (amended), 12-5-540 to -550 (new), 50-23-5 (amended)
BILL NUMBER:	HB 1362
ACT NUMBER:	650
GEORGIA LAWS:	2000 Ga. Laws 458
SUMMARY:	The Act, known as the "Flint River Drought Protection Act," adds several sections to the Code to identify the importance of Georgia's water resources, define certain terms, and authorize the Board of Natural Resources and the Director of the Environmental Protection Division (EPD) of the Department of Natural Resources to create and enforce a drought protection program and administer funds. The Board is also required to implement such measures as are necessary to prevent future droughts in the Flint River basin, including the use of irrigation auctions as a water conservation technique. The Act provides compensation for nonirrigated acres either under a voluntary irrigation reduction plan or under an involuntary reduction order issued by the Director of the EPD. The Act gives the EPD authority to conduct reasonably necessary investigations and inspections of irrigated land. The Act provides enforcement measures and penalties. It encourages the

Georgia Environmental Facilities Authority to work with the Director of the EPD to assist in the implementation and funding management of the drought protection program. Finally, the Act changes certain irrigation well water standards and permitting requirements.

EFFECTIVE DATE: April 19, 2000[1]

History

The Flint River is a 349-mile long river that runs from Atlanta into South Georgia.[2] There, it joins the Chattahoochee River to form the Apalachicola River, which flows across the Florida panhandle and into the Gulf of Mexico.[3]

Georgia's Flint River basin is predominantly an agricultural region of the state,[4] and agriculture is the largest industry in Georgia.[5] The eighteen counties in Georgia that produce 43.5 % of the state's total agricultural income depend on the waters of the Flint River for irrigation.[6] The importance of agriculture to the state, combined with the growing concerns about the effects of severe drought on Georgia and its neighboring states, led many agricultural, business, and environmental groups to come together to balance the state's agricultural needs with the water rights of neighboring states in times of drought.[7]

The underlying driving force behind HB 1362 was, in large part, the litigation between Georgia, Florida, and Alabama over water rights in the region.[8] The litigation actually motivated the Georgia Environmental Protection Division (EPD) to examine

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1. *See* 2000 Ga. Laws 458, §§ 4-5, at 468. The Act took effect upon approval by the Governor. *See id.*

2. *See* Charles Seabrook, *The Flint River System: Water Worries Tri-State Flap Could Mean Irrigation Limits for Farmers*, ATLANTA J. & CONST., Apr. 10, 2000, at D1.

3. *See id.*

4. *See* Audio Recording of House Proceedings, Feb. 16, 2000 (remarks by Rep. Richard Royal) <http://www.ganet.org/services/leg/audio/2000archive.html> [hereinafter House Audio].

5. *See id.*; *see also* Telephone Interview with Rep. Richard Royal, House District No. 164 (June 7, 2000) [hereinafter Royal Interview].

6. *See* House Audio, *supra* note 4.

7. *See id.*

8. *See id.*

the Flint River water flow.[9] In its initial studies, the EPD discovered that high use of irrigation during times of severe drought had the potential of dramatically reducing the flow of the Flint River.[10] This finding led the EPD to discuss the problem with the U.S. Army Corps of Engineers.[11] In addition to the interstate water rights concerns, the Corps of Engineers was also concerned about the environmental implications of reduced water flow in the Flint.[12] Prompted by the discussions between the EPD and the Corps of Engineers, members of the Georgia House of Representatives met with the Georgia Farm Bureau, state agribusiness leaders, individual farmers in the region, and environmental groups to develop a solution to the water flow problem.[13] That solution took the form of HB 1362, a mechanism to take acreage out of irrigation production during times of severe drought.[14]

HB 1362 was viewed by many as a good faith effort by Georgia to reduce the amount of water consumption by farmers during times of drought, thus preserving the river flow into Florida.[15] If Florida and Georgia enter into an agreement that guarantees Florida a minimum water flow amount from the Flint, HB 1362 will have the additional purpose of ensuring compliance with that legal obligation.[16]

In addition to the legal impact of the bill, HB 1362 was also seen as an environmental protection measure to preserve the ecology of the Flint River.[17] The Flint River is home to many endangered species.[18] If the river's ecology cannot be protected by the state, the federal Environmental Protection Agency (EPA) may institute even more severe water restrictions on the region.[19] The Corps of Engineers and the EPA could force

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9. *See* Royal Interview, *supra* note 5.
10. *See id.*
11. *See id.*
12. *See id.*
13. *See id.*; *see also* Telephone Interview with Rep. Bob Hanner, House District No. 159 (July 7, 2000) [hereinafter Hanner Interview].
14. *See* Royal Interview, *supra* note 5.
15. *See* House Audio, *supra* note 4.
16. *See Bill Pays Farmers Who Don't Irrigate During Droughts*, AP NEWSWIRES, Apr. 19, 2000, *available in* WESTLAW, GANEWS.
17. *See* House Audio, *supra* note 4.
18. *See id.*
19. *See id.* (remarks by Rep. Bob Hanner).

farmers to cease irrigating their lands completely.[20] In order to preserve the water flow of the Flint, it is estimated that farmers will need to cease irrigation on approximately 100,000 acres of land during severe drought periods.[21]

HB 1362

Representatives Richard Royal, Bob Hanner, Tom McCall, Henry Reaves, Thomas Murphy, and Newt Hudson of the 164th, 159th, 90th, 178th, 18th and 156th Districts, respectively, sponsored HB 1362.[22] HB 1362 was introduced on February 7, 2000.[23] The House assigned the bill to its Committee on Natural Resources & Environment, which favorably reported the bill, as substituted, on February 10, 2000.[24] The Committee substitute changed a provision of the bill to authorize the Georgia Environmental Facilities Authority to contract with the Director of the EPD to implement and execute a drought protection program for the Flint River basin.[25]

On the House floor, Representative Bobby Franklin of the 39th District offered a floor amendment that would have changed how the General Assembly would review the rules and regulations promulgated by the Board of Natural Resources.[26]

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20. *See* Royal Interview, *supra* note 5.
21. *See* House Audio, *supra* note 4.
22. *See* HB 1362, as introduced, 2000 Ga. Gen. Assem.
23. *See* State of Georgia Final Composite Status Sheet, Mar. 22, 2000.
24. *See id.*
25. *Compare* HB 1362, as introduced, 2000 Ga. Gen. Assem., *with* HB 1362 (HCS), 2000 Ga. Gen. Assem. The original version of the bill specified that the Georgia Environmental Facilities Authority should contract with the Board of Natural Resources, rather than the Director of the EPD. *See* HB 1362, as introduced, 2000 Ga. Gen. Assem. This change was made, upon recommendation of the Governor's Office, for purely logistical reasons so that all of the state agencies could work most effectively with each other. *See* Hanner Interview, *supra* note 13.
26. *See* Failed House Floor Amendment to HB 1362, introduced by Rep. Bobby Franklin, Feb. 16, 2000. Even without the amendment, the General Assembly will still have oversight of the promulgation of agency rules and regulations. *See* Hanner Interview, *supra* note 13. If the General Assembly disagrees with a regulation, it can strike it down by law during the next legislative session. *See id.* The General Assembly must ensure that the EPD and Board of Natural Resources comply with the Administrative Procedures Act. *See id.*

This floor amendment failed (27-136), and the House passed the bill, as substituted, on February 16, 2000.[27]

The Senate assigned HB 1362 to its Natural Resources Committee, which favorably reported the bill on March 3, 2000.[28] The Senate passed the bill, without any additional changes,[29] on March 13, 2000.[30] Governor Roy Barnes signed HB 1362 into law on April 19, 2000.[31]

The Act

Section 1 of the Act, entitled the "Flint River Drought Protection Act," amends Chapter 5 of Title 12 of the Georgia Code by adding several Code sections relating to water resource preservation in Georgia's Flint River basin.[32]

The Act adds Code section 12-5-541, which states that the policy of the Act is to protect Georgia's public health, safety, and welfare by preserving the state's water in times of drought.[33] Section 12-5-542 defines certain terms to be used throughout the Act.[34]

The Act adds Code section 12-5-543, which authorizes the Board of Natural Resources to establish and implement a drought abatement program for the Flint River basin.[35] The Board may adopt any rules that are necessary to implement the policy goals of the state.[36] This Code section prescribes suggested rules for the Board to implement, including an irrigation abatement program, water withdrawal permits, and an irrigation auction.[37] Finally, this Code section provides that any

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27. *See* Georgia House of Representatives Voting Record, HB 1362 (Feb. 16, 2000); House Audio, *supra* note 4 (vote on amendments).

28. *See* State of Georgia Final Composite Status Sheet, Mar. 22, 2000.

29. *Compare* HB 1362 (HCS), 2000 Ga. Gen. Assem., *with* HB 1362, as passed, 2000 Ga. Gen. Assem.

30. *See* Georgia Senate Voting Record, HB 1362 (Mar. 13, 2000).

31. *See* 2000 Ga. Laws 458, § 5, at 468.

32. *See id.* § 1, at 459-67; *see also* O.C.G.A. § 12-5-140 (Supp. 2000).

33. *See* O.C.G.A. § 12-5-541 (Supp. 2000).

34. *See id.* § 12-5-542.

35. *See id.* § 12-5-543(a).

36. *See id.* § 12-5-543(b).

37. *See id.* To benefit from the drought abatement program and payments, a permittee must demonstrate actual prior irrigation usage and must have applied for a surface-water or ground-water withdrawal permit before December 1, 1999, and received that permit prior to December 1, 2000. *See id.*

rules promulgated by the Board will be submitted to the Georgia General Assembly and will automatically become effective unless they are specifically disapproved by the General Assembly.[38]

The Act also gives additional power to the Director of the EPD by adding Code section 12-5-544.[39] The Director is given the authority to implement and enforce the provisions of the Act, including the establishment of acceptable Flint River stream flow levels, identification of affected regions, prediction of drought conditions, investigation and inspection of irrigated land, collection of fines and payments, and cooperation with the affected state and local agencies.[40] The Act adds Code section 12-5-545, which identifies the power of the Georgia Environmental Facilities Authority to administer drought protection funds.[41] The Act provides that the drought protection funds must be earmarked as drought protection funds and not allocated to the general fund.[42]

The Act adds Code section 12-5-546 to require the EPD to issue a prediction every March as to whether a drought is expected that year.[43] If a drought is predicted, the Act requires that the Division conduct an irrigation reduction auction where, in exchange for monetary compensation, irrigation system permittees in the Flint River basin will agree to abate irrigation of their land for the remainder of the year.[44] Under Code section 12-5-547, if the auction is unsuccessful in significantly reducing the basin's drought problem, the Director has the authority to implement forced irrigation abatement.[45] Again, the Act provides for compensation to those persons who are forced to cease irrigation of their land.[46]

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38. *See id.* § 12-5-543(c). This provision was the subject of Representative Franklin's failed floor amendment. *See* House Audio, *supra* note 4 (remarks by Rep. Bobby Franklin).
39. *See* O.C.G.A. § 12-5-544 (Supp. 2000).
40. *See id.*
41. *See id.* § 12-5-545.
42. *See id.*
43. *See id.* § 12-5-546(a).
44. *See id.* § 12-5-546(b); *see also id.* § 12-5-546(c)-(e).
45. *See id.* § 12-5-547.
46. *See id.*

The Director is authorized to investigate and inspect irrigated lands under Code section 12-5-548.[47] Furthermore, the Act prohibits landowners from interfering with lawful inspections by authorized personnel.[48] When the Director has reason to believe that a landowner or permittee has violated the Act or the DNR's rules, Code section 12-5-549 gives the Director authority to take certain steps to ensure compliance.[49] First, the Director can confer with the landowner, and if that approach is unsuccessful, he or she may issue an order of compliance.[50] Within thirty days of receipt of the order, the individual may request a hearing.[51] The Director has the power to have the order enforced in the superior court of the county in which the violation occurred.[52] Finally, this Code section establishes a prima facie case for an irrigation restriction violation.[53]

Code section 12-5-550 establishes a repayment penalty for irrigation violators.[54] The Director is required to give written notice to the violator.[55] If the violator refuses to pay or fails to challenge the notice, then the violation is deemed admitted and the Director will issue a final, unappealable order.[56]

Section 2 of the Act amends Code section 12-5-134 by adding a provision requiring permits for large wells (capable of producing 100,000 gallons or more of water each day).[57] Such wells can only be constructed after the EPD issues the landowner a letter of concurrence or a permit.[58] Finally, section 3 of the Act amends Code section 50-23-5 by adding subsection 31.[59] This subsection requires the Georgia

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47. *See id.* § 12-5-548(a).
48. *See id.* § 12-5-548(b).
49. *See id.* § 12-5-549(a).
50. *See id.*
51. *See id.* § 12-5-549(b).
52. *See id.* § 12-5-549(d).
53. *See id.* § 12-5-549(e).
54. *See id.* § 12-5-550(a). If a person irrigates in violation of his irrigation reduction agreement or a compliance order issued against him, he must pay a penalty of three times the dollar amount of payments he received from drought protection funds. *See id.*
55. *See id.* § 12-5-550(b).
56. *See id.* § 12-5-550(c)-(d).
57. *Compare* 1985 Ga. Laws 1192, § 1, at 1209 (formerly found at O.C.G.A. § 12-5-134(3) (1996)), *with* O.C.G.A. § 12-5-134(3) (Supp. 2000).
58. *Compare* 1985 Ga. Laws 1192, § 1, at 1209 (formerly found at O.C.G.A. § 12-5-134(3) (1996)), *with* O.C.G.A. § 12-5-134(3) (Supp. 2000).
59. *Compare* 1994 Ga. Laws 1108, § 6, at 1110-27 (formerly found at O.C.G.A. § 50-23-5

Environmental Facilities Authority to work with the Director of the EPD to implement the drought protection program.[60]

Opposition to HB 1362

HB 1362 met some opposition in both houses of the Georgia General Assembly. Representative Jeff Brown of the 130th District expressed concern that the bill was premature because the bill attempted to solve the water usage problem before the results of a $750,000 study of the Flint River were finalized.[61] In addition, the bill might be premature because the tri-state compact between Georgia, Florida, and Alabama was not yet resolved.[62] Despite these objections, HB 1362 passed both houses by a strong majority vote.[63]

Laura D. Windsor

(1998)), *with* O.C.G.A. § 50-23-5(31) (Supp. 2000).

60. *See* O.C.G.A. § 50-23-5(31) (Supp. 2000).

61. *See* House Audio, *supra* note 4 (remarks by Rep. Jeff Brown). *But see* Royal Interview, *supra* note 5 (asserting that farmers would not be able to survive if they were forced to wait for the completion of the five year study).

62. *See* House Audio, *supra* note 4 (remarks by Rep. Jeff Brown).

63. *See* Georgia House of Representatives Voting Record, HB 1362 (Feb. 16, 2000); Georgia Senate Voting Record, HB 1362 (Mar. 13, 2000).

ATTACHMENT 8

Letter from S. Tucker, U.S. Fish and Wildlife Service, to C. Couch, Georgia Environmental Protection Division (Dec. 8, 2008)

United States Department of the Interior

Fish and Wildlife Service
105 West Park Drive, Suite D
Athens, Georgia 30606

West Georgia Sub Office
P.O. Box 52560
Ft. Benning, Georgia 31995-2560

Coastal Sub Office
4270 Norwich Street
Brunswick, Georgia 31520

December 8, 2008

Dr. Carol Couch
Georgia Environmental Protection Division
2 Martin Luther King Jr. Drive
Suite 1152 East Tower
Atlanta, Georgia 30334

Dear Dr. Couch:

The Fish and Wildlife Service (Service) has concerns relating to the lack of implementation of water resource management in the Flint River Basin as outlined in Georgia's Environmental Protection Division's (EPD) Flint River Basin Regional Water and Development Plan (Plan) finalized in March 2006. As you know, the drought continued into 2007 and 2008 with record low flows throughout Georgia and the Southeast. In portions of the Flint River Basin, especially Spring Creek, the effects of natural low flows were exacerbated by water withdrawals for agricultural irrigation. Despite the occurrence of extreme low flows, key measures included in the Basin Plan and associated Flint River Drought Protection Act (Chapter 391-3-28) to reduce water withdrawals have not been put into place. We applaud the measures that have been enacted such as end-gun shut offs, leak detection and repair, and retrofitting or irrigation systems. It is unknown how much water this will keep in the creeks, although this is an effort that should be continued. A measure not used was a provision of the Flint River Drought Protection Act to reduce irrigation withdrawals by 20 percent in sub-basins with greatest risks of experiencing low flows due to irrigation. This tool could have been utilized to keep flow in Spring Creek and other parts of the Flint River Basin.

A report by Hicks and Golladay (2006) looked at the impacts of agricultural pumping on streams, including Spring Creek in southwestern Georgia. The impact of groundwater pumping on streamflow is significantly greater in the Spring Creek watershed because the Floridan Aquifer has a more direct hydraulic connection to Spring Creek. Since the advent of center-pivot irrigation, by early summer, many of the tributary streams to Spring Creek cease to flow, even during years of normal rainfall. The Plan shows calculated reductions in streamflow caused by reduced ground-water discharge to HUC-8 sub-basins (McDowell 2006). In drought years, for certain months, the simulated reduction is actually greater than the observed flows during a drought year. This happened only in Spring Creek.

The Hicks and Golladay (2006) analysis of streamflow data shows consistent and substantial declines in minimum and seasonal streamflow associated with the development and implementation of agricultural irrigation in the Flint River area of southwestern Georgia.

EXHIBIT
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2/13/16 SB

These declines resulted in some of the lowest flows on record during recent droughts. There is no climatologic indication that recent droughts were more severe or persistent than those in the past (e.g., 1930's or 1950's). Thus, Hicks and Golladay conclude that water use is the primary factor causing record low streamflow and other alterations in regional hydrology.

The mussel fauna in Spring Creek has been drastically impacted in the last eight years due to low flows. A high diversity of mussels, as many as 14 species in one survey, has been recorded from Spring Creek prior to and including the summer of 2000. Two federally-listed mussel species, the shinyrayed pocketbook (*Hamiota subangulata*) and oval pigtoe (*Pleurobema pyriforme*), are among the mussels in Spring Creek. Long stretches of Spring Creek dried up for the first time, according to local landowners, in Miller County, Georgia, during mid-June of 2000. According to USGS gage data (2000), the flows at the Spring Creek near Iron City gage were as low as 0 cfs from mid-August to October 1. Service personnel collected 113 fresh dead shinyrayed pocketbooks and 86 fresh dead oval pigtoes from several locations in mid-June 2000 (see attached photograph #1). Numerous native non-listed mussel species (in the thousand's) also perished. Flow did not return in this portion of Spring Creek until October of 2000. Spring Creek went dry again in these same areas in early June 2007 (see enclosed photograph #2). Service personnel collected 94 fresh dead shinyrayed pocketbooks and two fresh dead oval pigtoes from the same locations as in the summer of 2000. The number of native non-listed mussels observed was drastically reduced from the number seen in 2000. Flow did not return back to these areas until November 2007. Service personnel conducted several surveys in these same locations during the summer of 2008. Only one shinyrayed pocketbook and 21 other native mussels total (six species) were found. The mussel populations in Spring Creek appear to be on a steep trajectory to extirpation.

Although few mussels were found in these stretches in 2008, in 2007, there were more individuals than we expected to be present based on the deaths that occurred in 2000 and a survey done in 2004 (a high flow year). Thus, in 2007, the mussel population seemed to have undergone some recovery from the impacts of 2000. Nevertheless, as the dwindling numbers indicate, repeated and successive low flow years incrementally reduce the remaining population. Mussels observed in these stretches were in the thousands (14 species) in 2000, while in 2008, only 21 (six species) mussels total were found during several surveys. No flow not only causes direct mortality of mussels, no flow and extreme low flows prevent fish host from gaining access to gravid mussels ready to release mature glochidia. We have also observed mussels expelling glochidia under stress of declining water levels and increasing water temperature. This is a direct impact to the mussels' ability to persist in Spring Creek.

Spring Creek was designated on November 15, 2007, as critical habitat for the endangered shinyrayed pocketbook, oval pigtoe, and the Gulf moccasinshell (not found in recent surveys). Critical habitat is a term defined in the Endangered Species Act. It refers to specific geographic areas that are essential for the conservation of a threatened or endangered species and that may require special management consideration or protection. When designating critical habitat, the Service identifies the physical and biological habitat features that each life stage (adult, juvenile, glochidia) must have for normal behavior, growth, survival, and what each species needs for

normal reproductive success and dispersal rates. These essential habitat features are called primary constituent elements (PCE). There are five PCE's in this critical habitat listing. Three of the five are either not met consistently or compromised during these no flow or extreme low flow events, and include permanently flowing water, water quality, and fish hosts. Mussels cannot live without permanently flowing water and during these extreme low flow events, water quality declines with increased water temperatures, decreased dissolved oxygen, and increased concentration of waste water discharges in some rivers and creeks including Spring Creek. Areas with no flow also act as barriers to allow fish host to move up and down stream to areas that may still contain mussel populations. Fish hosts also become trapped in isolated pools as the stream dries up and eventually die as water temperatures increase and dissolved oxygen decreases.

In our letter to EPD and Mr. Rob McDowell, dated January 13, 2006, relating to the draft Plan, we stated "Because of the magnitude of flow deviations from natural flows, those ongoing and projected, it is our recommendation that prior to implementation of the Flint River Water Development and Conservation Plan, EPD acquire the appropriate permit from the Service. To do otherwise places EPD and those implementing the Plan at peril for violation of the ESA. More fundamentally however, it is our belief that water conservation to provide for sustainable flow and reasonable use will not be achieved in certain stream reaches without significant changes to current water use." We cannot see that any change in circumstances has occurred that would prompt us to alter this position. We would like to work with you on conservation of endangered species in Spring Creek and other portions of the Flint River Basin and therefore request that you advise us on your intent regarding future actions.

If you have any questions, please contact me at (706) 613-9493 ext. 230.

Sincerely,

Sandra S. Tucker

Sandra S. Tucker
Field Supervisor

cc: file
GDNR-WRD, Social Circle
USFWS, Ft. Benning
USFWS, RO, Atlanta

Enclosure

Photograph #1

Mussel salvage effort, Spring Creek at Old Mill Acres site, June 20, 2000

Photograph #2

Spring Creek at Old Mill Acres site, June 21, 2007

References

Hicks, David W. and S.W. Golladay. 2006. Impacts of agricultural pumping on selected streams in southwestern Georgia. J.W. Jones Ecological Research Center, Newton, Georgia, 30 pp. (Unpublished)

McDowell, R. 2006. Flint River Basin Regional Water Development and Conservation Plan. Georgia Department of Natural Resources, Environmental Protection Division, Atlanta, Georgia. http://www1.gadnr.org/frbp/

ATTACHMENT 9

Email from T. Cash to C. Lewis (Jan. 13, 2011)

From: Tim Cash Thursday - January 13, 2011 11:57 AM
To: Lewis, Cliff
Subject: Re: Fwd: Re: Fwd: Lower Flint Drought Issues

Linda is trying set up a meeting with him. Don't have a date but she is trying to get it on his calendar within the next few daays. Thanks!

Tim Cash
Assistant Chief
Watershed Protection Branch
Georgia Environmental Protection Division
404-675-1766(o)
404-308-8189(mobile)

-----Original Message-----
From: Cliff Lewis
To: Cash, Tim <Tim.Cash@dnr.state.ga.us>

Sent: 1/13/2011 11:54:17 AM
Subject: Re: Fwd: Re: Fwd: Lower Flint Drought Issues

Believe we can. I have asked Wei if he is available at 1:00 pm today by phone. He has to be our starting point. I can get Tommy on these crop prices, etc. I assume this is ASAP, but what are you shooting for in terms of having this info to Allen?

>>> Tim Cash 01/13/11 11:37 AM >>>
Thank you for the quick turn around time on this.

Of course, the bottom line for Allen will be the total cost. Going to Allen with a price per acre will not tell him what he needs to know. Can y'all bracket this with some degree of certainty? I'm assuming this will require us to get some input from Wei and make some assumptions about the number of acres by crop type that will need to be taken out of production to achieve the desired flow at the Newton gage. Can y'all do this?

Tim Cash
Assistant Chief
Watershed Protection Branch
Georgia Environmental Protection Division
404-675-1766(o)
404-308-8189(mobile)

-----Original Message-----
From: Cliff Lewis
Cc: Burdette, Clay <Clay.Burdette@dnr.state.ga.us>
To: Cash, Tim <Tim.Cash@dnr.state.ga.us>
Cc: Rooks, Edward <Edward.Rooks@dnr.state.ga.us>
Cc: Rumph, Tommy <Tommy.Rumph@dnr.state.ga.us>

Sent: 1/13/2011 10:27:15 AM
Subject: Re: Fwd: Re: Fwd: Lower Flint Drought Issues

Tim,

1) Attached is:

a) an updated copy of what a 2011 FRDPA process would look
b) copy of the eligibility criteria that were determined in 2009
c) an interactive crop cost spreadsheet that is composed of expected crop yields and prices from 2009. Tommy and I reviewed this info this morning. Tommy can update and would have to update this interactive spreadsheet in order to project potential per acre payments . The numbers change daily. As of 2009, based on Return of Expected Yield (factoring in government guarantees) it would appear our price per acre range indicated around $150. Now, the spreadsheet is descriptive of crop situations statewide. If we narrow down our target areas to the three FRB sub-basins, we believe that these numbers were and still are deflated since you southwest Georgia yields are great than other part of the state. In our 2009 estimation for the three sub-basins targeted, $250-$350 was our recommended price per acre range. The reason we recommended this range is because for the 2 FRB sub-basins targeted (Spring Creek and Ichauway). For example, when we did this in 2009, Cotton was at $0.61/lb with a governmental subsidy to pay $0.72/lb. As of last night (1-12-11), Cotton for 2011 can be sold for $1.06/lb. Peanut example: In 2009, contracts were at $355/ton and this year when contracts were opened, they were at $550/ton PLUS $25 seed premiums (for growers that grow peanut seed, which many do). You can play with the numbers on the sheet. Point is that an FRDPA per acre payment would have to be greater than we estimated in 2009.

2) Because of the criteria of "Permits must be for a permanent fixed irrigation system", Ag Unit should use the calculated acres from the GIS pivot shapefile for irrigated acres (not the permitted acres in the database) on the Auction Certificates as eligible acres for the auction. The reason why is because it was possible that not all of the permitted acres are irrigated by a permanent irrigation system (ex. total permitted acres could be part traveler acres and part pivot acres).

Cliff Lewis
Acting Assistant Branch Chief
Ochlockonee/Suwannee/Satilla/St. Mary's' Basins
Watershed Protection Branch
Georgia Environmental Protection Division
531 Main St, Suite D
Tifton, Georgia 31794
(o) 229-391-2400 (c) 229-357-1510

>>> Clay Burdette 01/13/11 10:07 AM >>>
Edward, the table is good; could you find any cost???

Cliff, My mind is old but I thought just after I became mgr 1-08 we/you had to come up with a cost of having a drought auction??????

>>> Edward Rooks 1/13/2011 9:20 AM >>>
Acres table attached.

>>> Clay Burdette 1/13/2011 8:13 am >>>
do you have this???

>>> Tim Cash 1/13/2011 7:53 AM >>>
Clay - in either 2007 or 2008 prior to the March 1 lower Flint drought declaration, the Ag Permitting Unit put together an estimate of what an auction would cost. Could you have someone find that and send it to me?

Tim Cash
Assistant Branch Chief
Chattahoochee and Flint River Basins
Watershed Protection Branch
Georgia Environmental Protection Division
4420 International Parkway, Suite 101
Atlanta, Georgia 30354
404-675-1766 (o)404-308-8189 (c)

From: Wei Zeng Thursday - January 13, 2011 2:54 PM
To: Cliff Lewis; Edward Rooks; Hailian Liang; Menghong Wen; Tim Cash; Tommy Rumph
Subject: Fwd: acres
Attachments: 2009_FRBA_Eligible_Permits_Summary_2_26_2009.xls (31744 bytes) [View] [Open] [Save As]
Cliff and Tim,

Here's my understanding of what was said in the Flint River Basin Regional Water Development and Conservation Plan. By reducing the amount of irrigation by 20%, we would be able to meet the critical low flow criteria in the Ichawaynochaway Creek and Lower Flint HUC-8 units. However, we would not meet the criteria in the Spring Creek HUC-8 unit.

I assume that we should take the eligible acreage from the Ichawaynochaway Creek and Lower Flint HUC-8 units and apply a 20% reduction across the board to comply with the Plan. (Since the Plan says that a reduction in the Spring Creek HUC-8 unit does not address the problem of not meeting critical low flow criteria, we will not target this HUC-8 unit.) If you disagree with this understanding, please let me know as soon as possible.

We can provide the beneficial effects of irrigation reduction, but will depend on others to determine the cost of such action. Thanks.

Wei

From: Tim Cash Thursday - January 13, 2011 3:47 PM
To: Wei Zeng
CC: Cliff Lewis
Subject: Re: Fwd: acres
Wei - The FRBP provides for a 20% reduction in irrigated acreage in Spring Creek, Ichawaynochaway Creek and the lower Flint River sub-basins as part of an auction under the FRDPA even though the USFWS's critical low-flow criteria set forth in Section 6.3 of the Plan may not be met in Spring Creek. Please read the following:

From page 23 of the FRBP:

"6. If, under the Rules for Flint River Drought Protection (Chapter 391-3-28) irrigation withdrawals are reduced by 20% in those sub-basins with the greatest risk of experiencing irrigation-induced low flows, stream discharges that will prevent stream drying and harm to endangered fresh-water mussels will likely be sustained (Section 6.3)."

...and from page 54 (emphasis added):

"4. If irrigation is decreased during a drought year by 20% of current use in Ichawaynochaway Creek and lower Flint River sub-basins, critical low-flow criteria will be met. If irrigation is decreased during a drought year in the Spring Creek sub-basin by 20%, it is assumed this will have a beneficial affect on water levels and stream ecology even though critical low-flow criteria may not be met. This will require application of the Flint River Drought Protection Act in such a way that enough irrigated acreage is temporarily converted to dry-land acreage, which can be done either through the voluntary auction process or non-voluntary irrigation suspension with compensation as defined by State law."

Therefore, we should be shooting for a reduction of 20% of "current use" in all three sub-basins. I am assuming that "current use" as used in the plan meant whatever was considered current use at the time the USGS model was run for the development of the FRBP. If we use whatever actual current use is now, a 20% reduction may not be adequate to protect the minimum flow

criteria, or it may not be necessary if the original estimate of "current use" is higher than the estimate of what current use actually is now. Therefore, we should be shooting for a target of protecting the minimum low flow criteria, determining the percent water use reduction that would have to occur in Ichawaynochaway Creek and lower Flint River sub-basins, and then shoot for the same percentage reduction in Spring Creek. It would be interesting to know what the percent reduction would need to be in the Spring Creek sub-basin to protect the minimum flow criteria in Spring Creek, but I understand that is something that we may not need to know at this particular time; our main interest at the present time should be to do what we are required to do to achieve strict compliance with FRDPA as guided by the FRBP.

From: Wei Zeng Tuesday - January 18, 2011 3:45 PM
To: Cliff Lewis; Tim Cash
CC: Hailian Liang; Menghong Wen
Subject: Re: Fwd: acres
Tim and Cliff,

A follow-up question on the input to the groundwater model. We have several ways of doing this, and I would like to have clear guidance from you on how to proceed.

1. We can make an across-the-board reduction in irrigation (through 20% reduction in application depth) in all three HUC-8 units, i.e. Lower Flint, Ichawaynochaway Creek, and Spring Creek unit. This is the easiest way to do the reduction. However, if we want to achieve the best efficiency, we want to do 2.

2. We can figure out the amount of 20% of irrigation reduction, and then apply the reduction only to the Capacity Use Areas. A possibility is that we may not be able to achieve the type of reduction with only the Capacity Use Areas, and this leads us to 3.

3. We figure out the amount of 20% of irrigation reduction, and then apply the reduction to both the Capacity Use Areas and the Restricted Use Areas.

Please let me know what you think would be the most appropriate way to do this. Thanks.

Wei
From: Tim Cash Tuesday - January 18, 2011 4:09 PM
To: Zeng, Wei, Lewis, Cliff
CC: Liang, Hailian, Wen, Menghong
Subject: Re: Fwd: acres
2 and 3
Tim Cash
From: Cliff Lewis
To: Cash, Tim <Tim.Cash@dnr.state.ga.us>

Sent: 1/19/2011 3:40:20 PM
Subject: Re: Fwd: acres

Tim, Tommy and I have determined the price per acre range that we can expect most farmers would bid if in an auction. I can show you how and why this would be the range, what we would expect we would end up paying per acre approximately,etc. All I really need now is Wei's estimate of acreage that would need to be removed so that I could put a few scenarios together for potential total auction costs. Didn't want to put any numbers in email. I will be driving to Perry to speak at the Crop Advisors Agricultural Seminar tomorrow morning and I would have time to call you and at least run the costs by you. We could schedule a time to look at the method of determining those costs after we talk, so that if/when you present to Allen, you will know what you are talking about in terms of commodity prices. If necessary, I don't mind helping explain any of this stuff to Allen when the time comes, whatever you need.

Cliff Lewis

From: Tim Cash Tuesday - January 25, 2011 8:24 AM
To: Cliff Lewis; Wei Zeng
CC: Bill Morris
Subject: Fwd: Fw: Pending Drought
Attachments: Envelope

Attached is an e-mail from Allen to Linda with an e-mail form Richard Royal to Allen forwarding an e-mail from Woody Hicks who is wondering why EPD is not out talking to people in South Georgia about pre-drought planning; I have my own response to that question that I won't bother y'all with. Allen's e-mail to Linda says we need to discuss.

Wei - I will come see you today about what we need to get ready to brief Allen on drought conditions. We need the following in this order of priority:

1. Results of the FRDPA drought matrix with current data;
2. The number of acres that need to be taken out of irrigation in the Lower Flint; and
3. An updated statewide drought management plan analysis completed.

Cliff - we need to know how much an auction will cost. How long will it take you to get a number once you get an acreage number?

From: richard royal <richardroyal@yahoo.com> Monday - January 24, 2011 4:33 PM
To: Allen Barnes <Allen.Barnes@dnr.state.ga.us>
Subject: Fw: Pending Drought

Attachments: Mime.822 (9120 bytes) [View] [Save As]

--- On **Mon, 1/24/11, Woody Hicks <*whicks@jonesctr.org*>** wrote:

From: Woody Hicks <whicks@jonesctr.org>
Subject: Pending Drought
To: "Richard Royal" <richardroyal@yahoo.com>, "Mark Masters" <mmasters@h2opolicycenter.org>, "Doug Wilson" <dougwilsonh2o@gmail.com>
Date: Monday, January 24, 2011, 10:54 AM

NOAA has released their climate forecasts for Winter-Spring 2011 (see link below). To say that it reflects "gloom and doom" for the SE Region may be an understatement.

http://www.noaanews.noaa.gov/stories2011/images/seasonal_drought.jpg

Streams in Southwest Georgia are currently flowing at about 50% or less of the long-term median. Presently our streams are flowing at the normal rate we would expect for early June in a normal year. Groundwater levels are at near record lows for this time of year. Levels have not recovered at all from Summer 2010 water use impacts. Some observation wells tapping the Upper Floridan aquifer are presently 25-30 feet below normal. The combination of below normal stream levels and aquifer levels will result in many connected streams being impacted much earlier than in previous drought years.

I am concerned that we are not hearing any discussion from GaEPD regarding pre-drought planning. If the present climate and hydrologic trends continue, we could see a more severe drought than our region has seen during modern time.

It appears from the NOAA climate predictor that much of Georgia will be engaged in severe drought through Spring. NOAA experts feel strongly that the drought will persist perhaps more than one year. Clearly, the hydrologic and agricultural impacts on our region of Georgia very likely will be extreme. How do we get the proverbial ball moving regarding pre-drought planning? What can agriculture do regarding pre-drought planning?

I'm trying not to do my "Chicken Little" imitation, but I am worried about the sky falling.

Woody

--
Woody Hicks, Scientist
Joseph W. Jones Ecological Res Ctr
3988 Jones Center Drive
Newton, GA 39870

phone: (229) 734-4706

ATTACHMENT 10

Memorandum from W. Zeng to A. Barnes regarding "Groundwater conditions in southwest Georgia and low flow in the Flint River in the Apalachicola-Chattahoochee-Flint River Basin"

Memorandum

EXHIBIT

Caldwell 35

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To: Allen Barnes

From: Wei Zeng

Date: September 6, 2011

Subject: Groundwater conditions in southwest Georgia and low flow in the Flint River in the Apalachicola-Chattahoochee-Flint River Basin

The purpose of this memorandum is to give you an update on recent groundwater conditions and relevant surface water flow conditions in southwest Georgia. On both groundwater and surface water conditions, we made a comparison between the most recent period and the 2007 through 2008 period. The current conditions are similar or slightly worse than what we have experienced in the last drought.

Groundwater Conditions

We used daily averaged ground water levels at nine USGS observation wells in southwest Georgia. These wells are all located inside the so-called "Dougherty Plain" or "Sub-area 4," which corresponds to the area where groundwater pumping from the Upper Floridan Aquifer has a significant and quantifiable effect on surface water flow in the Flint River and its major tributaries. The locations of these wells as well as the boundary of the Floridan Aquifer can be seen in Figure 1 of Appendix A.

For each of the nine wells, we overlaid the 2010-2011 (so far in 2011) observation (in blue color) on top of 2007-2008 observation (in yellow color). We also drew a horizontal line in red to emphasize the initial conditions of 2011, or the end effect at the conclusion of 2010. The magnitude of recharge (or the lack of it) can be seen more clearly with the red line.

In short summary, groundwater conditions up to this point in 2011 bear the following two troubling features:

1. There was a clear lack of recharge and replenishment of groundwater storage after the conclusion of the 2010 growing season. This was probably caused by the La Nina phenomenon in the winter of 2010 resulting in weaker precipitation in the region. Even when compared to 2007 and 2008 (the last year with a strong La Nina), the two previous drought years, the lack of groundwater recovery in this year was stunning.
2. For all nine wells, the current groundwater levels are worse than at the same time in 2008. Most of these wells have similar or worse levels in comparison to at the same time in 2007. This observation is across the board, which indicates lower groundwater storage across the region.

The groundwater levels can be seen in Figures 2 through 10 in Appendix A.

Stream Flow in the Flint River

In drier times when there is the lack of normal precipitation, a large portion of the flow in the lower Flint River is the result of groundwater discharge into the river channel. When groundwater levels are low, the hydraulic head driving this discharge is low, which will in turn result in lower discharge and lower flow in the channel.

This is what we have observed in the Flint River this year. Figures 11 and 12 show monthly average flow in the Flint River at Bainbridge and Newton gages respectively. We overlaid 2011 conditions with those of 2006, 2007, and 2008. Stream flows in the Flint River in the past four months at both locations are very similar to what were observed back in 2007, which was associated with some of the worst conditions ever recorded. In fact, the cumulative flow at Bainbridge this year is lower than that of the same period in 2007.

It is also very troubling to observe the daily low flow record being broken in the past few days. Before this past week, the lowest daily average flow ever recorded in the Flint River at Bainbridge was 1190 cfs on September 13, 2002. Flow at Bainbridge in the past four days has tied this record once and broken it twice. The low groundwater level and discharge has shown its effects on stream flow.

Projections of Potential Future Conditions

In meetings and conference calls that took place in the past few weeks, climatologists from both federal and state levels pointed to the possibility of a second year of La Nina, which would likely cause another winter and spring (in 2012) to be drier and warmer than normal. If this prediction materializes, then we will be faced with much depleted storage in both groundwater aquifers and surface water reservoirs and another underperforming recharge season.

If this comes to fruition, then the major resources supporting both the Chattahoochee River and the Flint River will be under enormous amount of pressure both to provide for economic activities inside Georgia and to support ecological flows in the Apalachicola River.

We will continue to update you on conditions in both the Chattahoochee and the Flint Rivers.

Appendix A

Recorded Groundwater Levels and Flint River Flow

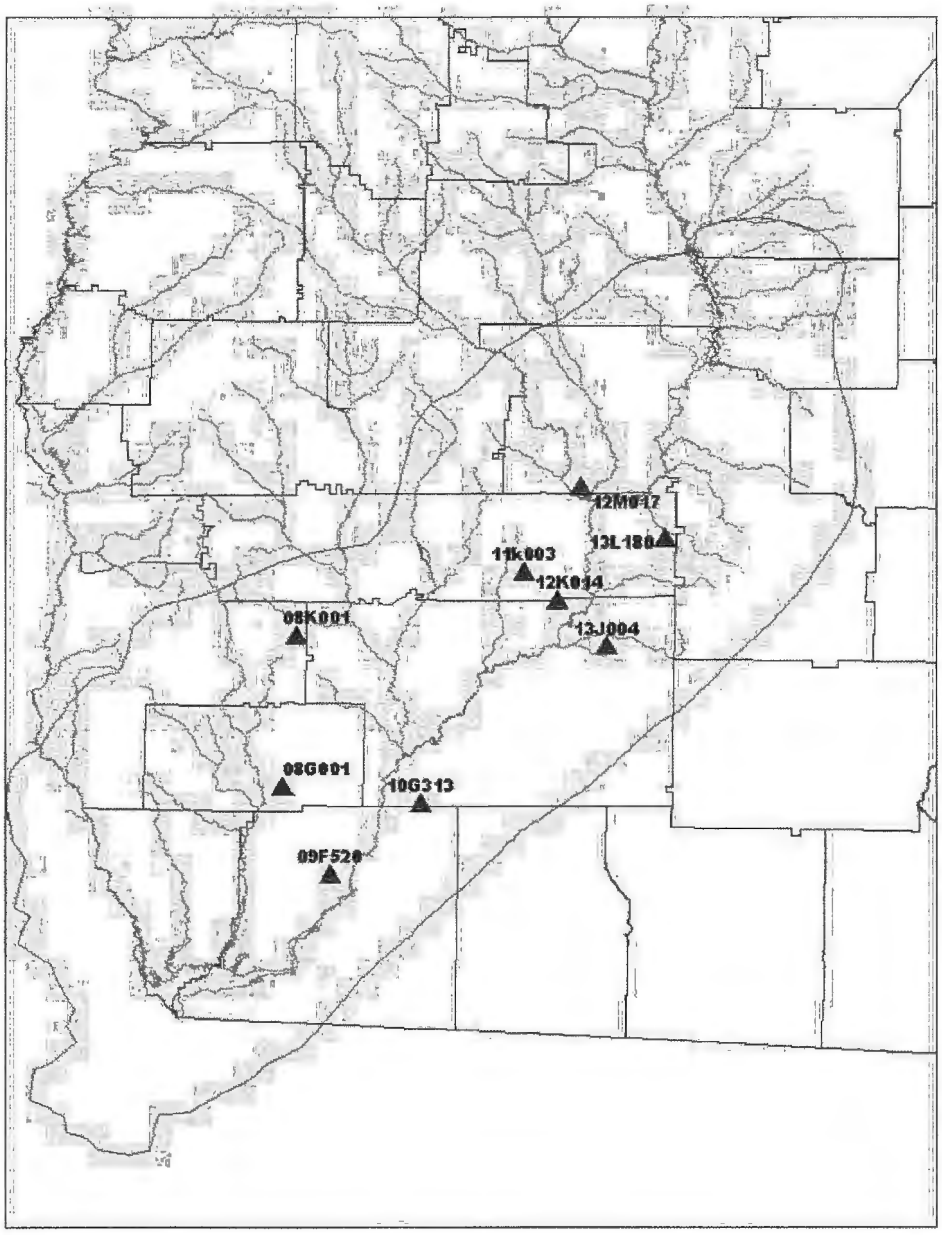

Figure 1 Locations of groundwater observation wells in southwest Georgia

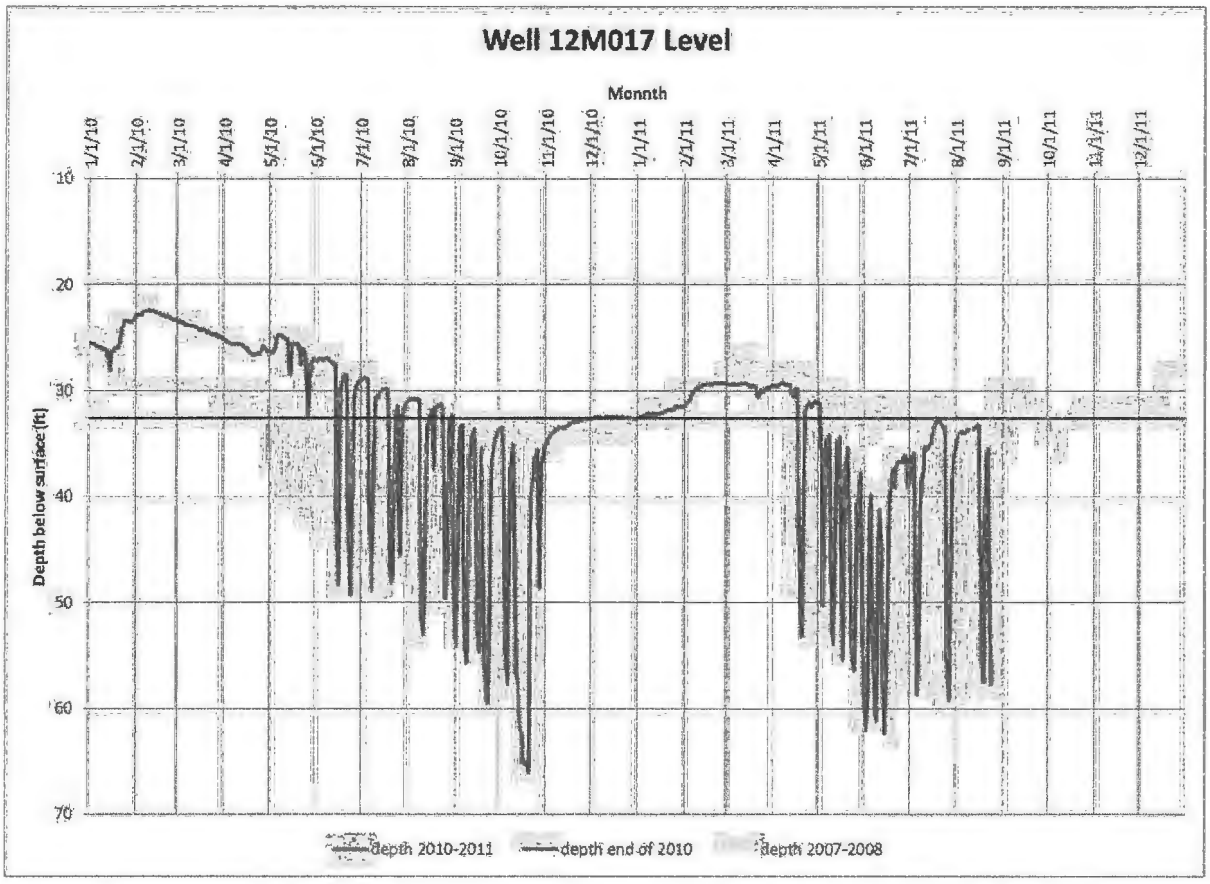

Figure 2 Well 12M017 in south Lee County (close to Albany, GA)

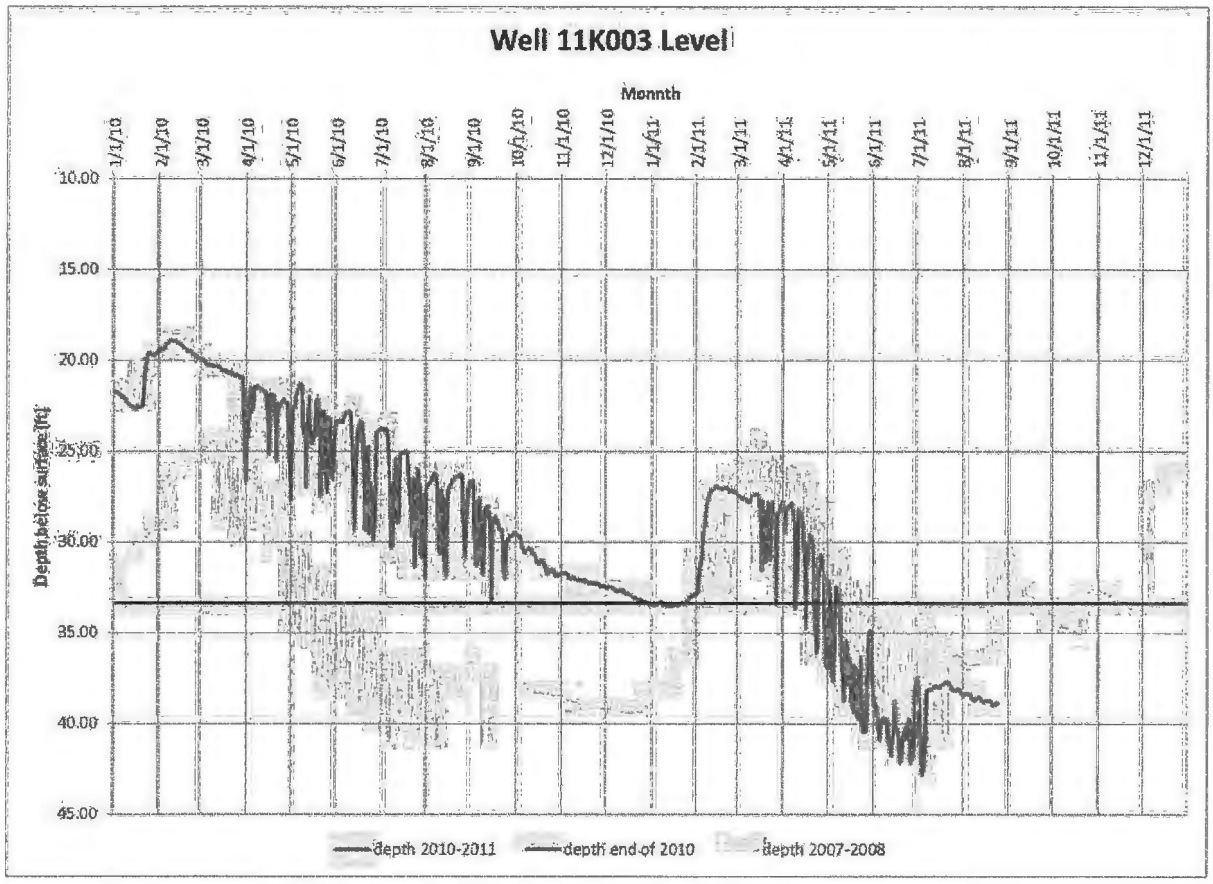

Figure 3 Well 11K003 in west Dougherty County

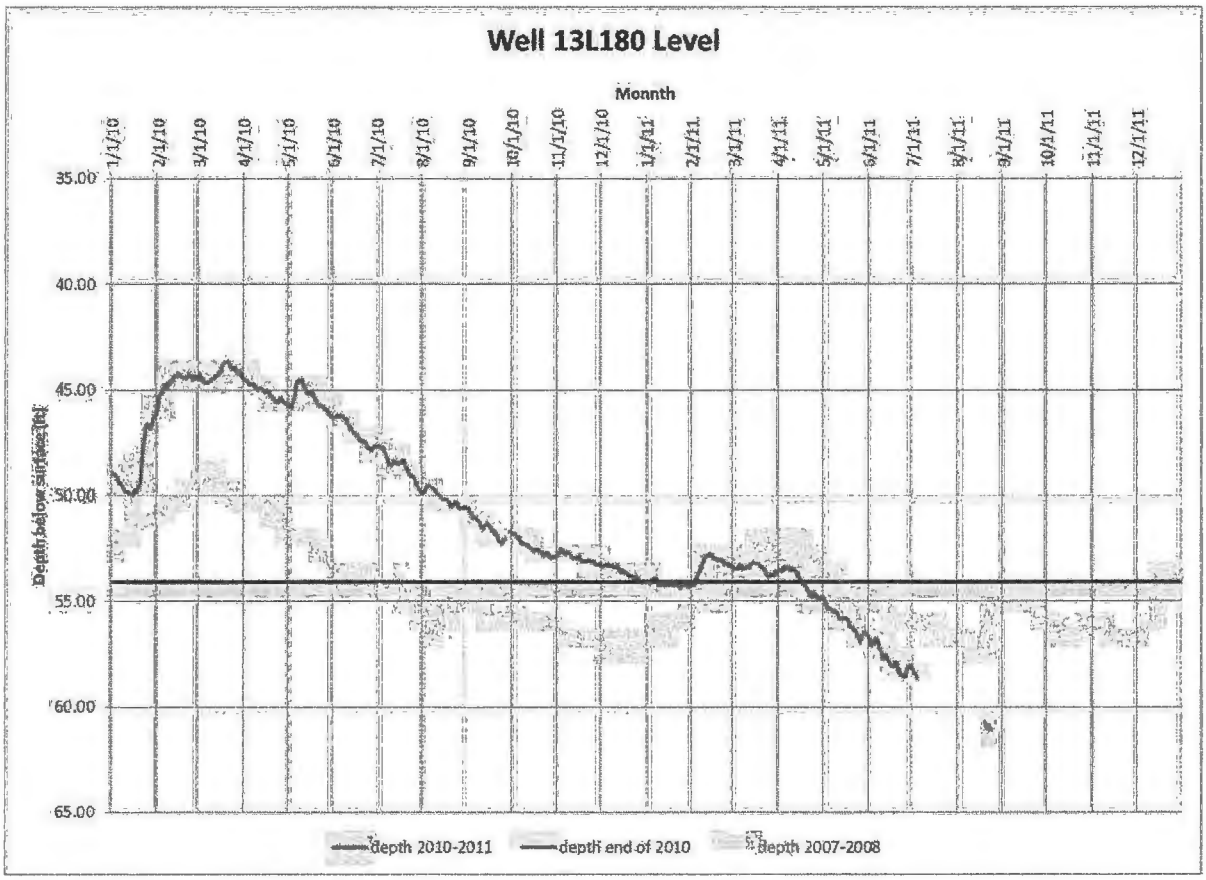

Figure 4 Well 13L180 in east Dougherty County

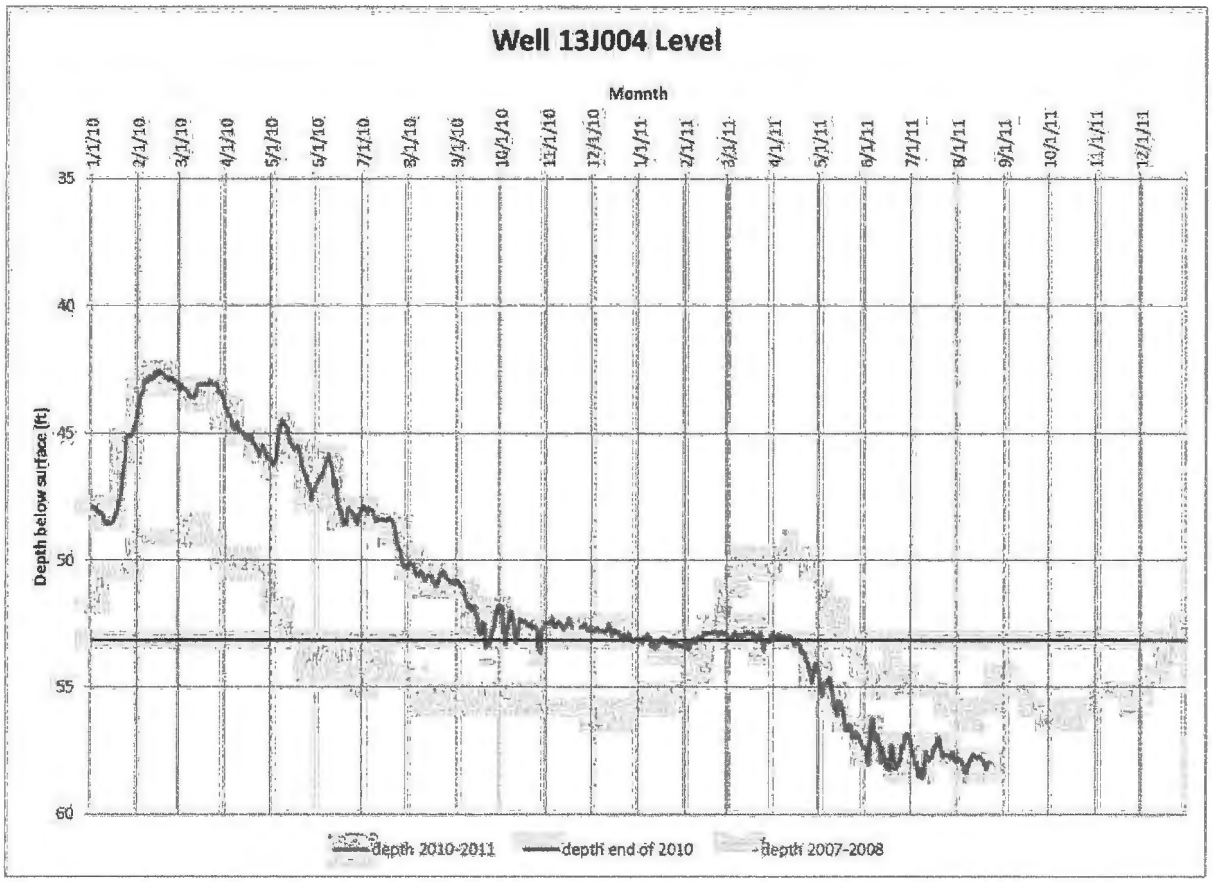

Figure 5 Well 13J004 in Mitchell County

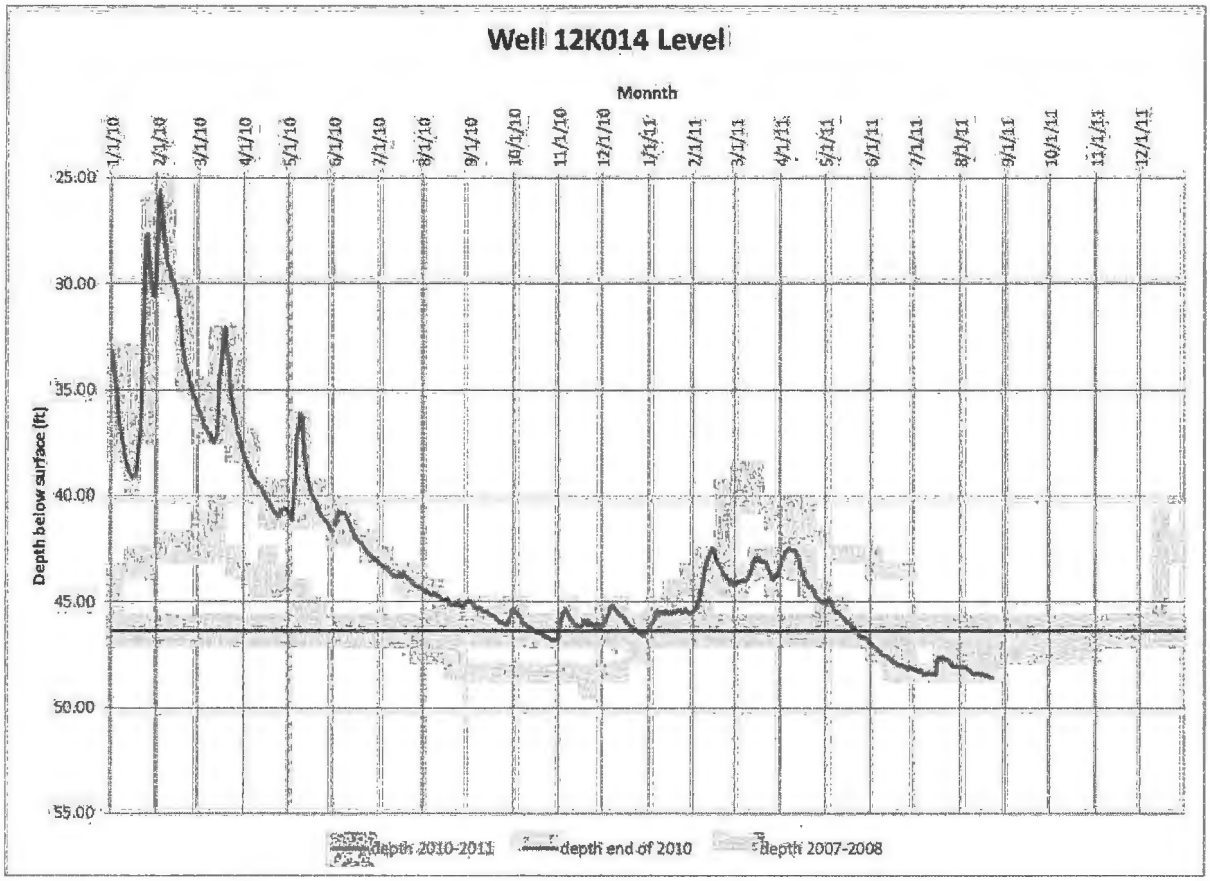

Figure 6 Well 12K014 in northeastern Baker County

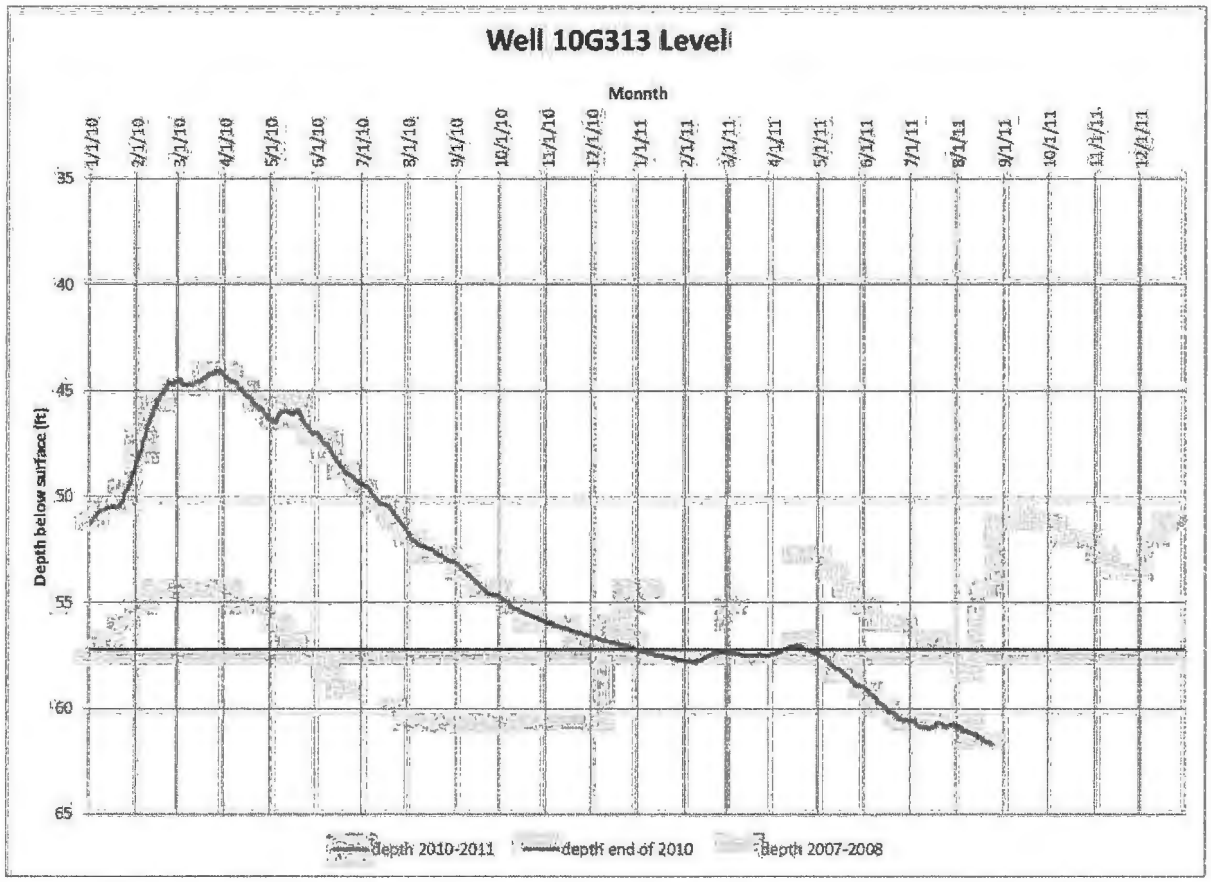

Figure 7 Well 10G313 in southwestern Mitchell County

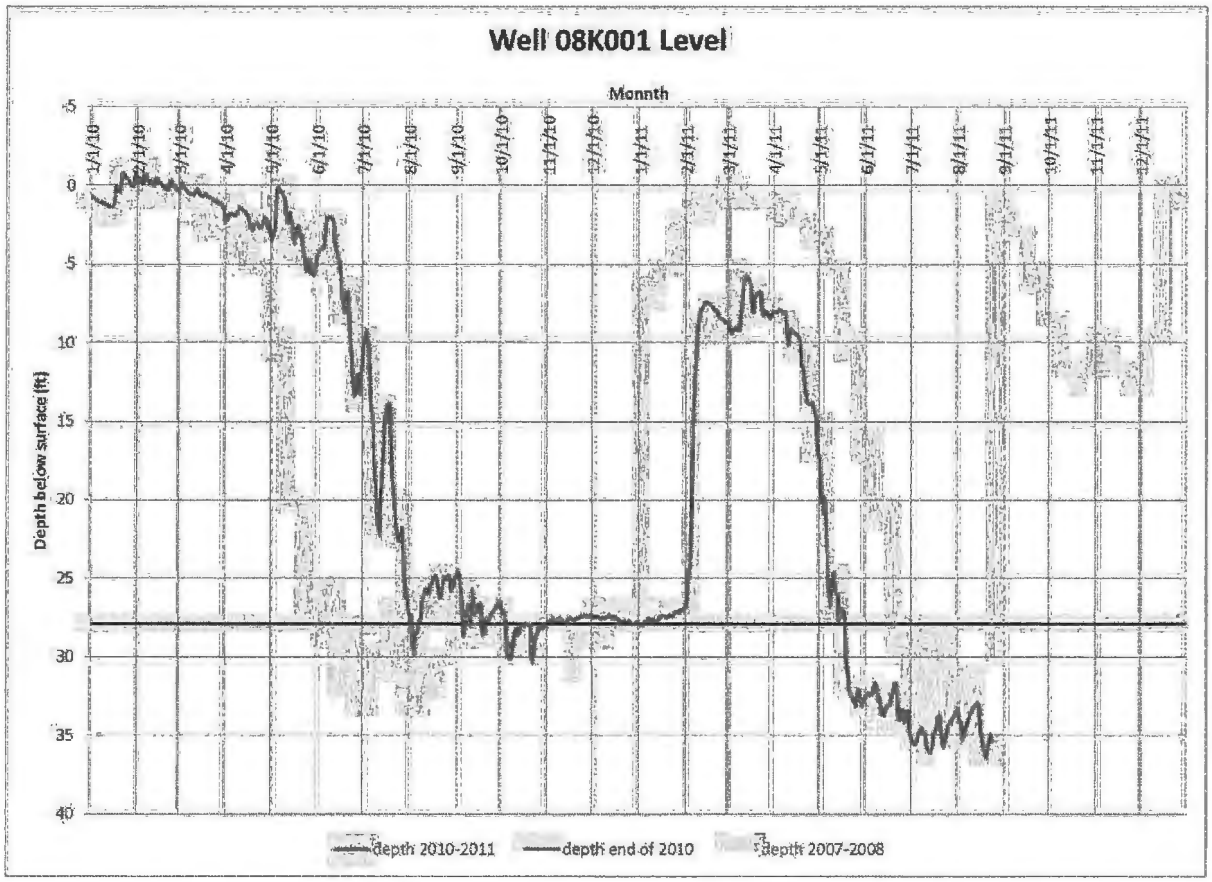

Figure 8 Well 08K001 in Early County

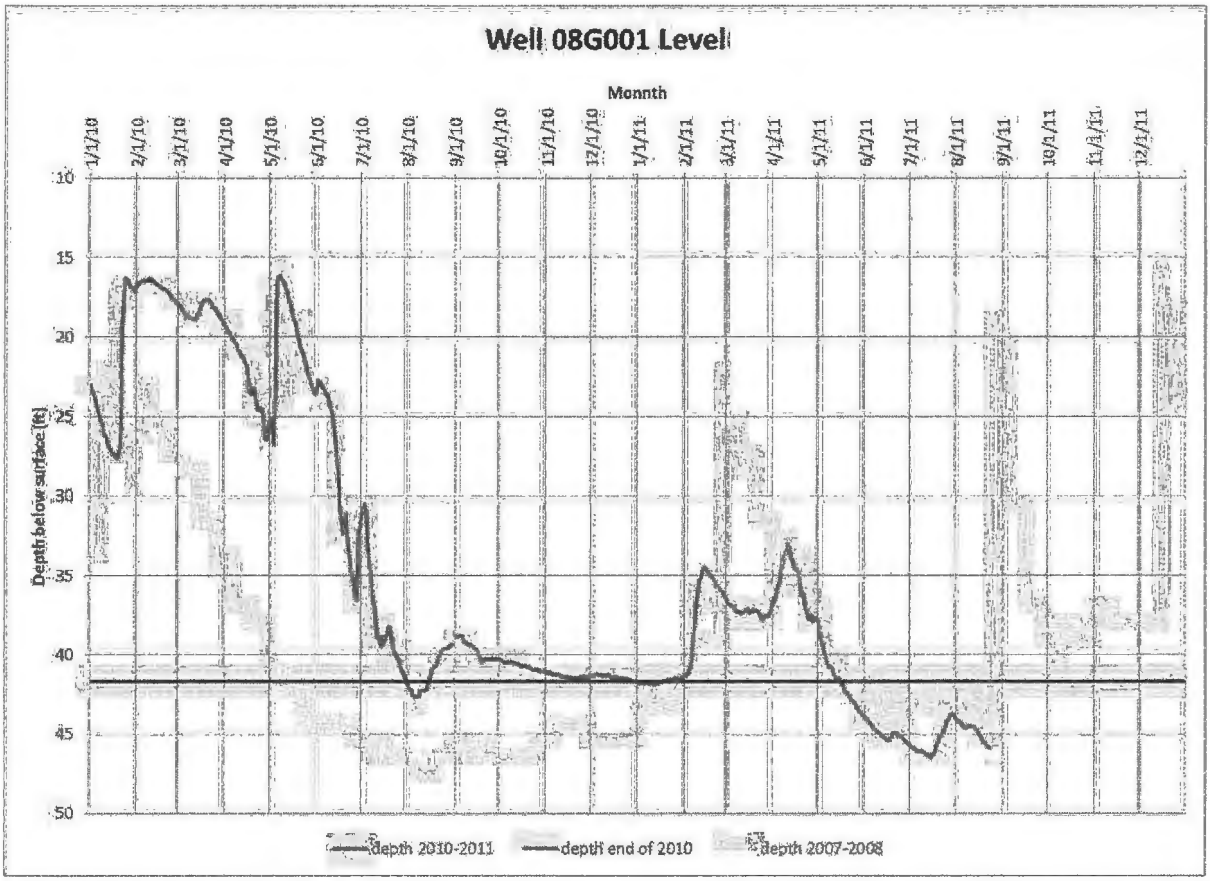

Figure 9 Well 08G001 in Miller County

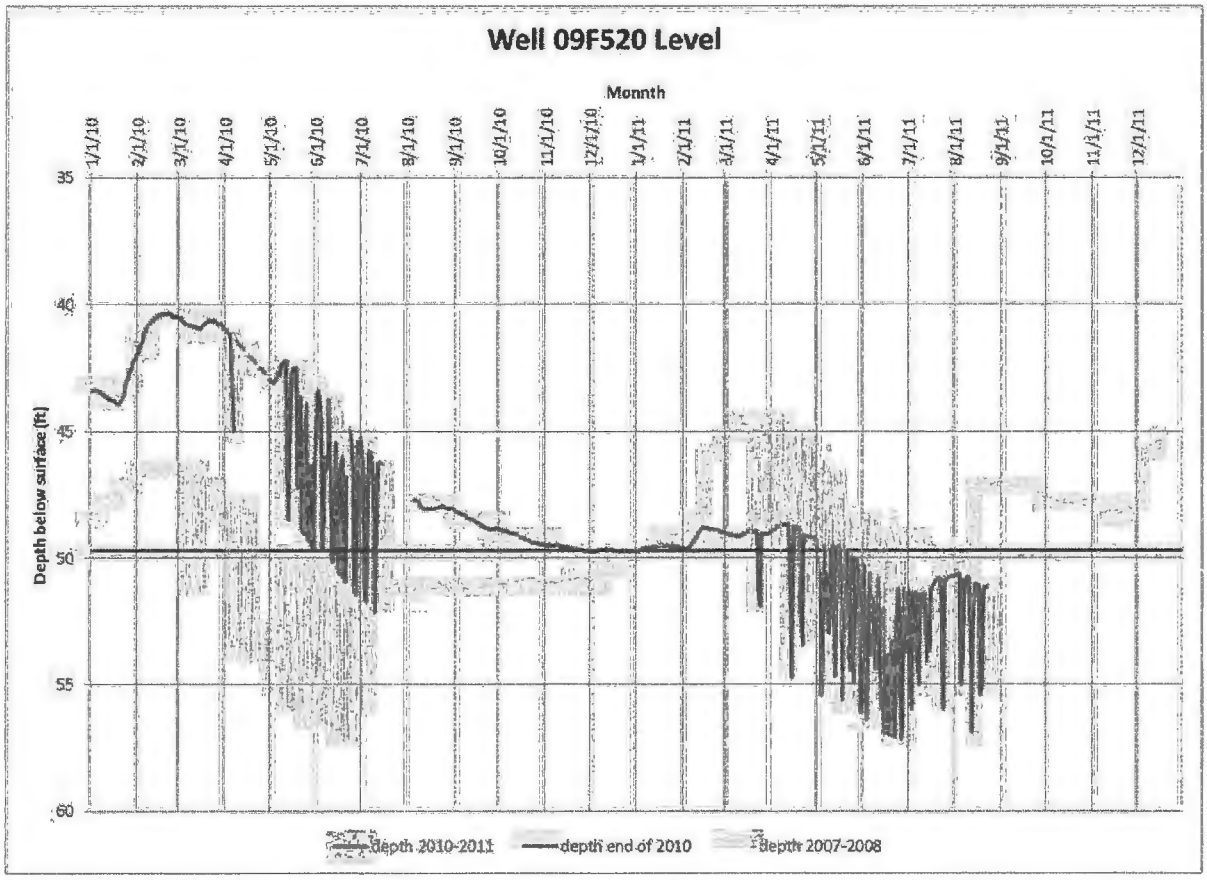

Figure 10 Well 09F520 in Decatur County

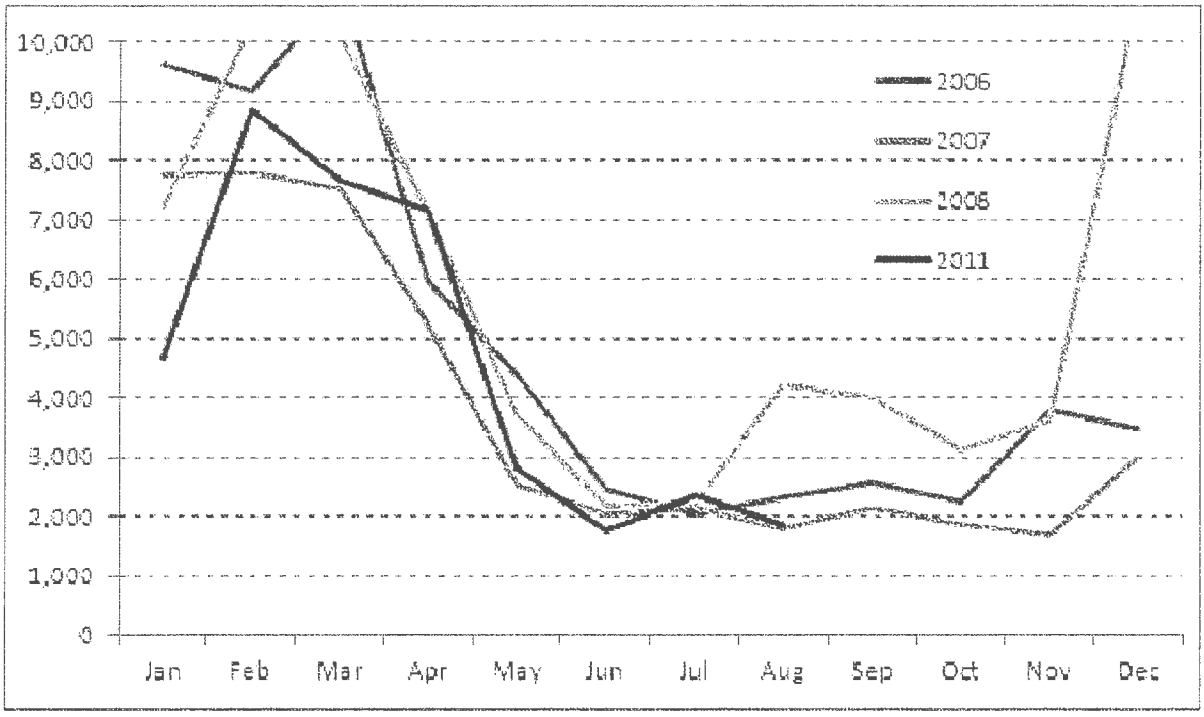

Figure 11 Monthly average flow at Flint River near Bainbridge, GA (in cfs)

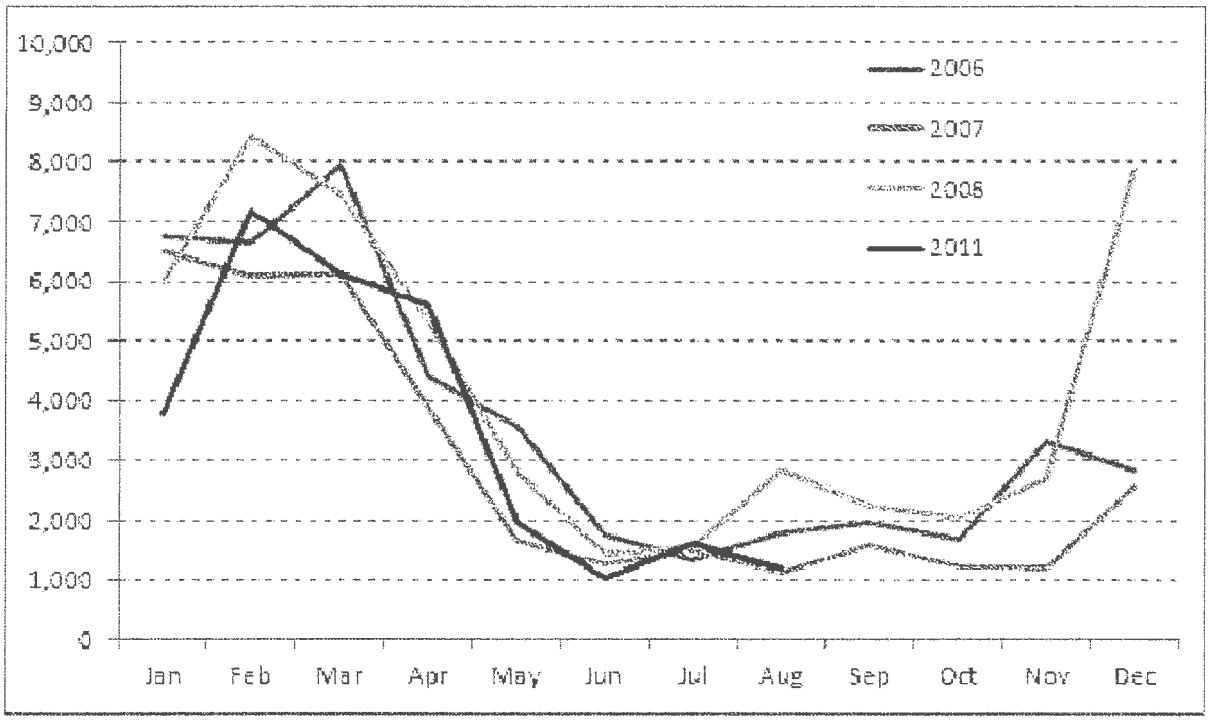

Figure 12 Monthly average flow at Flint River near Newton, GA (in cfs)

ATTACHMENT 11

Draft Press Release by J. Kennedy, Georgia State Geologist

Kennedy's Modifications (18 Feb)

By statute, each February the Georgia Environmental Protection Division (EPD) evaluates a set of lower Flint River basin rainfall, stream flow, and groundwater data before predicting the likelihood of severe drought conditions over the basin during the calendar year. One of the intentions of the statue was protection of the Flint River stream flow as necessary for a healthy riverine ecosystem and a healthy population of aquatic life. The statute defined drought conditions as any condition which results in a stream flow that is lower than an acceptable Flint River stream flow. EPD's evaluation of those data in February 2012 indicates that severe drought conditions can be expected. When such a prediction is made, the statute provides EPD with an irrigation reduction auction water management tool whose purpose is to limit the impact of irrigation water use on Flint River flows. EPD will not implement such a auction this year.

EPD's evaluation of flow conditions in some of the tributaries feeding the Flint River - before irrigation – indicates low stream flows and base flows. These streams may go dry because of a combination of extended lack of rainfall and already depleted aquifer levels, resulting in little or no contribution from the aquifer to stream base flow. In such instances there is no stream flow from which farmers may withdraw, and the water level in some portions of the aquifer may be so low that further withdrawals would not have a material adverse impact on the base flow in some of these streams. Where such instances occur, there would be limited or no value in paying farmers to cease irrigation from non-existent stream flow and groundwaters already too low to affect stream flows.

"EPD has analyzed data on stream flows and determined that a reduction in irrigation would not make a difference this year," said EPD Director Jud Turner. "Southwest Georgia has been in drought for XX months and it's going to take a significant amount of rain to improve conditions."

Along those tributaries where there are indeed flow benefits associated with suspending irrigation (e.g., Ichawaynochaway Creek), the 2012 net value (to growers) of an acre of major farm commodities is expected to be in the $300 to $700 range. The average per acre price Georgia paid to suspend irrigation acres during the '01 and '02 auctions was between $127 and $136. (There is likely to be legitimate questions regarding why EPD does not suspend irrigation water use by those permit holders who are subject to involuntary suspension of their ag water use.) Given such high farm commodity prices in 2012, there will be no incentive for eligible farmers to participate in an auction. Georgia's drought protection fund does not contain the financial resources necessary to finance suspension of irrigation acres in the range of $300 to $700 per acre.

EPD is working closely with the U.S. Fish and Wildlife Service to demonstrate how flows in Spring Creek could be augmented using groundwater. (More details about augmentation program.) This is being done to protect specific reaches of Spring Creek during periods of low flows caused by drought.

ATTACHMENT 12

Georgia Department of Natural Resources Press Release – "Georgia EPD Declines Drought Declaration" (Mar. 1, 2012)

Georgia Department of Natural Resources

2 Martin Luther King Jr., Dr., Suite 1152 East Tower, Atlanta, Georgia 30334
Mark Williams, Commissioner
Judson H. Turner, Director
Environmental Protection Division
(404) 656-4713

For Immediate Release **March 1, 2012**

Georgia EPD Declines Drought Declaration for Flint River Basin

The Georgia Environmental Protection Division (EPD) will not issue a severe drought declaration in the lower Flint River basin this year.

"EPD has analyzed data on stream flows and determined that a reduction in irrigation that might be achievable through operation of the Flint River Drought Protection Act would have a negligible impact on surface water flows this year," said EPD Director Jud Turner. "Southwest Georgia has experienced historically low basin inflow within several areas of the lower Flint River basin for several months, and it's going to take a significant amount of rain to improve conditions."

The Flint River Drought Protection Act (the Act) requires the EPD Director make an announcement regarding severe drought by March 1 of each year. The Act provides the authorization to compensate farmers who voluntarily stop irrigating their crops with surface or ground water after a severe drought declaration, although no funds are currently appropriated for this purpose.

EPD analyzes data on streamflow, rainfall and groundwater levels before making a decision. The only severe drought declarations were made in 2001 and 2002. Over the years, better information has become available on the number of acres under irrigation in the region, the location of irrigated acres that would most likely impact stream flows and the amount of irrigation water expected to be pumped for various crops in dry years. This information, along with critical hydrologic data from the current climatic cycle (2011-present), will form the basis for recommendations regarding changes to the Act to be introduced in the 2013 legislative session.

"There is no doubt that we need a viable management tool to deal with drought in the Flint River Basin," said Turner. "The lessons we have learned over the past decade regarding the basin during times of severely reduced basin inflow will help us craft a tool that increases the effectiveness of the Act and the management of the basin."

(more)

This year's evaluation of streams in the lower Flint River basin shows that some are very likely to go dry during the summer months even without irrigation due to a lack of rainfall and already depleted groundwater levels. For example, in part of the Spring Creek watershed there is already little streamflow from which farmers may withdraw water and the groundwater level in some areas is expected to be so low that further withdrawals will not affect flow in the streams.

EPD, working with the U.S. Fish and Wildlife Service, has launched a project to augment flows in Spring Creek using groundwater. The additional water in Spring Creek will help insure that certain species of endangered mussels survive during periods of drought.

News Media Contact: Kevin Chambers 404-651-7970

ATTACHMENT 13

Attachment 13 contains two historical gage records from the U.S. Geological Survey for monthly mean flows at:

(1) The Apalachicola River at Chattahoochee, Florida

(2) The Flint River at Bainbridge, Georgia

For the first set of readings for the Apalachicola River, we have marked each monthly mean with less than 6,000 cfs extreme low flow with yellow highlighting. A distinct historical pattern can be seen, culminating in the lowest flows on record for the longest period in 2012.

For the second set of readings for the Flint River, the same historical pattern is evident: we have highlighted extreme low flows at less than 2,500 cfs on those pages.

The gage data are available at
http://waterdata.usgs.gov/fl/nwis/inventory/?site_no=02358000&agency_cd=USGS and
http://waterdata.usgs.gov/nwis/inventory/?site_no=02356000&agency_cd=USGS.

National Water Information System: Web Interface

Data Category: Surface Water | Geographic Area: Florida | GO

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USGS Surface-Water Monthly Statistics for Florida

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USGS 02358000 APALACHICOLA RIVER AT CHATTAHOOCHEE FLA

Available data for this site | Time-series: Monthly statistics | GO

Gadsden County, Florida
Hydrologic Unit Code 03130011
Latitude 30°42'03", Longitude 84°51'33" NAD27
Drainage area 17,200.00 square miles
Gage datum 00.00 feet above NGVD29

Output formats

HTML table of all data
Tab-separated data
Reselect output format

00060, Discharge, cubic feet per second, Monthly mean in ft3/s (Calculation Period: 1928-10-01 -> 2016-01-31) Calculation period restricted by USGS staff due to special conditions at/near site												
YEAR	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1928										19,550	13,800	14,170
1929	22,810	38,370	171,600	37,240	36,240	23,850	19,440	15,820	13,790	37,510	28,200	28,150
1930	27,170	35,040	38,620	31,420	18,560	14,340	11,280	11,790	14,910	11,560	28,990	23,420
1931	23,430	19,990	20,210	21,800	19,580	8,898	9,010	11,590	7,235	5,980	5,524	14,870
1932	29,050	28,660	23,490	18,980	15,750	15,470	14,670	17,530	9,827	12,390	15,370	27,350
1933	37,090	43,010	41,050	37,990	21,400	13,810	14,360	12,190	11,380	8,111	7,888	8,906
1934	10,750	11,230	31,040	17,740	17,490	21,200	14,730	13,440	10,030	14,200	8,658	10,580

1935	12,020	13,850	27,450	20,690	14,500	8,905	11,030	11,690	12,670	7,056	9,299	9,688
1936	62,470	64,920	32,760	72,170	20,080	12,860	14,030	24,600	11,710	20,850	12,160	24,790
1937	40,600	41,100	37,350	44,220	34,550	16,500	15,760	15,360	17,630	15,380	17,820	16,890
1938	17,360	14,190	19,220	51,150	17,670	15,280	19,150	16,090	9,610	8,180	7,714	8,670
1939	11,770	27,200	47,610	31,250	20,970	21,810	16,840	26,560	17,520	12,370	9,127	10,170
1940	19,360	36,480	30,250	26,530	15,400	13,060	32,050	14,660	10,370	7,184	9,716	13,400
1941	16,750	14,510	19,060	16,750	9,840	7,148	13,980	11,120	7,562	6,973	6,387	18,740
1942	31,810	31,360	53,100	31,960	16,600	19,660	16,370	18,000	12,920	12,170	10,950	16,470
1943	45,080	32,800	62,780	35,250	24,250	17,060	17,280	15,180	9,753	8,413	9,960	11,010
1944	20,220	23,850	55,540	80,700	42,550	17,380	15,630	15,350	15,550	10,570	9,647	13,430
1945	15,670	29,970	26,660	19,360	27,710	12,490	15,590	14,980	14,580	12,350	13,950	26,680
1946	58,510	38,470	36,370	40,920	38,120	27,670	20,640	24,120	15,080	13,020	13,200	11,930
1947	33,060	22,530	44,650	45,220	28,640	24,880	20,030	17,230	12,000	10,370	26,450	40,840
1948	29,550	47,330	64,940	61,140	20,320	17,540	37,850	29,250	17,100	18,250	28,230	70,390
1949	45,700	53,200	37,870	36,310	39,200	23,040	31,170	23,640	19,720	14,170	13,280	15,230
1950	16,050	17,950	27,040	21,610	15,510	16,090	12,010	11,360	14,390	8,985	8,788	11,730
1951	14,280	13,210	16,260	24,280	13,570	9,547	9,921	8,129	7,304	7,225	11,160	20,540
1952	19,030	29,250	58,860	31,780	19,940	16,930	9,268	9,862	9,708	7,205	7,230	11,600
1953	24,340	28,020	31,830	29,700	44,980	15,630	22,660	14,190	13,430	16,970	11,210	42,900
1954	34,660	23,260	24,390	21,500	13,250	10,860	10,700	8,188	6,092	5,319	5,990	8,798
1955	14,050	19,430	12,780	19,330	12,210	7,892	12,450	10,920	6,850	5,499	5,909	7,991
1956	7,262	20,800	27,680	24,110	13,560	8,594	10,150	7,721	10,540	11,270	7,682	16,370
1957	14,470	13,350	22,720	39,860	23,980	12,630	10,230	7,008	8,567	14,610	19,000	23,970
1958	19,730	29,320	46,220	39,410	18,560	14,360	19,850	15,160	10,580	9,589	9,011	11,310
1959	17,020	37,460	44,010	30,810	18,860	31,900	15,770	12,720	12,330	15,590	16,560	16,970
1960	26,700	48,460	39,770	65,570	20,480	13,790	13,110	13,580	11,980	13,190	10,160	11,600
1961	12,690	32,800	47,440	57,160	29,450	20,030	20,340	16,250	14,100	8,345	8,707	29,270
1962	32,430	30,900	42,050	50,490	17,750	14,920	12,620	10,290	9,514	9,228	10,480	12,560
1963	28,170	30,790	23,860	20,910	20,410	17,890	17,660	12,210	8,841	9,217	9,152	18,900
1964	51,990	48,720	64,920	71,310	53,260	16,820	26,010	27,880	17,680	38,500	21,600	41,330
1965	38,940	52,420	50,700	39,250	17,280	26,320	20,290	14,310	13,100	17,310	13,080	16,030
1966	33,440	57,780	72,670	24,010	27,750	20,980	13,540	16,120	11,570	12,820	20,140	17,280
1967	45,630	35,730	23,920	14,280	13,420	15,960	20,630	16,390	18,390	12,440	16,660	29,880
1968	29,770	17,080	30,310	18,960	13,390	11,960	11,240	10,740	9,125	7,773	8,860	12,860
1969	15,740	18,940	24,330	30,240	21,140	13,420	10,990	12,870	13,980	12,660	11,230	13,410
1970	17,950	23,520	40,300	37,550	13,040	17,700	13,260	17,080	12,970	10,390	15,530	14,890
1971	31,000	38,500	67,350	34,600	30,500	16,070	20,730	25,340	14,280	12,920	12,150	31,410
1972	43,100	41,640	32,140	19,690	14,680	17,280	17,010	13,190	10,410	9,757	10,420	33,670
1973	46,530	59,330	44,480	70,500	38,150	39,460	18,100	18,340	13,670	11,730	12,690	17,020
1974	42,740	58,880	25,820	41,730	18,450	15,790	11,920	14,810	14,760	10,550	10,430	20,270
1975	37,700	53,890	65,070	69,540	26,700	27,620	26,990	29,100	16,590	27,470	23,190	21,920
1976	31,850	33,580	38,920	28,970	36,340	28,700	20,190	13,870	12,480	15,000	18,030	42,260
1977	39,770	22,150	53,120	37,910	14,530	11,890	9,815	12,020	11,240	10,110	25,580	18,580

1978	49,090	42,730	46,070	25,480	36,170	17,840	11,530	19,150	11,610	9,527	8,570	9,401
1979	20,660	41,280	45,030	55,480	26,430	14,950	13,460	12,140	13,490	14,210	16,540	15,820
1980	19,990	25,840	64,040	62,500	33,270	17,440	14,060	11,790	9,669	9,110	9,050	9,096
1981	9,065	28,660	16,030	23,920	10,410	10,210	9,658	9,265	9,066	7,104	5,614	7,614
1982	28,380	48,740	22,190	24,460	18,200	14,020	15,950	21,140	13,380	12,400	12,720	35,630
1983	37,210	50,480	58,760	58,340	22,480	19,620	17,130	13,310	13,130	12,640	14,560	47,220
1984	40,870	37,870	51,160	37,170	32,390	17,490	15,610	30,150	15,060	10,840	11,010	13,650
1985	13,160	32,570	21,360	15,080	12,130	9,877	9,476	13,940	12,430	9,864	11,010	21,760
1986	19,370	29,700	29,460	13,980	9,530	8,779	7,441	5,259	6,421	5,978	12,210	20,850
1987	36,850	36,600	46,000	27,550	15,390	18,900	19,070	11,860	10,640	8,826	7,137	9,250
1988	19,930	24,160	23,570	19,440	15,340	9,377	6,510	4,750	9,477	11,330	11,020	10,530
1989	11,400	10,420	17,420	28,970	14,550	25,080	33,540	15,680	14,270	20,790	18,900	33,180
1990	50,900	53,640	66,920	27,770	17,090	16,380	9,618	8,677	7,912	7,885	9,127	9,733
1991	18,120	30,650	45,400	25,380	38,170	22,540	26,190	21,870	17,530	12,770	9,976	14,860
1992	23,300	39,120	37,700	20,920	12,840	13,170	12,640	12,910	13,740	13,500	31,790	43,530
1993	47,710	33,640	52,080	39,770	21,100	12,890	11,810	11,050	9,566	9,720	13,270	15,220
1994	17,920	33,200	34,750	27,340	15,860	14,630	87,780	31,950	25,440	30,370	21,870	33,930
1995	27,860	57,610	44,600	20,750	15,320	14,430	11,590	11,580	10,140	15,300	20,950	19,950
1996	25,920	48,680	52,220	29,000	19,360	14,450	12,670	10,780	11,020	13,350	11,420	15,720
1997	26,930	39,130	32,780	17,910	22,140	18,950	17,290	14,310	11,180	11,480	19,660	51,660
1998	49,810	67,310	90,330	44,750	28,840	13,010	13,200	12,450	14,560	18,640	15,900	11,510
1999	15,880	22,680	17,280	10,880	8,807	11,040	12,040	10,870	6,548	5,727	6,246	7,576
2000	11,550	16,650	14,570	17,330	8,413	4,826	5,117	5,806	5,889	5,659	6,361	10,300
2001	14,690	11,990	57,190	30,860	11,560	18,600	11,150	9,585	7,173	6,130	5,975	7,337
2002	9,036	13,770	14,770	13,890	8,326	6,578	6,084	5,735	6,991	8,206	17,300	20,130
2003	15,860	23,760	48,700	32,950	43,040	37,120	35,360	25,700	13,970	12,050	13,310	16,790
2004	17,680	30,020	16,390	11,510	9,885	9,458	12,740	9,998	28,410	16,400	20,490	24,730
2005	21,100	24,350	41,760	71,790	21,740	25,520	56,320	32,350	15,090	10,360	11,840	18,430
2006	25,040	23,450	26,530	16,120	13,770	6,953	5,773	5,738	6,969	6,169	12,120	9,153
2007	21,310	18,940	19,490	13,540	6,869	5,153	5,351	5,154	5,343	5,133	4,976	5,981
2008	14,770	28,410	24,020	18,240	9,048	5,405	5,863	13,520	8,945	7,415	10,630	29,420
2009	17,650	11,400	37,120	66,960	22,220	14,520	8,245	8,641	21,890	22,640	36,440	74,950
2010	54,220	61,170	41,840	19,460	29,570	14,130	9,203	8,097	5,977	7,158	7,724	9,836
2011	10,820	20,050	21,960	19,640	7,521	4,781	6,244	5,484	5,734	5,346	5,651	5,196
2012	11,310	11,050	16,240	9,513	5,352	5,525	5,498	5,438	5,212	5,381	5,316	5,418
2013	8,890	45,380	38,270	22,010	21,270	15,220	37,090	32,960	14,870	10,090	9,465	26,760
2014	32,740	35,710	30,270	61,730	29,560	13,490	11,280	8,968	8,759	9,992	10,230	16,630
2015	25,190	20,350	24,850	28,190	16,070	13,080	9,486	8,474	8,723	10,330	28,280	49,810
2016	67,800											
Mean of monthly Discharge	27,100	32,600	39,200	33,400	21,000	15,900	16,500	14,600	12,000	12,000	13,300	20,500

** No Incomplete data have been used for statistical calculation

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USGS 02356000 FLINT RIVER AT BAINBRIDGE, GA

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Decatur County, Georgia
Hydrologic Unit Code 03130008
Latitude 30°54'41", Longitude 84°34'48" NAD27
Drainage area 7,570 square miles
Gage datum 57.7 feet above NAVD88

Output formats

HTML table of all data | Tab-separated data | Reselect output format

00060, Discharge, cubic feet per second,												
YEAR	Monthly mean in ft3/s (Calculation Period: 1907-10-01 -> 2015-03-31)											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1907										7,821	6,075	17,670
1908	22,450	25,870	18,610	19,260	20,980	8,319	7,865	7,026	6,972	4,995	5,294	5,889
1909	6,254	11,820	19,580	10,510	10,080	6,521	6,316	6,219	4,219	3,795	3,670	4,277
1910	4,580	7,308	10,030	7,203	5,256	5,372	7,040	5,052	4,369	3,307	3,233	3,762

1911	5,323	4,701	4,033	5,727	3,896	3,203	3,905	4,077	3,142	3,304	4,173	10,390
1912	23,840	17,690	31,680	30,650	20,290	12,650	12,290	10,440	7,644	9,330	9,348	9,784
1913	10,580	13,320	34,380	18,380	8,340	7,800	6,786	7,501	6,436	5,175	5,004	5,102
1928										10,210	6,486	6,787
1929	10,660	17,940	59,990	16,920	14,710	9,943	8,150	6,362	5,217	17,330	9,530	10,880
1930	11,360	15,230	15,590	14,450	7,445	5,920	4,836	5,775	6,080	4,706	12,960	10,350
1931	10,590	8,415	8,463	8,034	8,259	3,625	3,700	5,123	3,039	2,809	2,593	4,034
1932	10,400	8,856	9,333	6,734	4,879	6,198	6,179	7,726	3,916	4,532	4,867	7,141
1933	12,160	16,400	16,390	13,050	8,108	5,616	5,465	4,591	4,598	3,645	2,991	3,879
1934	4,081	4,700	11,650	7,111	7,084	8,840	5,799	4,731	3,867	4,106	2,933	4,093
1935	4,627	5,165	9,326	7,338	4,507	2,893	4,031	4,364	5,495	3,111	3,180	3,532
1936	19,530	23,140	11,340	26,840	7,201	4,781	4,988	10,570	4,729	7,184	4,767	10,490
1937	12,920	15,680	14,190	16,560	12,090	5,898	6,577	5,855	5,982	5,626	6,467	6,517
1938	6,611	5,626	5,900	16,760	6,408	6,035	6,211	5,416	3,320	3,157	3,335	4,139
1939	5,071	9,496	20,540	12,580	8,183	7,649	6,839	8,162	6,204	4,908	3,565	4,259
1940	7,957	15,560	11,340	10,620	6,367	5,170	10,910	5,881	3,958	3,114	4,702	5,792
1941	7,458	6,585	8,071	7,489	4,357	3,332	5,708	4,237	3,128	4,167	3,406	8,976
1942	16,620	13,280	22,020	12,870	6,410	6,995	6,863	7,631	5,375	5,397	5,177	6,927
1943	17,880	13,830	22,750	14,330	9,863	7,438	6,479	5,533	4,122	3,704	4,080	5,065
1944	7,919	8,212	22,240	33,700	18,340	7,570	6,922	6,153	6,243	4,472	4,619	5,968
1945	6,480	9,647	10,930	7,362	12,280	5,709	7,242	7,106	6,037	5,110	5,744	9,903
1946	23,240	15,000	14,180	16,480	14,950	11,400	9,116	9,067	6,526	5,762	6,006	5,251
1947	10,810	8,701	18,780	18,130	11,470	9,878	8,016	8,427	5,512	5,067	12,180	19,320
1948	14,850	21,010	28,660	28,660	8,958	7,232	11,350	9,763	6,053	7,979	7,611	27,100
1949	18,740	20,500	15,250	13,990	14,310	8,381	10,520	9,443	6,611	5,282	4,792	5,635
1950	5,521	6,258	9,716	8,079	5,759	5,835	4,252	3,984	5,203	3,311	3,338	4,519
1951	5,917	5,014	5,990	8,709	4,859	3,182	3,738	3,289	2,764	3,021	4,639	6,744
1952	7,470	11,920	21,750	12,610	7,239	6,046	3,509	3,938	3,976	3,227	3,165	4,205
1953	8,166	10,650	13,530	11,670	16,890	6,264	9,999	6,116	6,653	9,120	4,930	17,270
1954	14,630	8,852	8,714	7,903	5,293	3,739	3,337	3,052	2,409	2,217	2,424	3,627
1955	4,833	5,895	4,585	8,124	4,297	3,123	4,177	4,100	3,167	2,348	2,600	3,226
1956	3,161	8,371	11,030	10,330	4,713	3,263	4,148	3,452	2,970	5,278	3,582	5,641
1957	8,256	7,049	8,586	15,210	11,040	6,119	4,408	4,250	4,433	7,086	8,049	14,330
1958	10,930	14,380	21,960	19,440	10,090	7,650	9,262	6,871	3,873	3,920	4,095	5,003
1959	6,755	15,890	19,490	14,690	8,653	13,110	6,669	5,563	5,100	6,187	7,210	7,214
1960	9,289	20,030	17,130	26,580	8,697	5,900	5,610	5,583	4,170	5,226	3,768	4,113
1961	4,711	8,123	18,800	23,940	12,890	8,302	7,545	5,831	5,052	3,023	3,315	8,509
1962	11,220	10,350	16,470	20,000	6,604	4,634	4,098	3,468	3,538	4,162	4,499	4,561
1963	10,820	13,020	11,640	7,105	7,059	6,891	7,887	5,027	3,107	4,353	3,203	6,628
1964	21,050	19,980	24,520	22,270	18,630	6,545	11,190	11,580	7,073	13,460	7,680	14,490
1965	16,200	21,290	19,920	15,280	7,204	10,640	9,926	7,384	5,638	7,291	4,971	6,358
1966	13,180	21,340	30,610	10,940	11,390	9,776	5,474	6,564	4,176	4,936	7,318	6,713
1967	18,220	15,420	9,887	6,240	5,149	5,300	6,780	5,527	5,988	3,805	4,975	8,236

1968	9,547	6,175	9,303	5,783	4,582	3,702	3,596	3,339	2,488	2,932	3,865	4,809
1969	5,197	6,191	8,465	8,967	7,435	4,620	3,886	4,661	4,274	3,727	3,025	4,494
1970	6,381	8,360	12,720	17,170	5,717	8,534	5,113	6,812	4,401	3,561	4,896	5,727
1971	11,610	13,870	24,260	15,160	13,800	6,979	8,328	9,418	5,558			
2001								2,865	2,726	2,098	1,897	2,989
2002	3,355	4,934	6,175	5,757	3,314	2,066	2,241	1,839	2,091	3,707	6,643	6,011
2003	6,825	8,449	17,980	13,000	14,550	12,920	10,790	10,460	5,660	4,326	4,506	5,134
2004	5,136	11,500	7,371	4,429	4,454	4,616	4,646	3,534	12,390	8,107	7,015	8,226
2005	7,419	9,742	13,330	29,610	9,127	12,530	20,480	10,930	5,852	4,524	4,259	6,877
2006	9,619	9,178	10,960	5,959	4,400	2,479	2,030	2,331	2,555	2,242	3,797	3,469
2007	7,745	7,796	7,528	5,245	2,545	2,032	2,145	1,807	2,149	1,853	1,694	3,008
2008	7,240	10,300	10,070	7,147	3,712	2,196	2,225	4,218	4,013	3,125	3,634	10,820
2009	6,829	4,988	10,780	29,030	9,774	6,085	3,229	3,485	5,399	6,540	10,960	24,110
2010	20,710	24,030	15,700	9,289	11,220	6,980	4,219	3,459	2,930	2,602	3,689	3,562
2011	4,662	8,605	7,407	6,916	2,746	1,739	2,297	1,836	1,422	1,643	1,672	2,592
2012	3,906	4,510	5,073	3,134	2,170	2,043	1,410	1,658	1,683	1,875	1,655	2,091
2013	3,463	13,660	16,610	9,371	7,373	5,800	10,650	11,870	5,749	3,362	3,318	7,532
2014	13,450	14,180	13,150	24,070	13,450	6,203	4,262	2,696	3,083	3,751	4,043	6,818
2015	11,160	9,256	11,910									
Mean of monthly Discharge	10,100	11,800	15,200	13,700	8,740	6,330	6,350	5,790	4,640	4,860	4,890	7,380

** No Incomplete data have been used for statistical calculation

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ATTACHMENT 14

Monthly mean flows as recorded by the USGS on the following gages: Ichawaynochaway Creek at Milford, Georgia; Spring Creek near Iron City, Georgia; and Ichawaynochaway Creek below Newton, Georgia. Yellow highlights demonstrate monthly mean flows violating Georgia's 25% AAD requirements. The gage data are available at http://waterdata.usgs.gov/ga/nwis/inventory/?site_no=02353500&agency_cd=USGS; http://waterdata.usgs.gov/nwis/inventory/?site_no=02357000&agency_cd=USGS; and http://waterdata.usgs.gov/ga/nwis/inventory/site_no=02355350&agency_cd=USGS.

USGS 02353500 ICHAWAYNOCHAWAY CREEK AT MILFORD, GA

Available data for this site: Time-series: Monthly statistics GO

Baker County, Georgia
Hydrologic Unit Code 03130009
Latitude 31°22'58", Longitude 84°32'47" NAD83
Drainage area 620 square miles
Gage datum 150.30 feet above NGVD29

Output formats: HTML table of all data | Tab-separated data | Reselect output format

00060, Discharge, cubic feet per second,
Monthly mean in ft3/s (Calculation Period: 2006-01-01 -> 2015-10-31)
Period-of-record for statistical calculation restricted by user

YEAR	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2006	819.9	836.1	735.7	341.9	316.7	134.3	97.3	142.0	234.1	215.3	341.7	538.7
2007	805.5	830.2	475.9	602.5	96.0	77.3	96.6	58.5	103.0	123.8	156.6	380.0
2008	843.6	1,179	910.5	613.5	180.0	62.2	127.8	1,163	468.6	378.4	381.4	2,030
2009	749.3	476.2	952.7	2,461	806.5	411.2	339.8	572.0	544.5	533.0	591.3	2,548
2010	2,219	2,249	975.6	650.3	901.2	561.3	297.4	236.0	156.9	197.1	288.7	370.0
2011	515.3	814.2	589.5	401.6	71.5	24.8	210.7	93.8	80.5	115.1	168.1	292.4
2012	332.9	380.1	369.2	243.5	93.5	96.5	16.6	71.5	142.9	138.8	115.7	282.1
2013	247.0	1,839	1,237	660.3	272.2	327.3	1,146	1,058	380.7	314.9	370.0	840.5
2014	1,032	1,327	964.5	2,578	1,218	418.0	350.9	196.2	283.2	403.8	429.3	873.9
2015	925.5	768.2	854.9	947.1	446.5	347.0	292.5	202.3	260.4	309.7		

USGS 02357000 SPRING CREEK NEAR IRON CITY, GA

Available data for this site: Time-series: Monthly statistics GO

Decatur County, Georgia
Hydrologic Unit Code 03130010
Latitude 31°02'25", Longitude 84°44'24" NAD83
Drainage area 490 square miles
Gage datum 85.70 feet above NGVD29

Output formats: HTML table of all data | Tab-separated data | Reselect output format

00060, Discharge, cubic feet per second,
Monthly mean in ft3/s (Calculation Period: 2006-01-01 -> 2015-10-31)
Period-of-record for statistical calculation restricted by user

YEAR	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2006	866.0	699.8	482.4	148.4	252.8	43.7	5.64	7.02	139.3	71.3	161.5	239.3
2007	791.3	915.3	630.0	316.4	40.2	2.30	0.153	0.000	0.000	0.000	0.000	27.1
2008	445.4	1,236	996.3	442.7	73.0	8.08	4.79	897.6	423.5	120.5	109.3	1,542
2009	539.5	463.5	1,600	3,578	496.8	303.3	197.0	189.3	140.5	116.4	141.2	936.6
2010	1,518	1,828	856.5	453.3	670.5	201.3	47.9	12.4	8.72	5.58	8.77	13.5
2011	35.9	226.7	248.6	219.9	20.6	0.861	31.7	5.49	0.000	0.000	0.000	2.94
2012	21.7	88.6	466.8	225.7	47.0	54.1	2.42	0.338	5.50	8.63	0.021	20.6
2013	55.2	2,442	1,407	530.5	205.7	68.3	2,201	2,161	724.9	255.0	153.8	396.0
2014	796.4	1,140	1,179	2,368	1,495	185.6	65.1	18.2	27.9	46.1	69.0	428.1
2015	751.0	572.2	584.7	586.3	323.6	143.7	98.5	35.0	27.4	40.6		

USGS 02355350 ICHAWAYNOCHAWAY CREEK BELOW NEWTON, GA

Available data for this site: Time-series: Monthly statistics GO

Baker County, Georgia
Hydrologic Unit Code 03130009
Latitude 31°13'03", Longitude 84°28'15" NAD83
Drainage area 1,040 square miles
Gage datum 98.67 feet above NGVD29

Output formats: HTML table of all data | Tab-separated data | Reselect output format

00060, Discharge, cubic feet per second,
Monthly mean in ft3/s (Calculation Period: 2006-01-01 -> 2015-10-31)
Period-of-record for statistical calculation restricted by user

YEAR	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2006	1,468	1,394	1,300	528.7	462.3	218.6	156.6	188.9	283.1	245.2	394.4	648.5
2007	1,332	1,524	960.8	968.4	193.8	125.2	134.8	96.5	138.8	153.7	179.0	401.2
2008	1,130		1,724	1,022	248.1	104.1	177.1		865.4	485.6	504.4	
2009	1,197	823.5			1,431	956.6	449.0	700.9	934.8	735.8	803.0	
2010			1,945	1,144		790.7	425.5	288.1	200.7	207.5	286.1	390.9
2011	591.6	1,080	857.9	605.9	138.6	54.7	227.7	133.4	98.7	128.3	169.5	292.0
2012	366.6	439.3	580.5	375.6	163.9	144.7	44.2	96.6	158.9	156.6	122.1	285.4
2013	296.1			1,288	587.3	446.8	1,623		796.6	508.6	504.8	1,164
2014	1,741		1,847			770.1	498.7	281.5	353.3	504.2	508.2	
2015	1,671	1,325	1,533		744.0	429.9	385.1	237.6	279.2	328.1		

ATTACHMENT 15

Excerpts from the Deposition Transcript of Suat Irmak, Ph.D. (Aug. 2-4, 2016)

SUAT IRMAK, Ph.D.

NO. 142, Original

In the

Supreme Court of the United States

STATE OF FLORIDA,

Plaintiff,

v.

STATE OF GEORGIA,

Defendant.

Before the Special Master

Hon. Ralph I. Lancaster

VIDEOTAPED DEPOSITION OF

SUAT IRMAK, Ph.D.

Volume 1

August 2, 2016

10:03 A.M.

Reported by: Michele E. Eddy, RPR, CRR, CLR

JOB NO. 109595

SUAT IRMAK, Ph.D.

August 2, 2016
10:03 A.M.

Videotaped Deposition of SUAT IRMAK, Ph.D., held at the offices of Latham & Watkins, LLP, 555 Eleventh Street, Northwest, Suite 1000, Washington, D.C., pursuant to notice, before Michele E. Eddy, a Registered Professional Reporter, Certified Realtime Reporter, and Notary Public of the states of Maryland, Virginia, and the District of Columbia.

SUAT IRMAK, Ph.D.

APPEARANCES:

Latham & Watkins
Attorneys for Plaintiff
555 Eleventh Street, Northwest
Washington, D.C. 20004
BY: PHILIP PERRY, ESQUIRE
GEORGE CHIPEV, ESQUIRE
BENJAMIN LAWLESS, ESQUIRE

Kirkland & Ellis
Attorneys for Defendant
655 Fifteenth Street, Northwest
Washington, D.C. 20005
BY: K. WINN ALLEN, ESQUIRE

ALSO PRESENT:
John C. Allen, Deputy Director
Jordan Mummert, Videographer

SUAT IRMAK, Ph.D.

(Exhibit 1, Exhibit 2, Exhibit 3, Exhibit 4, and Exhibit 5 were marked for identification.)

THE VIDEOGRAPHER: This is the start of the deposition of Suat Irmak in the matter State of Florida versus State of Georgia.

This deposition is being held at 555 11th Street, Northwest, Washington, D.C., on August 2nd, 2016, at approximately 10:03 a.m.

My name is Jordan Mummert from TSG Reporting, Inc. I'm the legal video specialist. The court reporter is Michele Eddy in association with TSG Reporting.

Will the counsel please introduce yourselves.

MR. PERRY: Phil Perry, representing Florida.

MR. LAWLESS: Benjamin Lawless, representing Florida.

MR. CHIPEV: George Chipev, representing Florida.

MR. WINN ALLEN: Winn Allen, on

SUAT IRMAK, Ph.D.

behalf of the State of Georgia.

MR. JOHN ALLEN: John Allen, on behalf of the State of Georgia.

THE VIDEOGRAPHER: The court reporter may swear in the witness.

SUAT IRMAK, Ph.D.,
having been duly sworn, testified as follows:

EXAMINATION

BY MR. PERRY:

Q Dr. Irmak, is that how I pronounce it?

A Sure.

Q Can you please tell me if I've mispronounced it as we go --

A No.

Q I don't want to make a mistake, particularly not over and over. So thank you.

On behalf of the State of Florida, welcome, and thank you for your attendance. I ask you in advance for your patience. This is going to take a few days, and it will be grueling to some extent. If you need a break at any time, just ask. I apologize in advance

if I interrupt you. If I have done so, please tell me and I'll rephrase my question. And, likewise, if you can, please try not to interrupt me if that's possible.

Sir, have you been deposed before?

A No, sir.

Q If at any point you have questions, please feel free to ask your counsel as we go. I'm sure he'll make some objections, and to the extent he wants to instruct you regarding answers or nonanswers, he can do that on certain grounds. But if you are confused at any point, please note that confusion so we are --

A Thank you.

Q -- absolutely clear as we go forward that there's no confusion in this record and that you are providing responses to the questions I ask. Is that okay?

A That's okay.

Q So one other thing. It's always important in a deposition that you give verbal answers. There will be times, likely, when you want to nod, and please excuse me in advance,

but I will ask you for a verbal answer in those circumstances.

A Okay.

Q So, sir, we have premarked, I think, five exhibits that are to your left there. If you all can make sure that counsel have those, I would appreciate it.

Can you please take a look at the exhibit that's marked as number 1.

A (Document review.)

Q Sir, can you identify the exhibit that's been marked number 1 for me, please.

A Exhibit number 1 is the expert report that I put together for this case.

Q And with whom did you work in putting that expert report together?

A This is my -- I wrote alone. This is my report.

Q Did you receive assistance from anybody from the State of Georgia?

A When I needed some specific materials or information or documents, then I contacted.

Q With whom did you speak from the State of Georgia when you needed information or

materials?

A Through the attorney, I talked to several people from State of Georgia. Dr. Gail Cowie, Dr. Wei Zeng, and Dr. Menghong -- and I apologize, I cannot recall his last name.

Q Wen?

A Yes.

Q With respect to Dr. Gail Cowie, did you consult with her as to part 2 of your report?

A It wasn't a consultation. It was me trying to gather some more specific information or materials or documents on a given topic.

Q Were there documents supplied to you that were not disclosed to us with your report?

A I don't think so. I think all the documents she supplied were provided.

Q I will have a number of questions as to part 2 in particular and where the information in part 2 came from. But, sir, if I might, can I ask you to look at the exhibit that's been marked number 2?

A Yes.

Q Can you identify that for me, please.

A This is a document we put together to present the differences that might result in terms of using hardware acreage versus throw acreage in terms of calculating consumptive use.

Q Does that present a opinion in this case?

A This presents an analysis or process to show the differences that will exist when using hardware acreage versus throw acreage for consumptive use calculations.

Q Do you mind if, for the rest of this deposition, we call it the July 28 memo?

A That will be fine.

Q So with respect to Exhibits 1 and 2, your report and your July 28th memo, do they -- do they include all the expert opinions you intend to offer in this case?

A To date, yes. There may be additional things that I need to consult with my -- with my counsel.

Q Sir, one of the goals for this deposition is to ensure that I understand every expert opinion that you may offer at trial, all

SUAT IRMAK, Ph.D.

Q Okay, sir.
So you said 70 to 90 percent sand content in the soil. Did I hear you right?
A Yes.
Q What would be the water holding capacity of soil like that?
A Water holding capacity of that soil will be 70, 24, 12, 8. That will be .5 to .7 inches per foot.
Q Can you turn to page 12 of your report, please.
A 112, you said?
Q Just 12.
So in the last paragraph there, in the first sentence, you write "Because Southwest Georgia has extremely sandy soils, e.g., 80 to 90 percent sand, 0.5 or less organic matter content, the soil water holding capacity of most agricultural soils in the Georgia portion of the ACF Basin is also very low, e.g., .5 to .7 inch per soil layer or less."
A "Per foot of soil layer," yes.
Q Okay, sir. Can you please turn with

SUAT IRMAK, Ph.D.

me to page 107 of your report.
A (Document review.)
Q If you're there, I would invite your attention to the first paragraph. Are you there?
A Yes, sir.
Q So about five or six lines down the first paragraph, you write "Since Georgia, especially Southwest Georgia, has coarse textured soils with very low soil water holding capacities, which typically range from .7 inches, 18 millimeters per foot, 30 centimeters of soil layer, to .9 inches, 23 millimeters per foot, these precipitation events may not be as effective in terms of reducing irrigation requirements."
Do you see that?
A I see that.
Q So, sir, you can see why I would be a little confused. There's -- on page 12 it says .5 to .7, and on page 107 it says .7 to .9. Can you help me --
A That's correct.
Q -- reconcile those?

SUAT IRMAK, Ph.D.

A Okay. So in some of the NRCS Web Soil Survey materials that I reviewed for Southwest Georgia, the -- in general -- in general, the Southwest Georgia ACF Basin soils sand content ranges from 70 to 90 percent, most, not all soils, of course, but most soils.
Since soil properties have spatial variability, again, same as precipitation, in some other documents that NRCS has, they have another range. Now, the challenge is -- and I think that any scientific person in my discipline will know that -- the way we categorize soils -- in fact, we don't, but USDA does. In the entire United States, USDA is in charge of categorizing soil types.
So in some cases USDA takes zero to 8-inch soil layer, and then whatever that textual properties, physical properties indicate that soil texture is, they take that as soil type. While in many other cases they take zero to 12-inch, the top foot soil layer, and categorize that as soil type.
So in this case for Southwest Georgia, there are two, from zero inch to --

SUAT IRMAK, Ph.D.

zero to 8-inch and then zero to 12.
Q Okay. So, sir, did you mention a moment ago that you reviewed some series of literature for Southwest Georgia on soil type?
A I looked on the Web Soil Survey.
Q I'm sorry, which?
A The Web Soil Survey.
Q Web source? Is that what you said?
A Web Soil --
Q Oh, Web Soil.
A -- Survey.
It's a national -- it's a federally put-together survey of soils.
Q SSURGO?
A Actually, SSURGO was developed from that soil data set.
Q So they relate to each other?
A I don't know for a fact, but if I say they are related to each other, then I wouldn't know in what sense they are related. So I don't know for a fact. I don't know exactly.
Q Do you mind if I call it S-S-U-R-G-O SSURGO for now?
A I would like to stick with the NRCS

is?

A That would be another one of those soil types.

Q Sir, I would like to show you, if I might, Seminole County.

(Exhibit 18 and Exhibit 19 were marked for identification.)

Q Sir, Exhibits 18 and 19 are similar to the exhibits we just discussed for Miller County but they were created using the SSURGO database for Seminole County. Do you see those?

A Sir, I do see that, but I need to mention that one of the most critical crucial information is missing from those maps.

Q What's that, sir?

A Because I do not know those percentages or the ranges of available soil water for what soil layer it's associated to. Without that information, that is very difficult.

Q Well, sir, that was considered in preparing this information and, in particular, on Exhibit 19.

A I respectfully say without knowing -- if these are, and most likely they are -- if these were developed based on the topsoil properties, and by not considering the deeper layers --

Q 4 feet of soil.

A I'm sorry?

Q 4 feet of soil.

A So then where is the layer-by-layer information?

Q Well, sir, this is a summary.

A So this is -- this is 1 inch per 4 feet of soil?

Q Sir, this is a summary of the information available for 4 feet of soil on the SSURGO database.

A I honestly don't know what that means, sir. If you are suggesting this 1 inch, let's say the first number, this one in Exhibit 18, the first color is less than 1 inch per foot of soil, if this is -- if this is for the 4 feet soil, that's a different thing.

Q There's a mix of soils within the 4 feet.

A That's the reason I'm asking you. Do you have --

Q This is a generalized calculation of the water holding capacity of that mix of soils --

A I --

Q -- at all those locations.

A I -- with great respect, I totally disagree with this. Without knowing what layer of soil has what percentage over what inch of available water per layer, I don't know how to interpret that.

Q You don't know those answers, do you?

A The average is 4 -- .5 to .7 percent -- .5 to .7 inch per foot. That's the average.

Q What analysis did you do of the 4 feet of soil in Seminole County?

A I was not tasked to go out and take soil samples and determine those soil physical properties in Seminole County.

Q No, sir, you assumed that it was .5 to .7.

A On average.

Q On average. But you've done no analysis.

MR. WINN ALLEN: Object to the form of the question.

A If you -- if you look at Web Soil Survey data and if you do -- if you take the topsoil, second layer, third layer, fourth layer layer, and corn grows up to 5 feet or so in sandy soil, fifth layer, and average them for the whole soil profile, effective root zone -- that's what you call that -- this is about .5 to .7 inch per foot, on the average.

Q What's your basis for saying that's the case in Georgia?

A Throughout my career working with sandy soils.

Q Sir, I'm not disputing that that may have been the type of soil you were working with in Florida when you were working on your dissertation, but the soils, according to the SSURGO database and other experts who are professors at the University of Georgia, including Dr. Hoogenboom, find that that's just not the prevalent soil in the state of Georgia

in the Flint River Basin.

MR. WINN ALLEN: Objection, argumentative.

A My sandy soil -- working with sandy soil experience is not only in the state of Florida. As you might know, the Sandhills area of Nebraska has more sandy soils than perhaps two states combined.

Q Well, sir, we've done this analysis for many counties in Nebraska, too, and we will get to that, and we'll show you what the irrigation restrictions are in Nebraska where you're an expert and what the soil types are, and we'll probably do that tomorrow. So we can talk about Sandhills and other places.

A No, I was trying to say, you said these are different soils than the ones that I wrote in my Ph.D. dissertation in Florida. But my sandy soil experience is not limited to Florida. That's what I was --

Q Yes, and I'm going to show you what the soils are in Nebraska tomorrow, too.

So, sir, rather than go through 15 more of these maps, which we can do tomorrow if

we need to, I'm going to show you --

(Exhibit 20 was marked for identification.)

Q -- a map that combines all the data for all the different counties in the ACF Basin in Georgia. This doesn't include Florida.

So, sir, do you see that?

A Could I ask the source of that data?

Q SSURGO.

A But you said Dr. Hoogenboom put this together. Am I --

Q No, I said Dr. Hoogenboom is one of our experts and has been advising us.

A Okay. Is he a soil scientist, though?

Q You know he was with the College of Agriculture in the state of Georgia I think for 10 or 12 years.

Sir, do you see the percentage of soil that's between .5 and .7 inches of water holding capacity on this chart?

A So are these all in -- if I may, I have a fundamental disagreement about how these data are presented. If you -- if the chart doesn't show layer by layer individually, I am

not able to make a determination.

Q Sir, did you present your data layer by layer when you reached a conclusion that most of the soil was .5 to .7 percent?

A That's an average of all individual layers. That's an average of four -- or average of five layers, but --

Q But how did you come to a conclusion that that was the appropriate number for five layers of soil in the state of Georgia in the Flint River Basin?

A Web Soil Survey.

Q You looked at the Web Soil Survey?

A Absolutely I did.

Q Do you have a record of what you looked at?

A I don't believe so.

Q It wasn't in your expert materials that you supplied to us?

A I don't think so.

Q But -- or that you relied on?

A I did rely on that. So if you get --

Q We're entitled to information you relied on as part of your expert report. So

can you help us find it in your expert materials?

A As you might know, in Web Soil Survey you can click to a specific location anywhere in the United States and then you can look at the soil layers information. There is no way for me to save that map or extract that. So it was a real-time process.

Q And did you make any notes or document in any fashion what you did on the website?

A I did not take any notes, but overall average was .5 to .7 inches. We did go from .5 to .9 but ...

Q And what -- what areas in Southwest Georgia did you address when you were looking at the Web Soil --

A I went from Flint River Basin middle to -- well, upper, middle, and lower.

Q How long did you take to perform this?

A That was 11 -- 10, 11 months ago. Based on my best recollection, I cannot recall exactly, but a couple hours, maybe.

Q And you kept no record and you provided no information to us in your expert report?
A I don't have any records of that.
Q Nowhere in your expert report does it talk about looking at the Web Soil Survey or assessing soil layers, does it?
A No.
MR. PERRY: Okay, sir, let's take a break now, and we'll come back in about ten minutes.
MR. WINN ALLEN: Before we go off, object to foundation of Exhibits 16, 17, 18, 19, and 20.
THE VIDEOGRAPHER: The time is 4:07. We're off the record.
(A brief recess was taken.)
THE VIDEOGRAPHER: The time is 4:28. We're on the record.
BY MR. PERRY:
Q Again, welcome back, sir.
A Thank you.
Q All right, sir. I want to focus back on Exhibit 20, if we could, please. Do you

have that before you?
A Yes.
Q For purposes of my next few questions, I want you to assume that the information on Exhibit 20 came from the Web Soil Survey you mentioned earlier and that it addresses 4 feet of soil on irrigated acres for shapefiles supplied to us by the State of Georgia in the ACF Basin in Georgia for the Upper Floridan groundwater irrigators and for surface water irrigators. Okay?
A Okay, sir.
Q All right. With that assumption in mind, viewing Exhibit 20, would you agree with me that only about 15 percent of soil in Georgia, where irrigators are operating, has a water holding capacity of .5 to .9 percent?
MR. WINN ALLEN: Object to foundation.
A Without knowing the specific layer-by-layer information, I think it's very difficult to make that determination. Furthermore, I want to add, if I may, corn can uptake water up to 5 feet, and I wondered why

your analysis stopped at 4 feet.
Q Sir, how much corn is grown in the Flint River Basin?
A I can look at my -- I don't know if I know the total number for the basin.
Q It's in your report, isn't it?
A Yes. I will --
Q Let me invite your attention, if I could, to pages 139 to 143, please.
A Yes.
Q In particular, I'm interested in page 139.
A Okay.
Q Do you see that?
A I see that.
Q Did you prepare table 42 -- pardon me -- figure 42a on page 139?
A Yes, I did.
Q And would you agree with me that corn production acres in Georgia now are far, far lower than they were 40 years ago?
A As I -- as I present, there is a declining trend overall, and specifically from 1980s, early 1980s, there's a decline.

However, since 1987, '88 to date, total corn acres that are harvested, I would call that pretty -- overall not stable for a fact, but there is not much -- there is no significant fluctuation in the corn acres harvested as compared to before 1982.
Q How many corn acres were harvested in 2014?
A 2014, 90,000.
Q How many corn acres were harvested in 1976?
A 1976, 355,000.
Q Could you turn with me to page 141, please.
Sir, how many cotton acres were harvested in 2014 on that page in the Flint River Basin?
A 200 and perhaps 85,000.
Q Sir, can you turn to page 143 with me, please.
A Yes.
Q How many peanut acres were harvested in Flint River Basin in 2014?
A 190,000 acres.

SUAT IRMAK, Ph.D.

NO. 142, Original

In the

Supreme Court of the United States

STATE OF FLORIDA,

Plaintiff,

v.

STATE OF GEORGIA,

Defendant.

Before the Special Master

Hon. Ralph I. Lancaster

CONTINUED VIDEOTAPED DEPOSITION OF

SUAT IRMAK, Ph.D.

Volume 2

August 3, 2016

9:34 A.M.

Reported by: Michele E. Eddy, RPR, CRR, CLR

JOB NO. 109596

SUAT IRMAK, Ph.D.

A Yes.
Q Which we'll get to. Thank you, sir.
A Thank you.
Q So could you describe how the Georgia Mobile Irrigation Laboratory functions, please.
A In general, these are -- this laboratory is designed to deliver service to the users on the ground to be able to enhance the adoption of certain technologies. That's the overall goal. And it's free. Again, its intention, overall intention, is to enhance overall conservation practices, measures, and then -- so they -- the laboratory staff members go out to certain fields or different fields and check the irrigation system out, center pivot systems. And then they perform some tests for uniformity. And there are standard tests for those uniformities, and we call them catch can tests.
Q I'm sorry, can you say that again.
A Catch can. Catch can.
Q Catch can.
A Yes.
Q Okay.

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A So the idea is to place cans to collect water under the pivot in certain distances and in certain orientation in the field, and then run the pivot over those cans and then see how much water is collected in each can over time as the pivot makes the revolution or circle, and then you -- you measure the amount of water collected in the can. And then there is a certain process, equation to apply to calculate the uniformity coefficient. We call that Christiansen's uniformity coefficient.
Q Chanson?
A Christiansen.
Q Okay.
A So based on that uniformity test, then the uniformity coefficient is determined and then they make an assessment, based on that number, what can be done to improve the efficiency and uniformity of that given center pivot.
Q How --
A It's a very --
Q Go ahead, please. You can continue.

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A It's a very involved process, you know. It's a simple description, but it is a very, very involved process and time consuming as well. I have done it myself, many, many times.

So then they make determination and either sprinkler nozzle needs to be replaced or repaired, or if there are leaks that need to be repaired. If the end gun is not operating properly, to check the reason for that and operate it. If there is no end gun, it needs to be installed. So all those determinations are made, and the service is provided to -- to the irrigators.
Q When you say if there is no end gun, were you referring to an end gun shutoff?
A Yes.
Q So if there is no end gun, the end gun shutoff needs to be --
A It's not needed. If there is end gun but there is no end gun shutoff device, then that determination is made and installed and operated. But not all center pivots have end guns.

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Q That's fair. What percentage don't have end guns in Georgia?
A I don't know the exact number.
Q Do you think it's more than 10 percent?
A Honestly, I don't know. I don't want to speculate.
Q Have you made any effort to determine what percentage of center pivots in ACF Georgia have end gun shutoff devices?
A I did not -- I haven't seen any data that separates center pivots with end gun and center pivots without end gun and center pivots with end gun shutoff device and center pivots without end gun shutoff devices. I didn't see that data. But the majority of the pivots in Georgia do have end gun shutoff devices.
Q Just to make sure that I get the record clear because I may have asked a question that was a little confusing, just with respect to end guns, not the shutoff devices, you haven't seen any data and you don't know what percentage of those actually have end guns, what percentage of center pivots have end

guns and what percent don't in the ACF Georgia?
A I honestly don't know the exact number.
Q Okay.
So, sir, how many individuals at GSWCC are involved in the Mobile Irrigation Laboratory program?
A I do not know the number. It has --
Q Do you know if it's more than five?
A Based on the -- based on the number of irrigators that were serviced, if you will, or center pivots serviced and retrofitted, maintained, and given the -- the hard work that is involved in that process, I will say, just an estimate, it is multiple people, of course. It has to be. Four, five, six, but I don't know the exact number.
Q Do you think it's a valuable program?
A I think it's a valuable program. It provides good service.
Q And you think -- actually, strike that. Let me just read a sentence to you.
At the end of the first paragraph under "Georgia Mobile Irrigation Laboratory,"

you write, "For any given irrigation system to have a high irrigation efficiency, it must first have a high uniformity coefficient."
You agree with that, don't you?
A Yes, sir, I wrote that so I agree with that.
Q Okay. So on the next page, if I can invite your attention to the first paragraph, and I'll read a sentence at the end of that first paragraph. "And end gun shutoff device can considerably reduce the water requirements for a given field by turning off the end gun in locations within a production field where irrigation water does not need to be applied."
You wrote that sentence, too, didn't you?
A Yes, I did.
Q And you agree with it.
A The end gun shutoff devices are designed solely for making the pivot not apply water in areas that may not contribute to productivity.
Q Okay. Can an end gun shutoff device considerably reduce the water requirements of a

given field?
A It depends on the -- it depends on the center pivot size. It depends on the end gun -- end gun itself. End gun is essentially a large sprinkler, essentially. So the capacity of the end gun will determine how much water is being applied, of course, and that will determine how much water could be reduced if end gun shutoff device is turned off at certain places.
Q You agree, don't you, that when a Mobile Irrigation Laboratory process has been completed for a center pivot system, it's reasonable to expect an overall average of 85 percent irrigation efficiency for that system?
A I have to go back and read the exact numbers. But the improvement in efficiency and uniformity depends on in what condition the center pivot and nozzle package was before the retrofit.
Q So after the retrofit, is it reasonable to expect 85 percent efficiency?
A It can be -- it can be less or more.
Q Would the efficiency you would

reasonably expect range from 81 to 88 percent?
A I believe that number is accurate if I recall. I need to check the exact number.
Q I invite your attention to page 65 where you wrote those words.
A Okay. So, yes, that's what I meant. It can be a little less. It can be a little more. But overall, if I take the average of all the pivots that were serviced, retrofitted, maintained, or maintenance was done to them, I think the average -- you said on page 65 -- from 81 to 85 percent, with an overall average, an average of all pivots is about 85 percent.
Q Sir, can you help me understand what's portrayed on figure 24a in this section on Mobile Irrigation Laboratory?
A So this figure represents the uniformity coefficient of individual center pivots that -- before the service or retrofit.
Q Can you help me understand for -- using terms a layman might understand, what uniformity coefficient is and why it's important?
A Uniformity coefficient is an

the ACF portion of Georgia?
A I don't think I have that information, but based on my best recollection, I don't think I have the ACF Basin-specific number.
Q Do you have a sense of why there are 253 center pivot systems identified on figure 24a?
A Why they were identified?
Q Why the number of center pivots pretested identified on figure 24a is 253.
A I'm sorry, "identified," you mean the ID numbers?
Q So let's go back and talk a little bit about 24a. This was the pretest center pivot uniformity percentage, right?
A Yes.
Q Okay. And there are 253 systems identified here; is that correct?
A That's correct.
Q Is that the number of systems that are located in the Georgia part of the ACF Basin?
A When I talked to the Commission staff

members -- staff member -- I do recall asking them if I can have a sample data of the -- of the center pivots that were retrofitted and the associated -- any other data. But, honestly, I do not recall asking them specifically for the center pivots that were serviced in the ACF Basin. So I do -- I -- in figure 24a and b, when I was doing the analysis, the center pivot ID numbers were also related to a county. I don't think I mentioned this in my report, but based on those counties, as I recall, most of them, or a significant percentage of those I recall are in ACF Basin, but I cannot give you an exact percentage.
Q So we looked at your figure a moment ago, figure 23. So do you think a significant percentage of the dots shown on figure 23 are in the ACF Basin?
A Many of them are in the ACF Basin. Significant? I don't know how to quantify significant in this case, but a large number is in the ACF Basin.
Q So, sir, help me understand this. You received information from GSWCC on this

program, right?
A Yes.
Q And you used that information to prepare this section at page 64 of your report, right?
A That's correct.
Q And you relied on that information in preparing this section at 64 to 71 of your report, right?
A That's correct.
Q Where is that information now?
A That information?
Q Yes.
A I should have provided that to my counsel.
Q I haven't seen it, so ...
A I have it. I can provide that.
Q That would be very helpful, thank you.
A Sure.
Q So let's go back to a statement I believe you made.
A I am sorry, I have all the raw data and all the figures.

Q Do you think you might have the locations where these projects were undertaken?
A I will send everything I have.
Q Okay. Thank you so much.
Yesterday I believe you testified a couple times that there are 8,900 center pivot irrigation systems, or thereabouts, in the ACF portion of Georgia; is that right?
A That's correct.
Q Sir, is it fair to say that less than 3 percent of those center pivot systems in the ACF portion of Georgia have been through this Georgia Mobile Irrigation Laboratory process?
A I don't think that will be fair to say because I asked them for a sample data. I have to assume that they didn't send me all the center pivots that were serviced or retrofitted. I asked them for a sample data. So I don't think it would be fair for me to assume that only -- these are the only center pivots that have been serviced by the Mobile Irrigation Lab.
Q And they sent you figure 23; is that right?

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A Figure 23, no, no. In fact, I downloaded this from their website.

Q So, sir, when you find your -- the papers that you received from GSWCC, it won't include figure 23?

A Figure 23 should be on their website.

Q And was figure 23 accessed by you recently?

A No.

Q When did you obtain figure 23?

A Oh, honestly, I don't remember, but that was months ago.

Q Okay. And your suspicion is that a version of figure 23 is probably still on their website?

A I did download this figure from the website.

Q Sir, you're aware, aren't you, that the State of Florida also has a Mobile Irrigation Laboratory program?

A I am not extremely familiar with it, but I know they do.

Q Are you familiar enough to know how it operates?

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A No, sir, I don't.

Q And it sounds like you've had experiences with similar programs in other states. Is that right?

A I do.

Q Is it your experience that those programs are effective in the other states where you've worked with them?

A Depends on, you know -- effectiveness depends on the dedication of the staff you have, the resources you have, the commitment that the State has for really going out and doing this to improve the conservation practices, how accurately those things are done. And in this case I looked at a number extensively in detail. I think it's very good quality. I mean, the process. The process. So, in general, I think they are good service. But, again, its effectiveness depends on how implementation is done.

Q Sir, are you aware that in the ACF portion of Florida, the large majority of center pivot irrigation systems have been through the Mobile Irrigation Laboratory

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program?

A I am not aware of that.

Q If Georgia asked you to recommend whether or not the program be expanded to cover a larger percentage of center pivot systems in ACF Georgia, what recommendation would you give?

A My recommendation -- you know, I have to mention this. As a scientist, I -- you know, I go to state conference, I am invited to give scientific, you know, data, information, and I always try to stay away from suggesting a policy. So this question -- you know, overall, I think this program is useful. It's benefiting the people, of course, and the resources, too. So, overall, I think it's a good practice.

Q Sir, if the State of Georgia asked you whether or not you would recommend that this program be expanded in ACF Georgia, what recommendation would you give?

A You know, I'm being very honest. I don't know if it's up to me to make a recommendation. I don't know that. Because

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I'm not used to that.

Q I understand, sir, but I'm asking you that question, given your expertise in irrigation and as an agricultural engineer.

MR. WINN ALLEN: Objection. Asked and answered.

A Throughout my career I worked with irrigators and agricultural professionals and irrigation districts to help them how to best utilize resources under given policy and decisions and conditions. When I'm asked to provide an opinion in terms of whether state government -- and I'm talking in general, not only Georgia. When I'm asked if a certain state should do this, should do that, I always try to stay away from that because my role as a scientist and researcher and educator is to help people to make best decisions, utilize best practices to adopt or in response to certain policies, but I don't make a recommendations for policies.

Q But, sir --

A But --

Q -- you're proposing to testify as an

expert in this case about whether or not irrigation efficiency is appropriate and whether Georgia practices are reasonable and proactive; isn't that right?

A That's correct. And I -- my opinion, based on many materials, information, documents, data, analysis, I think Georgia has been practicing very responsible, reasonable, effective practices, including Mobile Irrigation Laboratory service. I think this is a good service. It benefits people. It benefits resources.

Q Okay, sir. So if Georgia asked you for a recommendation as to whether the mobile irrigation program should be expanded, what recommendation would you give them?

MR. WINN ALLEN: Objection. Asked and answered.

A Sir, I am being very honest, and I'm not trying to be difficult, I promise you. But I am not sure if I can speak to that policy recommendation. But I can tell you, is all I'm saying is this program is useful. It is effective. It is one of the few programs, in

fact, in the whole United States. You know, Kansas has it, Florida has it, Georgia has it. It is a good program, and it's benefiting people and resources. That's all I can say, I think, in that case.

Q And you're saying that because it has a positive effect in improving irrigation efficiency, correct?

A It does have a positive effect improving irrigation efficiency, uniformity, and, as I said earlier, it has also related positive impact to improving uniformity and efficiency. It's positive indication to nitrogen management as well.

Q All right, sir, can I invite your attention back to Exhibit 23, please, which should be in the stacks.

A (Document review.)

I don't think I have that. Oh, I'm sorry.

Q It's the corn one.

A Okay.

Q All right, sir, we talked a little bit at length yesterday about Exhibit 23, and I

asked you a couple of questions. Do you remember when I asked you about whether it would be reasonable to leave this particular irrigation system that's pictured in Exhibit 23 operating and spraying the trees for three hours?

A I apologize, did you say three hours yesterday or six hours?

Q I said both. And I'm asking you just initially whether you remember my questions from yesterday.

A I do remember six hours.

Q Okay. So, sir, I think you said -- and I want you to correct me because I may be wrong here, but I think you may have said that it depends upon whether the farmer has other commitments or other things to do. Was that your answer yesterday?

A Sir, I did operate traveling gun in my career. I did operate every single irrigation system that is existing today. What I was saying yesterday was you asked me if it's reasonable for this irrigator to leave the system for six hours -- I recall six hours, but

if you said three hours, then I apologize.

Q I said both, sir.

A Okay. If that's reasonable.

What I was saying was irrigation practice on the paper, in the picture, in the discussion, verbal discussion, sounds like a very simple process. You go out and turn the system on and that's it. In practice, and I'm speaking from my -- from my experience. In practice, it is not an easy task, especially if a person has multiple fields, multiple systems to operate. And during the growing season, farmers never stop. Every single day there is something to do. I think we all know that, I think. So they turn the system on, let's say, early in the morning, and then they go out, spray for diseases and spray other things and cultivate, perhaps, and told the crop consultants to get an assessment, check the soil moisture, check grain prices, check insurance companies for -- if they have livestock operation, that adds perhaps three times more complications to the operations. They have families. They have other

efficient?
A I'm sorry, I was trying to find the --
Q Sure.
Would it be reasonable and proactive for the State of Georgia to require that all irrigation systems in ACF Georgia be at least 80 percent application efficient?
A I do believe Georgia did take this proactive reasonable approach.
Q I'm asking you if your conclusion is that that's a reasonable and proactive measure, to require at least 80 percent efficiency for all systems.
A In my judgment, I think that is a very reasonable practice.
Q Would it be reasonable and proactive if Georgia decided to ban traveler systems in the Flint River Basin?
A Sir, again, I promise you, I am not trying to be difficult, I promise you that. But as a researcher, as a scientist, when people ask me about should the government do this, should the government do that, my role as

a land grant university scientist and researcher and educator is to help citizens to make -- provide them research and scientifically based information and data and help them to manage their -- whatever system they have, to the best of our abilities, to the best of our knowledge and technology.
My role is not -- has not been to recommend policies and related things to the government. It's totally opposite, to help people to utilize the best resources, technology, information, data available to help them manage their -- whatever they have.
Q Okay, sir. So let me make sure I understand. You don't view your role as to assess whether or not a state program is reasonable and proactive. Instead, you are -- your role is to help farmers reach a reasonable solution for their individual farms?
MR. WINN ALLEN: Objection. Misstates prior testimony.
Q Is that right?
A No, sir, that's not what I said whatsoever. I can assess if a program is

reasonable or not. That is different.
Q Okay.
A But ...
Q So for Exhibit 23, is a program that allows a traveler system to spray the trees for six hours a reasonable program?
A Sir, you know, this is one system that is operating in a huge basin. Out of 8,900 to 9,000 systems, it is not even 1 percent. It's not even half percent. It is not even .1 percent of -- that doesn't represent even .1 percent of the total systems that operate in a very reasonable way. If I make a judgment based on this one single system, I would be misleading. That -- I don't --
Q I am asking you for a judgment on this one single system. If Georgia permits traveler systems to operate in a way where they, for six hours at a time, spray trees rather than a crop, is Georgia's law and regulation reasonable and proactive?
MR. WINN ALLEN: Objection. Assumes facts not in evidence.

A With all due respect, I don't know for a fact if that system was operating six hours. Did somebody wait there for six hours and watch that system?
Q Sir, I'm asking you to assume that it was.
A Okay.
Q I think you understand my question, sir. Please answer.
MR. WINN ALLEN: Objection. Asked and answered.
A Again, for me to make a judgment based on one single system, I have never done it in my whole life, in my career.
Q Are you unable to make a judgment with respect to the question I'm asking you?
A If I make a judgment whether to ban a certain irrigation system or not based on one irrigation system, I do not know if that will be complete, comprehensive judgment.
Q Sir, if Georgia state law allows farmers to position a traveler system such that it irrigates trees and not their crop for six hours, is Georgia law reasonable and proactive?

irrigate our cropping system in the field.
Q And that would be your advice to farmers in Georgia as well, wouldn't it?
A That would be my advice to anybody, not only in Georgia, but everywhere. But, again, this is one single system out of many.
MR. WINN ALLEN: Phil, can we take a break? We've been going about an hour and 15.
MR. PERRY: Sure. Yes, that's fine.
THE VIDEOGRAPHER: The time is 10:49. We're off the record.
(A brief recess was taken.)
(Exhibit 27 was marked for identification.)
THE VIDEOGRAPHER: The time is 11:10. We're on the record.
BY MR. PERRY:
Q Thanks again, sir. I'm going to try to move fairly quickly through a number of other photos and draw on your expertise. Do you have Exhibit 27 before you?
A Yes, I do.
Q Can you describe what you see there?
A I see a highway. I see a center

pivot. I see power poles, grass ways, and --
Q What type -- I'm sorry, sir. I don't mean to have you get into the type of grass or anything. What type of center pivot do you see there?
A What type? You mean the model or the company or --
Q Is it low pressure, high pressure, et cetera?
A This is actually a low-pressure system.
Q What type of nozzles does it have?
A These are low-pressure nozzles on the spans.
Q Not drop nozzles, though, right?
A No, but these are low-pressure impact sprinklers.
Q Do you know where Spring Creek is, sir?
A In the Lower Flint River Basin.
Q This picture was taken in the Spring Creek area. Sir, are you familiar with a requirement of Georgia law relating to 25 percent average annual discharge in Spring

Creek?
A I am aware of that. In fact, it's on page 54 of my report.
Q Can you describe what that requirement is?
A That requirement relates to newly -- I mean, new issued surface water withdrawal permits in Spring Creek and Ichaway. Some basins have low-flow protection plans. And what that means is these low protection plans require a complete shutdown, I guess, cessation of irrigation, when discharge at the withdrawal location -- discharge at the withdrawal location, that's important -- falls below 25 percent of the average annual discharge rate as calculated at the point based on the period of record for the nearest downstream continuous flow gage, plus a prorated portion of the permitted amount of downstream users. So that's what the 25 percent rule is.
Q What's the purpose of that rule?
A The purpose of that rule is to -- newly issued permits to have reasonable control. That's the overall goal.

Q What's the goal -- what's the rule attempting to achieve?
A The low-flow protection plan is -- in general, is a mechanism to withdraw water within certain water availability setting. That's the overall goal.
Q I'm sorry, water what setting?
A Availability.
Q Availability. Why is it important to have a 25 percent average annual discharge requirement on Spring Creek, for example?
A I honestly don't know why it's 25 percent. I wasn't involved in developing that number. I do not know what assumptions went into that, how it was calculated, so I am not familiar with that.
Q Is it your sense it is at least in part for environmental health of Spring Creek?
A I'm sorry --
MR. WINN ALLEN: Object to the foundation.
A -- impact?
Q Environmental health of Spring Creek?
MR. WINN ALLEN: Same objection.

A I honestly don't know what environmental health means. I don't know.
Q Do you know if the 25 percent average annual discharge requirement is intended to protect the ecology of Spring Creek?
MR. WINN ALLEN: Same objection.
A Again, I honestly don't know what went into that 25 percent determination. I am not an ecologist. I honestly don't feel comfortable getting into health of ecology or --
Q Did you assess ecology or environmental impacts in reaching the conclusions in your report that Georgia's regulatory system was reasonable and proactive?
A In my analysis, you know, I focus on the areas that I have expertise on. Environmental and Spring Creek health, ecology health, these are -- these are not the areas that I have expertise on. I don't know how to --
Q Okay. That's fair, sir. Just let me make sure I understand what your opinion is. Your opinion is not weighing the environmental

impacts of irrigation and determining that Georgia regulations are reasonable and proactive.
A I looked into Georgia's regulations and analyzed, evaluated their reasonableness. In this specific case, for example, for Spring Creek, in terms of water, irrigation water, I think there are some good practices in place that Georgia has spent time and effort to analyze, to develop, and implement good practices that will benefit the -- that improves the water resources management. And some of the examples include the 25 percent low-flow protection plan that you mentioned for -- and then there are other -- other plans, practices that are in place that were put in place by the State of Georgia, conservation requirements, for example, proximity to nearby -- nearby -- between the two wells, cannot be less than a quarter of a mile, if I remember correctly, and the well location cannot be less than half a mile, if I remember correctly, to a creek or other water bodies, and low protection that it will

serve -- I think these are -- these are very good reasonable, responsible, conservation measures to --
Q But, sir, when you were reaching your opinion, you didn't evaluate whether those measures were reasonable in light of the environmental consequences of withdrawing water from groundwater wells and from the rivers and tributaries, right?
A You know, environmental science -- there is environmental science, as you know. I am not an environmental scientist. I --
Q I just want to understand your opinion. Your opinion is not that these are reasonable in light of what might be required to address concerns about the environment in Georgia. It's just whether they're reasonable in light of your experience.
A Now, if you mean with "environment" like ecology and fish and wildlife and other species in the area, I cannot speak -- that's not my expertise.
Q So that was not a part of the basis for your opinion in this case?

A My opinions are as a result of many different aspects of water management -- withdrawal water management and use. I cannot make assessment into water resources versus fish, water resources versus different plant species in the basin, water resources versus other animals or other wildlife or habitat. That's not my expertise.
Q That's helpful, sir, thank you. Can you please take a look at Exhibit 25, which was marked yesterday.
A Yes, sir.
Q Can you identify the irrigation system pictured in Exhibit 25?
A It will be impossible to identify, but it is either a lateral move system or linear move system or center pivot and made by Valmont Industries in Valmont, Nebraska.
Q Your eyes are pretty good. I can't even see that with my bifocals.
A I didn't read what it says. I know the sign.
Q Oh, okay.
A I know the size of the sign. I know

properties, that can be soil physical properties, terrain, slope, in the field, that we may need to look at -- and traditionally we apply 1 inch per circle, right? That's the common practice.

Then we said, well, that may not be the best practice. Maybe we should apply different amounts at different parts of the field depending on the spatial variability within that field. And that's what this VRI is. It is a -- it enables us to apply variable rate or amount of water at different parts of the field to keep the soil moisture uniform in the field.

Q Sure.

A That would also enable plants to uptake soil moisture uniformly, and then that would also enable uniform uptake of nutrients and micronutrients.

Q So UGA Precision Ag Team is a team that's trying to help farmers in Georgia engage in the type of precision practices you're talking about?

A And they are the inventors of that

technology in the state of Georgia. State of Georgia is known for the technology probably all over the country.

Q So I see here on page 77 at the top, still in the VRI section of your report, where it says "In Georgia, the VRI pilot program has reduced water use on average by more than 15 percent or 5 million gallons of water per field in a dry year."

Do you see that?

A I see that.

Q Is it your judgment, sir, that these type of VRI programs could continue to increase irrigation efficiency in Georgia by 15 percent or so?

A These are the impact data -- and I am always interested in impact data. I hope you notice in my report that I just don't talk about technology and say, oh, this is being done in the state of Georgia, but I also provide what does it mean. Which is not an easy task, by the way. I need to mention that, too.

These are the fields that they pilot

tested, they programmed, and then these are the impact data. And I have all the confidence that these are good research data, good quality data. In the future, if this technology is implemented to, say, large scale or other fields, those exact numbers may not be transferable exactly depending on the field spatial variability. But I think they will be close to those numbers.

Q Do you think it would be a reasonable and good decision for the State of Georgia to invest state money and furthering the cause of variable rate irrigation through the UGA Precision Ag Team?

A Again, I promise you, I'm not trying to be difficult, but when you ask me those questions that go into -- into policy making by a given state, I honestly, I'm having a hard time to answer those because I don't see my role as telling or suggesting any given state, well, you need to do that, you need to do that. My role -- I see my role as I can analyze the implications of those policies, what they mean in terms of impact, what they can do, what they

cannot do. But I can't tell or make a recommendation to a state.

Q Just so I understand it, are you testifying that you feel uncomfortable in a position where you would tell a State that they needed to do more as part of a reasonable practice for regulating irrigation?

A I can -- I can analyze, study, evaluate, interpret what happens in a certain state, which I have done for State of Georgia, based on my judgment, based on my interpretations, analysis. I -- I know that State of Georgia has done a substantial number of signature programs, policies, initiatives, to enhance water management in the state. And I --

Q But you don't feel comfortable suggesting to the State of Georgia that they could or should do more than they've done?

A My task in this role is to analyze and calculate, I guess, also, and interpret the reasonableness of water use in the State of Georgia, which is a big umbrella. But in that, there are many, many, many components,

education, technology, implementation, way of irrigating. So I looked into all those. And, in my judgment, I think State of Georgia has invested substantially into those -- all those conservation areas, policies, initiatives.

So, again, what I was saying was, I can analyze all those, but when it comes to telling or recommending a certain State that you need to do this, you need to do that, I don't see this as my role.

Q Okay. So, sir, have you, in the process of preparing your report, identified what the budget of the State of Georgia is or the budget for EPD is?

A I have no idea on that.

Q So you haven't assessed whether expanding their current programs would be feasible in any way?

A I will leave that to my economist colleagues. I wouldn't even start doing this as an engineer.

Q So in your report you didn't attempt to determine whether it would be reasonable for Georgia to expend more money as a function of

its budget, right?

A As part of my -- as part of my analysis, I did look into some of -- how much State of Georgia has invested into some of the signature programs that they have developed, implemented, and managing those programs. And I highlight -- I presented them on page 54 -- I'm sorry, not page 54 -- on page 55, 56, a little bit on 57. But I didn't look into budget of the State, and I don't think -- I don't even know how to do that.

Q No. So we looked at the figures that you have on page 55 and 56, and we did compare it to the budget of the State. Do you happen to know what the budget of the State of Georgia is?

A I have no idea. I don't even know what the budget of Nebraska is.

Q Well, I think you'll find that Nebraska spends a considerably greater percentage of its budget on agriculture than the State of Georgia does, but --

MR. WINN ALLEN: Objection, assumes facts not in evidence.

Q But, sir, the totals here we can discuss after lunch, but the budget for the State of Georgia during the time period you're talking about -- well, I should say this. The budget for the State of Georgia currently is in the 20 billion dollar range. So we can talk later today about what portion of that budget this comprises.

THE WITNESS: Could I please grab some coffee? I'm out of coffee.

MR. PERRY: Let's take a break now for lunch. I think it's probably a convenient time. Let's go off the record.

THE VIDEOGRAPHER: The time is 12:22. We're off the record.

(A lunch recess was taken.)

THE VIDEOGRAPHER: The time is 1:31. We're on the record.

BY MR. PERRY:

Q Welcome back, sir.

A Thank you so much.

Q Can you turn with me, please, to your report, page 75 and 76. And this is Exhibit 1. And I'd invite your attention to the section

titled "Conservation Tillage Practices to Reduce Soil Evaporation." Do you see that?

A Yes.

Q All right. Sir, about two thirds down the first paragraph, it reads "Converting from conventional tillage to conservation tillage can reduce water use by up to 15 percent or more."

Do you see that?

A Yes.

Q You continue to agree with that statement as written, right?

A I do.

Q Now, in the third paragraph I believe you have some current estimates, although I'm not certain if they're current, for levels of conservation tillage in Georgia for various crops.

Do you have current estimates?

A The current estimates are not available by CTIC.

Q Okay. And who is CTIC?

A CTIC is the Conservation Tillage -- okay, I don't want to give you the wrong --

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Q Dr. Wei Zeng?
A Yes.
Q Dr. Masters?
A Mark Masters, yes.
Q I'm not sure if he's a doctor, Ph.D., or not.
A I honestly don't know. I just call him colleague.
Q Yes. And either Dr. or Mr. Eigenberg?
A I know Dave doesn't have a Ph.D., but to me this is different -- some of the most people whom I respect, they most don't have Ph.D. so it doesn't matter to me, Ph.D.
Q I'm just trying to make sure I don't mislabel them.
A I understand that. Dave Eigenberg, yes.
Q Anybody else that you can think of at this time?
A Yes. Mr. Cliff Lewis.
Q Okay.
A Mr. -- he might have Ph.D. so I don't want to mislabel him. Dr. Menghong. I can't

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remember his last name.
Q Right, I'm sorry, my fault. You said that earlier. Wen.
A Yes. Calvin Perry.
Q Okay, Calvin Perry.
A The colleague from Flint River Soil and Water Conservation Commission. I can't remember her name now. It will come to me.
Q Okay. We can go to the next one, and we'll come back if you remember it.
A I believe that's -- these are the -- these are the people, colleagues whom I can remember at this point sitting right here right now. I may be missing some others, but that's the best I can remember now.
Q Did you ever have a discussion with Mr. Jud Turner?
A Yes. He was in some of the -- some of the meetings we had, such as going through the acreage process in detail, he was there. Going through the irrigation depths, I believe he was there.
Q Okay. As I go through this, I'm going to ask you about each of their roles. Do

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you remember anybody else right now, though?
A I can't remember the colleague who is in the Flint River Basin. I think she was working with the Conservation Commission and she was doing a lot of programs within NRCS. I can't remember her name now. Sorry.
Q All right. Did any of these individuals provide you with historical documents of any kind?
A Historical?
Q Like old documents from EPD or old scientific analyses by EPD for you to rely upon?
A I didn't ask specifically for historical documents, and I don't believe they gave me historical documents or provided me historical. But I don't know what you mean by "historical." Like 1930s?
Q Like, for example, the 2006 plan?
A Yes, 2006 plan.
Q Have you ever seen the Lower Flint-Ochlockonee regional water planning document?
A I honestly do not recall.

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Q Do you know a Mr. Harold Reheis?
A I don't know him.
Q You didn't speak with him?
A I never met him my whole life.
Q He was formerly the director of EPD until roughly about 2003.
A Okay.
Q Was any of the text from page 48 through 64 supplied to you, or did you author this all yourself?
A Page 48 through 64?
Q Yes.
A Sir, I have to go through this in really detailed way. Putting this document together took me a long time. Going through -- and I hope you appreciate and you know that I know it's time consuming.
Q I know. It's a substantial piece of work, sir, so I recognize that.
A So I don't want to give you false information. I need to go through, read that step-by-step, perhaps sentence-by-sentence to tell you well. But overall, overall, it is mostly my findings, my -- and discussions,

visits with people, and me gathering information. And in some cases, if I needed specific information, more information on certain things, I would contact my counsel and ask, I need more information on this, on that. That's the process.

Q Okay. Let me just give you an example. There's a table, table 2 on page 57. Do you see that, sir?

A Yes.

Q Was that something you constructed or was that supplied to you?

A This is -- this is a combination of things. Yes, this is a combination of me putting things together, the information, data. Well, data, I mean information, I guess, I had. And then if there are missing parts, then I would ask. And that's how it was constructed.

Q I think when we look at the Lower Flint-Ochlockonee Regional Water Plan in a little while, you'll see this exact same formatting for demand management, among other things. And my sense is, and you can tell me when we get specifically to this issue, that

you may have had some help from Mark Masters on this.

A That may very well be the case.

Q So let's go back, if we could, to page 48. I presume from your comment earlier that there were occasions when you were drafting part 2 of your report where you had to call and ask for additional material. Do I understand you correctly?

A Yes, sir.

Q Can you recall offhand what the topics were, the additional material you asked for?

A I cannot recall exactly, but one of them that I recall is the financial investment.

Q Okay.

A That's one example.

Q All right. Sir, I just want to make sure I understand. In the very first paragraph of part 2 on page 48, you say that you were reviewing the policies and procedures that govern agricultural water use in the ACF Basin.

Can you state for me what your qualifications are to perform that type of

policy and procedure review.

A Sure. As I had mentioned earlier several times, that I am able to look at, analyze, study, and interpret the implications of certain policies in the real world. If policy says people need to do X to achieve this, I am able to look into that and make a judgment and provide opinion as to what this policy, on what kind of practices it has implications, and also in what way. In some cases I can quantify that, too. And I have done that for my work. So that's what I mean.

Q Okay. Understood. You said, I think, several times earlier today that you didn't feel it was your role to make recommendations for additional steps that Georgia might take to improve its agricultural water use policies and procedures. Is that a fair characterization of your testimony?

A I honestly couldn't follow everything you said, but I want to -- overall I think I agree with you. My role -- I don't see my role as sitting here and making recommendations to state governments, you need to do that, you

need to do this. But my role in this process is to study, analyze, interpret the reasonableness of water resources used and management in the State of Georgia.

Q Did the State of Georgia, including Jud Turner or Dr. Gail Cowie or any of the other individuals we talked about ask for your recommendations as to what additional steps they might take?

A I honestly do not recall anybody asking me about recommendations.

Q Sir, have you had any discussion with any of these individuals, including Jud Turner or Dr. Gail Cowie, about efforts to prepare potential legislation for the 2017 Georgia legislative session on agricultural issues?

A No, sir, I didn't have this conversation. I don't even know what that is.

Q Did Gail Cowie, Jud Turner, or anyone else discuss with you the prospect that they would undertake an effort to move surface water users along the Flint River and its tributaries to lower aquifers?

A Could you restate that?

Q Sure.
Let me ask first, did you review the deposition transcripts of Dr. Gail Cowie and Dr. Jud Turner in this case?
A I don't see -- I don't think so.
Q Did either of those individuals or any other individual you mentioned earlier from the State of Georgia discuss with you the potential initiatives that they are studying for moving surface water users to deep aquifers by drilling wells for those surface water users so they will no longer withdraw river water from the Flint or its tributaries?
A I honestly don't remember discussions on that at all.
Q Do you know what the term "ASR" refers to?
A ASR? I do not remember.
Q Aquifer storage and recovery?
A I guess I didn't know that.
Q Are you aware of any efforts by the State of Georgia to analyze aquifer storage and recovery in the Flint River Basin or anywhere in the ACF?

A Sir, the reason I'm pausing a few seconds, I want to go back and remember. That's the only reason. I do not recall that.
Q Did Jud Turner, Dr. Gail Cowie, or anyone else mention the possibility that the State of Georgia would seek to purchase and retire certain agricultural acreage in the Flint River Basin?
A No, but I did -- I did study, look into the retired acreages in -- 30,000-plus acres in, I believe it was 2000 or 2001, and then another 40,000 acres that were retired in 2002. I need to go back and check.
Q Just for those years alone are the Flint River Drought Protection Act, right?
A Yes.
Q I'm asking about something else, a permanent retirement by purchasing land or purchasing an easement to land to take irrigation acres out of use at least as irrigated acres. Have you heard of that?
A No, sir.
Q Under "Permitting" -- do you see that subsection on page 48?

A Yes.
Q You see there's a reference to the Groundwater Use Act?
A Yes.
Q Okay. So, sir, I'm going to hand you a copy of the 2006 plan.
(Exhibit 40 was marked for identification.)
Q I take it you've seen this document before?
A Yes, I have.
Q Did you read this entire document?
A No, sir, not the whole thing.
Q It's mighty long. Well, I'll save you a little bit of time and ask you to refer with me, at least at the outset here, to page 38.
A I appreciate that. 38?
Q Yes.
A (Document review.)
Yes.
Q At the bottom half of page 38, there's a reference to the Groundwater Use Act. Do you see that?
A Yes.

Q Sir, it reads "The Division or a party designated by the Division may develop a regional water development and conservation plan for the State's major aquifers or any portion thereof. Such plans shall include water development conservation and sustainable use and shall be based on detailed scientific analysis of the aquifer, the projected future condition of the aquifer, and current demand and estimated future demands on the aquifer."
Do you see that, sir?
A I see that.
Q Then it goes on. "Upon adoption of a regional plan, all permits issued by the Division shall be consistent with such plan."
Do you see that?
A Yes.
(Exhibit 41 was marked for identification.)
Q Sir, I'm giving you all the largest documents at this time.
A Thanks so much. I really appreciate that.
Q I would like to spend just a little time on Exhibit 41, if we could, sir.

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A Sure.
Q You've never seen it before?
A You know, honestly, I may have, but I am not 100 percent sure.
Q Okay. Let's look at a couple specific pages and see if that jogs your memory. I would like to invite your attention first to page 3-9.
A Are there pages numbers on this?
Q Keep going.
A Okay. Page 3-9. Yes.
Q Now, sir, you see there's a table 3-3 on page 3-9?
A Yes.
Q Then the sentence directly following that table reads "As noted above, the sustainable yield results estimate the volume of groundwater that can be used without causing adverse impacts."
Do you see that, sir?
A Yes.
Q I would like to invite your attention to table 3-3 and, in particular, the row for Upper Floridan aquifer in the Dougherty Plain.

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Do you see that?
A Yes.
Q Is it your understanding that the Upper Floridan aquifer in the Dougherty Plain is the aquifer in subarea 4?
A I am not 100 percent sure, but I think it is.
Q Okay. In the rightmost column, do you see where the column reads at its heading "Sustainable yield of individual aquifer min/max million gallons per day"?
A Yes.
Q I would like you to look at the third entry there that corresponds with the Upper Floridan aquifer in the Dougherty Plain. Do you see it says 237 to 328 million gallons per day?
A Yes.
Q Okay, sir. Now, just to the left of that in the column titled "Estimated Current Groundwater Withdrawal" in millions of gallons per day, it reads 450 to 587. Do you see that, sir?
A I see that.

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Q Would you agree with me, sir, that this table is reporting that the estimated current groundwater withdrawal exceeds the sustainable yield of the Upper Floridan aquifer in the Dougherty Plain?
MR. WINN ALLEN: Object to form and foundation.
A I'm trying to figure out what is the second set of data points under those bolded numbers.
Q Cfs?
A I know the unit, but I don't know what the numbers mean.
Q I think it's just a conversion from millions of gallons per day to cfs, probably using a multiplier of about 1.5.
A Okay. I apologize. What was the question? I was trying to --
Q Do you see that the estimated current groundwater withdrawal from the Upper Floridan aquifer and the Dougherty Plain exceeds the sustainable yield of that aquifer?
MR. WINN ALLEN: Same objection.
A I cannot comment on this without

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studying this in detail. What is sustainable yield means for an aquifer, what kind of assumptions went into that, how it was determined, what data set were used, how they were --
Q Sir, did you consider this in your report?
A No, sir.
Q Okay. So this played no role in your determining whether or not the State of Georgia's policies and procedures were reasonable or proactive?
A I don't know what sustainable yield of individual aquifer means. I know what the word "sustainable" means, but how it was determined, what assumptions went into it, have they been determined by measurements, modeling --
Q Sir, we can read this report, but I'm trying to ask a more simple question, and that's this. Did you consider this information on table 3.3 in determining whether or not the State of Georgia's agricultural policies and procedures were reasonable and proactive?

A This will be -- this table data here, it's a short table, a few numbers, but I will assume a significant process went into determining those without reading the whole, what, 200, 300 pages, and knowing the process modeling this and that, how it was determined, have they used hydrologic model, which I'm not a hydrologist. What is sustainable yield, how it's defined, how it's quantified, I have no idea.

Q Sir, this table has been the subject of enormous inquiry in this case, and we've deposed all the scientists about it. I'm not asking you to opine on the science, sir. I'm entitled to an answer to the following question. Did you consider table 3-3 in evaluating whether the State of Georgia's agricultural policies and procedures are reasonable and proactive?

A I evaluated a substantial number of programs, initiatives, practices, conservation measures, substantial amount of data related to evapotranspiration, crop water use, crop irrigation requirement, technology

implementation, and many other things to come up with an overall conclusion that the State of Georgia has done tremendous amount to utilize water resources as efficiently as they possibly can and still continuing to improve certain things. Based on all of those things that I evaluated in my report, that's where the conclusion of Georgia is, very reasonable, very responsible.

Q Sir, with all due respect, sir, you're not responding to my question. I'm entitled by law to an answer to this question. Did you consider table 3-3 on page 3-9 of Exhibit 41 in forming your opinion as to whether the State of Georgia's policies and procedures for regulating agriculture are reasonable and proactive?

MR. WINN ALLEN: Object to the form of the question.

A Sir, with all due respect, table 3.3 --

Q Did you consider it, sir?

MR. WINN ALLEN: Object to the form of the question.

A Table 3.3 is primarily hydrology, and I'm not a hydrologist. I didn't even look for that information. Even if I had this information, I wouldn't know how to interpret that. I'm not a hydrologist. I'm not an aquifer expert.

Q So you didn't consider it?

A I didn't look for that information.

Q Thank you, sir.

Can you please turn to page 3-6.

THE WITNESS: Can I take a five-minute break, please?

MR. PERRY: Sure.

THE VIDEOGRAPHER: The time is 3:36. We're off the record.

(A brief recess was taken.)

THE VIDEOGRAPHER: The time is 3:51. We're on the record.

MR. PERRY: He's corrected me a couple times.

BY MR. PERRY:

Q Sir, we're back on page 3-6 of Exhibit 41. Are you with me?

A Yes.

Q Sir, I invite your attention to table 3-1. I take it you have not seen this table previously either?

A No, sir.

Q Can I invite your attention down to the row titled "Bainbridge." Do you see that?

A Yes.

Q You know Bainbridge is at a location on the Flint River?

A Yes.

Q You know there's a flow gage at that location?

A Yes, sir.

Q Do you see, in the column titled "Percent of time flow is below the sustainability criteria," 13 percent for Bainbridge?

A I see that.

Q All right, sir.

Can I invite your attention over to the column on the far right for Bainbridge that reads "Flow regime target corresponding to the maximum shortfall cfs." Do you see that?

A I see that.

the council.
Q Did any of the people that you spoke with, including Jud Turner or Gail Cowie, mention to you what the council's position was?
A I don't think so.
Q Now, sir, if you could please turn with me to page 7-4.
A Yes.
Q Have you ever reviewed this particular section of the document we're looking at, Exhibit 41?
A I don't think so.
Q Sir, I want to invite your attention to the items in red with asterisks, titled, "High Priority Management Practice."
Do you see those two on 7-4?
A Yes.
Q Do you see "SF1," "evaluate reservoir storage options in the Flint River Basin that can provide flow augmentation in dry periods"?
A I see that.
Q What, if any, action have you taken in connection with your report to evaluate that option?

A Honestly, I don't know. I reviewed the augmentation study because I was interested in learning about what kind of studies that State of Georgia has invested in, scientific studies. I remember reading an augmentation study, but, honestly, I don't know if these are related or not.
Q Can you tell me what that augmentation study was?
A I cannot remember.
Q Do you know what the date was?
A No, sir.
Q Do you know who authored it?
A I don't remember the document.
Q Did you rely upon it in your report?
A It was something that I was interested in seeing what kind of scientific studies the State has initiated or supported. I remember reading that, but I don't remember, honestly, the details of it. And I don't think I -- I'm not even sure if I mentioned it in my report. Maybe I did. I need to go back, but, honestly, I don't remember. I don't remember the details.

Q Would it be relevant to you if the State had the option of using additional reservoir storage in the Flint River Basin to augment flows in dry periods?
A If it will be relevant to my study?
Q Uh-hmm.
A That will go into reservoir building and using that. I don't think so.
Q All right. Do you see where it says "Identify funding for evaluation and initiate evaluation by December 2011"?
A Yes.
Q All right. Sir, do you have any idea if there's been any progress in that effort?
A I don't know.
Q Do you see the subheading "SF2"?
A Yes.
Q It reads "Replace surface water withdrawals with groundwater withdrawals where site-specific evaluation indicates that this practice is practical and will not harm environmental resources." And then it's titled "High Priority Management Practice."
Do you see that?

A I see that.
Q Have you ever evaluated whether it's possible to replace surface water withdrawals with groundwater withdrawals?
A No, sir, I have not.
Q Has any -- have any of the EPD personnel, including Jud Turner or Dr. Gail Cowie, mentioned that to you?
A No, sir, I don't think so. But what I -- if I can say a word or two on this?
Q Yes, please.
A I think what I can say is that the fact that State has invested time and personnel and effort into really in detail -- I am seeing this now -- into detailed planning discussion, coming up with some ideas to further the management of all the resources in this state itself, I think speaks to responsible and reasonable water use and intention to even further enhance that.
(Exhibit 42 was marked for identification.)
Q Sir, are you familiar with what the 25 percent average annual discharge requirement is at the Flint River gage at Bainbridge?

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A I am familiar with the Spring Creek 25 percent discharge.

Q Are you familiar with that number at the Bainbridge gage?

A No, sir.

Q Do you remember not long ago we talked about the sustainability number, flow rate at the Bainbridge gage, of 2,506?

A Yes, based on that table.

Q Table 3-1 on page 3-6, right?

A Yes, sir.

Q Okay, sir.

Exhibit 42 is a copy of a gage reading for the Bainbridge gage that we downloaded from USGS. And it reports data, mean monthly discharges, for years beginning in 1907 through 1970 and then from 2001 to 2015. Do you see that, sir?

A I am looking at it.

Q And, sir, we've marked this gage data to indicate those months in which the flows fell below the 2,506 number that we just saw in table 3-1 in Exhibit 41. Do you see those yellowed boxes on this exhibit?

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A Yes, sir.

Q Have you ever considered any of the information presented on Exhibit 42 regarding flows at Bainbridge below the sustainability number, 2,506?

A No, sir.

Q Was this relevant -- strike that. Would this information be relevant to you in preparing your report?

A If you would allow me to elaborate on this, I have no idea -- and I will answer you, but please allow me to make a couple elaborations. I have no idea what -- how this flow regime target corresponding to the maximum shortfall, even what that means. I don't know the percent of time flow is below the sustainability criteria, how that was determined, what is the sustainability criteria, how it was determined. And then -- so I wouldn't even know how to interpret that.

Q So you weren't aware of any of the information that we talked about regarding sustainability criteria on Exhibits 41 and 42?

A No, sir.

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Q All right. Sir, back to Exhibit 41, please.

A Which one was that?

Q That's the big one that you're looking at, the Lower Flint-Ochlockonee plan. Do you see SF3 on page 7-5, sir?

A You said SF3?

Q Yes.

A Which is that?

Q It's on page 7-5.

A Yes.

Q And it's on table 7-1. And you'll find it's in the left-hand --

A Yes, I'm sorry, yes.

Q If you're with me, it reads "Evaluate streamflow augmentation via direct pumping from aquifers in order to support instream flows in dry periods." Do you see that, sir?

A Yes, sir.

Q Do you have any knowledge on that topic?

A No, sir.

Q Was that topic ever discussed by you

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with Jud Turner, Dr. Gail Cowie, or anybody else from EPD?

A I don't believe so, sir.

Q All right, sir. If you could turn, sir, with me, please, to page 7-15.

A Yes.

Q And the third bullet on 7-15 reads "Evaluate the impacts of farm ponds on streamflows through intercepted drainage and evaporative loss." Do you see that?

A I see that.

Q What, if any, analysis in this case have you done on the potential evaporative loss from farm ponds in the Flint River Basin?

A I didn't look at the evaporation losses of the farm ponds in the ACF Basin.

Q Okay, sir. Can I invite your attention, please, back to Exhibit 40.

A Yes.

Q I'm sorry, I believe it's the 2006 plan is Exhibit 40. Do I have that number wrong?

A I'm so sorry. I thought you said 30.

I apologize.
Q I'm afraid it's one of these other long documents, sir.
A Okay. Might be this one. Yes.
Q And I would ask that you turn with me to page 21.
A Yes.
Q And on page 21 do you see the heading titled "Summary of Technical Findings"?
A I see that.
Q And do you see on the cover of Exhibit 40 the title "Flint River Basin Regional Water Development and Conservation Plan"?
A I see that.
Q Do you see that it identifies the source of this information as Georgia Department of Natural Resources Environmental Protection Division on the cover?
A You mean on the cover. Yes.
Q All right. And below that, "Carol A. Couch, director"?
A Yes.
Q Back to page 22 in the section titled

"Summary of Technical Findings."
A Page 22.
Q Yes. Can you turn with me to page 23?
A Yes.
Q I would invite your attention specifically to item 3.
A I am so sorry. I don't have item 3 on page 23.
Q 22. My mistake. Please excuse me.
A That's okay. Yes.
Q Item 3 reads "Since extensive development of irrigation of Lower Flint River Basin, drought year flows are reached sooner and are lower than before irrigation became widespread. Furthermore, low-flow criteria established by the U.S. Fish and Wildlife Service designed to protect aquatic habitats are not met more frequently and for longer periods of time since development of irrigation. These data provide the clearest evidence that agricultural irrigation compounds the effect of climatic drought on streamflow in the basin. This effect is magnified during

droughts and is minimal during normal to wet years."
Do you see that section?
A I see that section, sir.
Q Were you aware of this technical finding when you prepared your report?
A No, sir. And this talks about low-flow criteria, Fish and -- U.S. Fish and Wildlife Service aquatic habitat. These are beyond the expertise that I have.
Q Yes, thank you, sir. Can you -- go ahead. I'm sorry, am I interrupting you, sir?
A I was going to say, all of this ecological habitat, fish and wildlife, that is something that I -- that's not -- I don't have any expertise on that.
Q Okay, sir. If you turn now to page 23, item 6 reads "If, under the rules of the Flint River Drought Protection Act, irrigation withdrawals are reduced by 20 percent in the subbasins with the greatest risk of experiencing irrigation-induced low flows, stream discharges that will prevent stream drying and harm to endangered freshwater

mussels will likely be sustained."
Do you see that, sir?
A I see that, sir.
Q Did you have any knowledge of that technical finding by Georgia Department of Natural Resources at the time you prepared your report?
A I didn't look into low-flow stream recharge and the endangered freshwater mussels relationship in my study, sir, no.
Q Your report did not evaluate whether the State of Georgia's regulations and agricultural policies were reasonable and proactive in relation to environmental issues in the Flint River Basin?
A No, sir.
Q Sir, let's go back to, if we could, please, to page 48 of your report.
A Of my report.
Q Which is Exhibit 1.
A Yes.
Q Actually, I would like to have you turn one page, to 49. Do you see that?
A Yes.

issues and then -- and then realize those and then take some actions. That's what I am seeing. I think that's exactly what the State of Georgia has done over the last two or three decades to improve, invest, initiate, to enhance the understanding of water resources and then develop, initiate, implement programs to conserve water resources, increase efficiencies, develop statewide, basin-wide plans to study and to do things better. That's what I'm seeing from this.

Q Sir, when were all the grandfathered permits issued?

MR. WINN ALLEN: Object to the form of the question.

A I don't know.

Q Do you know what a grandfathered permit is?

A Permits -- the permits that were issued before 1988.

Q Do you know if the majority of existing permits are grandfathered permits?

A I don't know.

Q Do you know what, if any, low-flow

protection requirements are in grandfathered permits?

A I wouldn't know that.

Q Would that issue be relevant to your opinion?

A In what sense?

Q In your opinion, you write about, as you just pointed out a moment ago, a number of restrictions on new permits.

A Efficiency requirements, shutoff devices, rain gauge devices, yes.

Q If none of those requirements applied to grandfathered permits, would that be relevant to your opinion?

A Grandfathered permits are not something that I looked into in great detail.

Q So you have no idea of what percentage of the acreage in the Flint River Basin is under grandfathered permits, do you?

A I do not remember that.

Q Were you ever told that?

A I do not recall.

Q Did Jud Turner, Dr. Gail Cowie, Wei Zeng, Mark Masters, David Eigenberg, or any of

the others that you discussed this case with at Georgia EPD ever mention grandfathered permits to you?

A Honestly, I remember hearing the word, but I do not recall -- I don't remember the -- the context of that.

(Exhibit 45 was marked for identification.)

MR. PERRY: How are we doing on time? Do you feel like you need a break or do you want to keep going?

THE WITNESS: I'm okay.

MR. WINN ALLEN: Can we take a break in ten minutes just because I've got to take a break in ten minutes.

MR. PERRY: I can take a break now if you want.

MR. WINN ALLEN: Ten minutes. Do you want to do this document, then take a break?

MR. PERRY: Easier to do it now.

MR. WINN ALLEN: Okay.

MR. PERRY: I have a string of things that are related to each other.

Off the record, please.

THE VIDEOGRAPHER: The time is 4:40. Off the record.

(A brief recess was taken.)

THE VIDEOGRAPHER: The time is 5:00. We're on the record.

BY MR. PERRY:

Q Welcome back, sir.

A Thank you.

Q Do you have Exhibit 45 before you?

A Yes, I do.

Q Sir, I would ask you to turn with me briefly to the last page of the letter, which is maybe the fourth page of Exhibit 45.

A Yes.

Q Do you see Harold Reheis, director, identified as the signatory?

A Yes.

Q It's your understanding he was the director of the Georgia Department of Natural Resources Environmental Protection Division in 1999?

A You told me that, yes, earlier.

Q And, sir, have you ever seen Exhibit 45 previously?

A I don't believe so.
Q Okay. Do you disagree to any -- strike that.
Would ceasing irrigation on approximately 100,000 acres of land during severe drought periods be a reasonable and proactive measure, in your expert judgment?
A Without getting into extensive analysis, data collection, interpretation, I don't think I can answer that.
Q All right. Sir, what's the current funding for the Flint River Drought Protection Act?
A I do not recall that off the top of my head, but let me -- current funding as of today?
Q Yes.
A I have no idea.
Q Do you know if the Flint River Drought Protection Act Fund has ever been funded since 2002 by the State of Georgia?
A I do not recall the temporal progression of the funding for that program.
Q Would it be relevant to you whether

or not the State of Georgia has ever funded since 2002 the Flint River Drought Protection Act?
A I'm sorry, could you restate that?
Q Would it be relevant to your opinions in this case whether or not the State of Georgia has funded the Flint River Drought Protection Act since 2002?
A Has ever funded or --
Q Funded like appropriated money and funds for the Flint River Basin Drought Protection Act.
A I do not know that, sir.
Q You don't know whether it would be relevant to your opinion or not?
A It's in place.
Q The Flint River Drought Protection Act is in place?
A I mean, the Flint River Drought Protection Act has been implemented, but I did not look specifically for the funding or funding amount for that.
Q Sir, was there a severe drought in 2011?

MR. WINN ALLEN: Object to the form of the question.
A It all depends on how you define severe, I guess. It was a below-average year.
Q Was there a severe drought in 2012?
MR. WINN ALLEN: Same objection.
A I do not know.
Q Was the Flint River Drought Protection Act implemented in either of those two years?
A In 2002?
Q 2011 or 2012.
A I'm sorry, I thought you said 2002. I don't believe so.
MR. PERRY: Let's go off the record for a minute.
THE VIDEOGRAPHER: The time is 5:43. We're off the record.
(A brief recess was taken.)

(Thereupon, the deposition was adjourned at 5:43 p.m.)

***

J U R A T

I, SUAT IRMAK, Ph.D., do hereby certify under penalty of perjury that I have read the foregoing transcript of my deposition taken on August 3, 2016; that I have made such corrections as appear noted herein in ink, initialed by me; that my testimony as contained herein, as corrected, is true and correct.

Signature: _____

Dated: _____

SUAT IRMAK, Ph.D.

NO. 142, Original

In the

Supreme Court of the United States

STATE OF FLORIDA,

Plaintiff,

v.

STATE OF GEORGIA,

Defendant.

Before the Special Master

Hon. Ralph I. Lancaster

CONTINUED VIDEOTAPED DEPOSITION OF

SUAT IRMAK, Ph.D.

Volume 3

August 4, 2016

9:04 A.M.

Reported by: Michele E. Eddy, RPR, CRR, CLR

JOB NO. 111100

to be able to more fine-tune that. It is a large basin. It's a very tedious process, but I do know that it is an ongoing -- ongoing process to fine-tune and more specifically capture irrigated acreages in great accuracy.

Q Okay, sir.

A It's -- I apologize. I think, in my judgment, it's already a great process, it's very robust, but it's an ongoing process every year to fine-tune to make it as accurate as possible.

(Exhibit 51 was marked for identification.)

A Could I -- could I ask what -- so he -- this person, he or she was permitted for 100 acres, and you said there is 34 additional acres?

Q Yes, sir.

A I was just wondering. I never see the permit, but is it possible that those corners of the field --

Q Sir, let's talk about that.

A Okay.

Q If you could take a look at Exhibit 51 with me, please. This is a document we

created after comparing the wetted acreage database you all supplied us with last Friday with permitted acreage in Georgia's official files. And you'll find we've got a number of examples here, I believe it's a couple dozen, where in many respects the unpermitted -- the total wetted acres exceed by a fair degree the permitted acreage.

Do you see that, sir?

A I'm still looking at it, but ...

(Document review.)

MR. WINN ALLEN: I'm just going to state for the record that Georgia's position is the wetted acreage database was not provided last Friday but was provided several months ago, as I've conveyed to counsel via separate correspondence.

MR. PERRY: That's fair, Winn. We have a disagreement on that, but we don't need to litigate that now.

Q Do you see all that data that we've laid out here on Exhibit 51, sir?

A I do see that, sir.

Q Well, sir, to date we have found

90,000 acres in the Flint River Basin that appear in your total wetted acreage database but are unpermitted and, thus, illegal. And, sir, my question for you is are you aware of Georgia doing any analysis to compare the wetted acreage database acres to acres that are permitted?

MR. WINN ALLEN: Objection. Assumes facts.

A Honestly, there is no way for me to know where this, you know, total wetted acres, additional acres or the difference between the two is coming from. I mean, I don't know how you -- how this column, "Total Wetted Acreage," was created. There is no way for me to know if these are really the case in the field or not.

Q Okay. Sir, that's fair. What we will do after the deposition is over is we will supply to Georgia's counsel a detailed list of all the permits that are addressed by this chart. And in addition to that, for all 90,000 acres we've identified to date that are illegally being irrigated in Georgia, we will provide a list of the permits and the wetted

acreage dated -- wetted acres being irrigated and the ability for -- and we will supply the ability for Georgia to go audit each of those farmers.

So I understand, sir, that it's a little hard for you to answer this question, but we will supply that information to your counsel.

A Okay.

Q Sir, we talked just a bit yesterday about the 25 percent average annual discharge requirement. That's also in your report, isn't it?

A (No audible response.)

(Exhibit 52 was marked for identification.)

A (Document review.)

Q Sir, have you ever previously seen what's been marked as Exhibit 52?

A No, sir.

Q Well, sir, we've discussed this document in multiple depositions, including with Dr. Gail Cowie and Dr. Nap Caldwell, whose names appear above. Do you see their names there?

A I see their names. I don't know them -- I know Gail, Dr. Cowie, but not the others.

Q Sir, can you read the letter? It appears to be a form letter that's attached to the first page of Exhibit 52, please.

A (Document review.)

Okay. I've read them, sir.

Q You've read it, sir?

A Yes.

Q Do you know if that type of form letter has been sent every year where flows have been below 25 percent AAD in the relevant tributaries in the Flint River?

MR. WINN ALLEN: Object to foundation.

A I wouldn't know if they were sent every year or not, but based on the requirement, I would assume some effort is made to monitor the flow and inform people.

Q Okay. Well, sir, I have here in front of me about ten gage readings for the gages that are identified on the first page of Exhibit 52. I'll ask now that three of them be

marked.

(Exhibit 53, Exhibit 54, and Exhibit 55 were marked for identification.)

MR. PERRY: Was Milford 54, or was that Reynoldsville?

MR. WINN ALLEN: Milford is 54.

MR. PERRY: Okay. And Reynoldsville is 55, right?

MR. WINN ALLEN: Yes, Reynoldsville is 55.

MR. PERRY: Okay.

Q So, sir, I have the gages for every one of the stations identified on the first page of Exhibit 52. And what we've done on the first three that we've marked, Exhibits 53, 54, and 55, is identify in yellow, since 2006, when this requirement was put in place, how many occasions on these mean monthly discharge gage data for each of these locations were below the 25 percent AAD criteria. Do you see those?

A I see the highlighted flows.

Q Okay. Did you, in preparing your report, evaluate whether or not the State of Georgia was meeting its 25 percent AAD

criteria?

A That was not part of my analysis, no.

Q Now, for Iron City, that's Spring Creek at Iron City, it's gage number 02357000 on Exhibit 53. Do you see that?

A Yes.

Q Would you agree with me, sir, that during 2012, ten months were below the 25 percent AAD requirement?

MR. WINN ALLEN: Objection, foundation. Assumes facts.

A I'm sorry, what was the 25 percent -- I mean the 25 percent of the AAD?

Q That's a good question, sir. So if you could compare the gage number on Exhibit 53 to the first page of Exhibit 52, you'll find that it's 190.55. No, actually, I'm sorry, I gave you the wrong number.

A Yes.

Q It's 125.19. It's 02357000. It's the last one. Do you see that now?

A I see that, sir.

Q I apologize, I misspoke.

A That's okay.

Q My mistake.

A You know, I didn't look at the streamflow for these gages, and then I didn't do any long-term annual average discharge analysis. I don't know if I can speak to this.

Q Okay. Well, sir, I could go through every year on every one of these gages, and it sounds to me from your testimony that that's not a task you undertook for any of these gages. Is that fair?

A Yes.

Q So your opinions in this case don't reflect any review of the actual flows and whether they did or didn't meet 25 percent AAD.

A That would be -- that would be accurate, sir.

Q Okay.

(Exhibit 56 and Exhibit 57 were marked for identification.)

A (Document review.)

Q Sir, I'm not going to ask you to read every page of Exhibit 56. It's quite lengthy. And I don't want to hold you any longer than necessary. So, sir, might you -- I mean, do

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Q So, sir, have you multiplied or done any calculation to determine what the numbers that you've identified on pages 55, 56 make up in a percentage of Georgia state budgets during that same time period?

A You mean multiplied just now?

Q No. Have you at any point in time?

A I did not look at State's overall appropriation or budget to multiply anything.

Q It's 0.009 percent.

Sir, do you know what the State of Nebraska invests in ag-related, agriculture-related programs?

A I don't, but this is not agriculture related. This is water resources.

Q Okay. Do you know what the State of Nebraska invests in water resources programs?

A I have no idea.

Q Do you know what the State of Iowa invests in water resources programs?

A Sir, I am an engineer, and I don't -- I am a scientist. I look at physical things. I look at -- we didn't talk about my background, but you know I hold -- my

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background or you studied my background. So I am not an economist.

Q Sir, I respect your background, and I'm not asking about your background. I respect that you have a very significant degree of experience in agricultural engineering and, in particular, in the efficiency of irrigation systems.

But the State of Georgia has asked you to opine on a great range of other things not described by that. So what I'm doing here is I'm asking you questions about all these other things that they have asked you to opine on. And I'm not sure why they've asked you to do that, but they have. So my questions go to what's in your report on these other topics at this moment.

MR. WINN ALLEN: Object to the form and the characterization of the question that was just asked.

MR. PERRY: I haven't even gotten to a question.

MR. WINN ALLEN: Well, any statement that was just made.

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A Sir, with all due respect, you asked me if I looked at the budget of Iowa that invested into water resources. I didn't have any reason to do that. I don't just sit in my office and check the states and look at how much budget they have, all 54 states and how much they spend in agriculture. I don't know why would I do that.

Q Well, sir, you've opined that the actions of the State of Georgia are reasonable and proactive and included specific investments as an example of that.

A That's right.

Q So the question is, did you compare those specific investments or the activity of the State of Georgia to the activities of any other state in the United States where the same issues of agriculture and water use are presented.

A In my mind, maybe there's an implicit comparison, but I certainly would not compare Georgia to Iowa, the example you used, because there is no irrigation in Iowa.

Q How about California?

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A California and Georgia, I -- to be able to make that comparison in terms of financial, economical, and related aspects, that will go into an economist. And I am not an economist. I would not even start doing this. These are some of the examples, some of the examples that I wanted to highlight that State of Georgia has invested in water resources, planning, management, implementation, signature programs. That was the sole purpose of my section of the report here.

It wasn't designed to say, well, what portion of the total state budget is invested because I would not even know how to make that analogy or comparison. But these are some of the examples of -- some, and there are many others, as we discussed, the federal dollars that the State of Georgia was successfully able to obtain, not -- it's not free. You have to -- again, you have to go through a very, very tough process to be able to get that proposal funded to obtain the federal dollar to use for water resources management and education and

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technology implementation.
Q Do you know how many people in the State of Georgia are involved in obtaining federal grants from NRCS?
A I -- I would not know that, sir.
MR. PERRY: Sir, any time you would like a break, I can continue or -- either way.
THE WITNESS: I think I would like to take a break.
MR. PERRY: Okay, thank you, sir.
THE WITNESS: Thank you.
THE VIDEOGRAPHER: The time is 10:12. We're off the record.
(A brief recess was taken.)
THE VIDEOGRAPHER: The time is 10:36. We're on the record.
(Exhibit 61 was marked for identification.)
BY MR. PERRY:
Q Sir, have you ever seen what's been marked Exhibit 61 before?
A No, sir, I don't think so.
Q Are you familiar with the term "ACF Compact Commission"?

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A I honestly do not recall if I read any documents related to that commission.
Q You recall the name Harold Reheis from yesterday, right?
A From yesterday, yes.
Q The prior director of EPD.
So you see the letter on the first page of Exhibit 61, right?
A Yes.
Q I'd invite your attention to the materials that follow and, in particular, page 4.
Sir, do you see table 1 on page 4?
A Yes.
Q Have you ever seen this particular table before?
A I don't believe so.
Q On the top it reads "Table 1, totals for mapped plus unmapped permitted, irrigated acres in the Flint River Basin."
Do you see that?
A Uh-hmm, yes.
Q Then there are five different columns with figures. Do you see those?

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A Yes.
Q Has anyone affiliated with the State of Georgia ever shared with you their estimates of irrigated acreage from 2003?
A I need to go back to try to remember. I do not remember specifically 2003, but we went through -- I went through the -- to verify the process that EPD used to -- and in partnership with Water Planning Policy Center, how the GIS was done, and we talked about this yesterday, and how acreages were determined, but I cannot -- and I think, in my judgment, it's a very robust process, but I cannot remember 2003 specifically.
Q Do you know what was done in or about 2003 to determine irrigated acres?
A In 2003 specifically, I need to go back to that -- to Exhibit 3, but I don't remember off the top of my head specifically.
Q Okay. Can I ask you to review the total at the bottom of column A on page 4.
A Yes.
Q Do you see the totals for "Groundwater Flint Only" are 550,000?

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A Yes. That's what it says on this document.
Q And then there's a subarea 4 column. Do you see that?
A Yes.
Q You're familiar with subarea 4, right?
A Yes.
Q It's not the entirety of the Flint River Basin, is it?
A A portion of that is outside of the Flint River Basin.
Q Yes. And do you see column C, "Total Surface Water Flint Only"?
A Yes.
Q 190,000?
A Yes.
Q And then the "Total Acres Flint Only" are 714,000?
A Based on this table, I mean, that's what it says on the table.
Q Okay. Your numbers that you've reported in this case are substantially below that, aren't they?

2016, something that Georgia has started many years ago, to get monthly readings. So there is no uniformity. That's my point. There is no uniformity in the state, that each NRD -- because these are independent entities. They are not reporting back to DNR. They are taxpayer-funded districts. So they are -- they can make independent decisions.

Q Yes. So in the North Platte, I believe, which you can probably see with the glasses, where it says "Flow Meters," it says "Yes, in overappropriated in Pumpkin Creek areas."

A Yes.

Q Can you explain that to me?

A So in Pumpkin Creek area, in that -- in the counties that are in that region or location, they do have to have flow meters, and NRDs go out and read them on an annual basis.

Q Okay. And then, just to make sure I understand, it says "And Pumpkin Creek, 36 inches over three years." So that would be a limitation of what they could do on a particular acre during a three-year period?

A Correct. Within that district, overall allocation is 70 inches for five years, but in that specific location it's 36, 12 inches per year, or 36 inches for three years.

Q So you've worked with farmers that have to abide by these allocations, haven't you?

A Yes, sir, I have.

Q Yes. And I imagine that they engage in all kinds of practices, with the knowledge that they have five-year or three-year requirements, to ensure that they don't exceed the limit; is that fair?

A I apologize, could you restate that.

Q Yes. Let me ask it as a more open-ended question.

What types of strategies do farmers in North Platte or South Platte NRDs use to make sure they don't exceed their allocations?

A Oh, Western Nebraska is an arid region, you know, 14 inches. That is a long-term average number. And in many, many, many years -- if you go back in the history many years, you get only 5, 5 inches or 7

inches.

So people have been experimenting different tools, different technologies, different strategies, limited irrigation, deficit irrigation, that are designed for that part of the world, not for everywhere. They practice different cropping systems. So they are struggling. I think that's the bottom line. They are struggling big time. And we, as scientists and researchers and educators, try to do our best to help them to manage their resources as best as they can. But that has been a huge challenge on our part as well because in an arid region, this kind of amount of water is tough to grow crops, to sustain families and livelihood of the communities and other things so ...

Q Are these mostly corn-producing areas?

A It's -- Western Nebraska is -- it does have short season corn. It does have long season corn. It does not have soybean because, as you might know, in Midwest, we grow maturity group number II soybean. As you go towards

west, then you can't grow that, due to sensitivity of soybean to sunlight.

They have -- in the last several years, they have started to -- well, not several -- maybe six, seven, eight years, they started to experiment with different cropping systems, canola, sunflower, and other things that turned out to be not very good.

So the bottom line is there are -- there are substantial challenges, substantial.

Q You mentioned deficit irrigation, I think, a minute ago. How do they do that?

A They do that based on what they learn from us.

Q What do you teach them?

A What we teach them is this. Deficit irrigation is a very specialized, very specific irrigation strategy that can be adopted or implemented in very specific regions, in very specific conditions. It is not applicable everywhere. So we teach them -- if you have, let's assume 12-inch-per-year allocation, let's assume that.

Q Uh-hmm.

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A And corn crop evapotranspiration in this district, in Scotts Bluff County -- that is Scotts Bluff County -- is about -- it can -- it can go up to 40, 45 inches. And that's not an assumption. That's a real number. But I have only 12 inches. And long-term historical precipitation is 14. 12 plus 14, that's 26. Well, I have to go up to 45. So I am deficit by roughly 20 inches. Well, that's a huge problem. It is a huge problem, life-changing problem, actually, and some people's lives did change in that area.

So what we teach them is each cropping system has different sensitivity to water stress, and at different crop growth stages and development stages. Let's assume corn. Corn is extremely sensitive to water stress in week 8 stage, week 10 stage, week 12 stage and week 16 stage. I don't know if you are familiar with those stages. If not --

Q I don't think. Go ahead.

A But I can convert them to vegetative stages. For example, corn is very sensitive to -- very sensitive to water stress during

SUAT IRMAK, Ph.D.

vegetative stage of tasseling and then silking and then grain fill, and then dent stage or milk stage. So you do not want to stress the crop during that period. If you do, then you are going to lose anywhere from 50 to 70 percent of your yield potential.

Now, if you recall, I said the corn is more sensitive to those certain specific stage, but that does not mean corn is not sensitive to water stress during other stages.

So we teach them, well, if you have only 12 inches, how do you best utilize that water during the growing season. Try to stress the crop during the early growing season and then apply some during tassel stage and then silking stage and other stages. But it is -- I have to tell you, if you go and talk to those farmers in area A, everybody is struggling big time. I see that personally.

Q What do you mean, "stress the crop in the early growing season"? Is that before any of those stages you were talking about?

A Yes. You can stress -- you have to stress. It's not you can, but -- and I don't

SUAT IRMAK, Ph.D.

advise anybody to, but in this case you must stress the crop, but when will be the best time to stress the crop. So from V0 to V8, I mean, from two-leaf stage to ten-leaf stage, if you want to -- if you have to stress, then this is the time you want to do it. That doesn't mean it's not going to impact your -- it will impact your yield, no question about that, but there is no other option.

Q What kind of yields have you seen in the South Platte, North Platte NRDs in recent years?

A Much lower than statewide average.

Q Do you have a sense in your mind of what the numbers are?

A I don't remember the numbers.

Q That's something that we could get from the website, I would think, right?

A You sure can.

Q So have you also worked in the Upper Republican and Middle Republican NRDs?

A A lot.

Q Can you describe the types of challenges that farmers face in those areas?

SUAT IRMAK, Ph.D.

A In the -- I'm sorry, did you say Lower and Upper?

Q I said Upper and Middle, but if you can't, Lower is fine, too.

A Upper -- and you said Big Blue, right?

Q I'm sorry?

A Did you say Big Blue NRD -- Upper Big Blue NRD?

Q I think, sure, why don't you define it that way.

A Okay, I just want to make sure we are in the -- on the same NRD.

Q Okay.

A So in terms of Upper Big Blue NRD -- and I think you said Little Blue NRD? I just want to --

Q Middle.

A Middle.

Q Yes. I mean, talk about all the Republican River NRDs. That's fine.

A Oh, Republican River. Well, these are two different worlds. That's why I want to make sure.

scenarios. I don't know.
A I bet it was not a deficit irrigation research.
Q Well, let's talk about that. What -- I suppose it depends on who's calling it deficit irrigation as to what deficit irrigation means, but how do you define that term, sir?
A Okay. You know, in my discipline, not everybody can come up with their own definition, wake up one day and say, oh, I'm going to call this this. It doesn't happen that way.
As a scientific community, we need to have some level of standardization on certain things, and I think that exists in every other discipline.
For deficit irrigation, that means, as I described earlier, if I'm growing corn, I'm going to wait -- if I am limited in terms of the amount of water I have, then I'm going to apply that water at specific growth stages. I'm going to wait to a certain -- I'm going to stress the crop and then apply an inch at

tassel stage, apply inch and a quarter at silking stage. And then I'm not going to stress the crop during that critical stage. Before and after, I will stress the crop.
So applying water, a certain amount of water at certain growth and development stages to a different cropping system is called deficit irrigation. This seems to me, since they say 66 percent, 33 percent -- and I assume 66 percent of the full irrigation, 33 percent of the full irrigation, which is a concept that I developed myself 14, 15 years ago. And I am glad that Georgia is implementing that. That's very nice to see.
But this is not deficit irrigation. I don't have any indication in this document that tells me that this really was a deficit irrigation.
Q That's very helpful, sir, because I think part of your report criticizes Dr. Sunding for using the term "deficit irrigation," but as far as I know, from the Shellman material, it's just the application of less water.

A That's limited irrigation.
Q Okay, limited irrigation.
A Yes.
Q So is it your position that limited irrigation is not possible in the state of Georgia?
A It will be challenging.
Q But not impossible.
A I really have to study that, sir. I honestly, I have to study -- you know, if I may say this, every time, you know, I say I really have to study, I really have to study, you know, I am known in -- I promise you, I am not bragging about myself whatsoever, but I am known as a person who really studies first before I make any comment. If I am not able to make a comment, I will say that. That's the reason I was humbled, honored to be invited to U.S. Congress to talk about different things. So I will honor my reputation in my discipline.
I don't see any evidence that this was a deficit irrigation, and since I see 66 percent of the full, 33 percent of the full irrigation, 99.9 percent I'm confident that

this is not a deficit irrigation research.
Q Okay, sir. So let me just make sure I understand. So nothing in your report offers an opinion about limited irrigation. It's about deficit irrigation.
A I am scanning my report through my brain now, see if I -- I cannot remember exactly if I mentioned limited. I know I talk about deficit. I don't think limited irrigation was mentioned in my report in these kind of context.
Q Okay, sir. That's helpful, because I want to understand precisely what you've said.
(Exhibit 66 was marked for identification.)
Q Sir, we created Exhibit 66. I just want to make sure that there's no doubt about that. And we've created it by using maps of the Claiborne aquifer created by USGS.
Do you see the brown area on the map?
A I apologize. I need some help about the brown.
MR. WINN ALLEN: Are you color-blind?
THE WITNESS: Yes.
MR. WINN ALLEN: He will help you.

how do you control for all those other factors. And it seems to me to be a very difficult task. And I'm not sure, because I'm not a statistician, what to say precisely about your point on 1999 and the one data -- two or three data points we have there on that one chart.

But I think you've already acknowledged that this is -- it's not easy to isolate only irrigation water in this fashion as a cause, or irrigation efficiency as a cause.

A Actually, this is not irrigation water. This is amount of water used.

Q Okay. That's fair. I misspoke there. But I think my point remains the same. Phrased as a question, I don't think you're testifying that there's only one cause of the upward movement of the lines you see on pages 147, 148, and 149. There might be multiple factors in play.

A There may be multiple, but the vast majority of that factor is crop evapotranspiration.

Q Okay. So ...

Why don't we take a few minutes and I can sort of figure out how I'm going to wrap up.

MR. WINN ALLEN: Okay. We'll take a break.

THE VIDEOGRAPHER: The time is 4:13. We're off the record.

(A brief recess was taken.)

(Exhibit 73 was marked for identification.)

THE VIDEOGRAPHER: The time is 4:32. We're on the record.

BY MR. PERRY:

Q Okay, sir, so 73.

A Yes.

Q This is an exhibit we created from the USDA census for Georgia. And as you can tell, it charts irrigation in 63 Georgia ACF counties. And it's particularly intended to identify the numbers of harvested and irrigated acres and, thus, the numbers of acres that are not irrigated.

Do you see that, sir?

A Yes.

Q Do you mind taking a look, please, at

this data and telling me if you see anything that looks amiss to you?

A Looks what, I'm sorry?

Q Looks like it may not be accurate.

MR. WINN ALLEN: Object to form and foundation.

A I -- honestly, I have no way of knowing whether this is accurate or not because I -- it seems like this was taken from census for Georgia, but I did not conduct these analyses.

Q Okay. Let me just ask you some general questions then.

A Sure.

Q So do you see the far right columns under "Percent Irrigated," sir?

A Yes.

Q So then there's a column for acres, and it says at the bottom "All farms, percent irrigated, 44 percent."

Do you see that?

A I see that.

Q Does that number seem appropriate to you for ACF Georgia counties?

MR. WINN ALLEN: Object to form. Foundation.

A I -- honestly, I wouldn't know that without sitting down and doing the analysis. I don't know what the percentage is.

Q Okay. And do you see that particular line on the left-hand side for 2,000-plus-acre farms?

A Yes.

Q Those are fairly large farms; is that fair to say?

A These are very large farms in Georgia standards.

Q Yes. Nothing like your 1-mile center pivot farm.

A No.

Q But there, for 2,000 acres plus, if you look at percent irrigated acres, you get 50 percent. Do you see that?

A I see that.

Q Which would imply, of course, that 50 percent are not irrigated as well.

Do you find that out of line with your expectations?

ATTACHMENT 16

Excerpts from the Deposition Transcript of Judson Turner (Feb. 10-11, 2016)

NO. 142 Original

IN THE SUPREME COURT OF THE UNITED STATES

STATE OF FLORIDA,
Plaintiff,
vs.
STATE OF GEORGIA,
Defendant.

- - -

Before the Special Master
Hon. Ralph I. Lancaster

VOLUME I

Videotaped 30(b)(6) Deposition of

JUDSON TURNER

February 10, 2016
10:00 a.m.

CARLTON FIELDS JORDEN BURT
ONE ATLANTIC CENTER
1201 WEST PEACHTREE STREET, N.W.
SUITE 3100
ATLANTA, GEORGIA 30303

********CONFIDENTIAL**********

Reported by: Lynne C. Fulwood
Certified Court Reporter

STATE OF GEORGIA

COUNTY OF COBB

VIDEOTAPED DEPOSITION OF JUDSON TURNER

Pursuant to Article 8.B of the RULES AND REGULATIONS OF THE BOARD OF COURT REPORTING OF THE JUDICIAL COUNCIL OF GEORGIA, I make the following disclosure:

I am a Georgia Certified Court Reporter. I am here as a representative of Huseby Global Litigation.

Huseby Global Litigation was contacted by the offices of LATHAM & WATKINS, LLP, to provide court reporting services for this deposition. Huseby Global Litigation will not be taking this deposition by O.C.G.A. 15-14-37 (a) and (b).

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ALSO PRESENT:
The Videographer

- - -

Videotaped deposition of JUDSON TURNER, taken by the Plaintiff, at 1201 West Peachtree Street, N.W., Suite 3000, Atlanta, Georgia 30309, on the 10th day of February 2016, at 10:00 a.m., before Lynne C. Fulwood, Certified Court Reporter.

INDEX TO EXHIBITS

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P R O C E E D I N G S,

- - -

(Whereupon, the video camera was turned on.)

THE VIDEOGRAPHER: This is the beginning of disk No. 1, in the deposition of Judson Turner, in the matter of State of Florida versus State of Georgia, et al., Case No. 142. Today's date is February 10th, 2016 and the time on the monitor is 9:57 a.m.

My name is Damon Okoro and I'm the videographer. The Court Reporter is Lynne Fulwood. We're with Huseby Global Litigation.

Counsel, please introduce yourselves after which the Court Reporter will swear in the witness.

MR. PERRY: Phil Perry from Latham and Watkins representing Florida.

MS. MANGONES: Andrea Mangones of Latham and Watkins also representing State of Florida.

MS. BENNETT: Lauren Bennett of Latham & Watkins also representing State of Florida.

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MR. KISE: Chris Kise, Foley Lardner for Florida.

MR. PRIMIS: Craig Primis, Kirkland & Ellis, LLP, for the State of Georgia.

MS. LEWIS: Britney Lewis also from Kirkland and Ellis, also the State of Georgia.

MR. ALLEN: John Allen for the State of Georgia.

JUDSON TURNER,

having first been duly sworn, was deposed and examined as follows:

EXAMINATION

BY MR. PERRY:

Q Sir, let me start by just thanking you on behalf of the State of Florida for appearing today and tomorrow and for your patience and in advance for your understanding. It's going to be a long couple of days and we appreciate your time and I know you're busy so, sir, have you ever been deposed before?

A I have not.

Q Have you taken or defended depositions?

A I have.

Q Okay. So then you're fairly familiar,

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perhaps more than many here at the table with that process so I'll be very brief about how I'm going to try to proceed.

One, I apologize also in advance if I interrupt you and I'll try not to but if I do, please just tell me, you've interrupted me; and likewise, if you could wait until I finish my question. You know how that happens. You've seen it I'm sure.

If at any point in time you don't understand my question, please ask me for a clarification. I'm completely happy to do that. I want to make sure you understand the question I'm asking and you answer that so is that all right with you?

A That's great.

Q Okay. Is there any reason you can't give accurate testimony today?

A No.

Q All right. At any point if you want to take a break, just let your counsel know. I'm very happy unless we're in the midst of a question/answer to do that. We can do it every hour and a half, every hour, whatever works for you.

I'd like to walk through your background very briefly if I might and I'm going to mark a

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couple of exhibits for that purpose.

(Whereupon, Exhibit Nos. 1 and 2 were marked for identification by the court reporter.)

BY MR. PERRY:

Q Well, thank you. Let's, before we get to the exhibits, talk very briefly about your current position and then your -- your recent employment history. You're the director now as I understand it of EPD; is that right?

A That's correct.

Q Okay. And prior to that position, what were your jobs or positions?

A If you just kind of work chronologically backwards from the EPD appointment, I was special executive counsel for water. But I was -- I had a small law practice and government affairs firm between '08, mid '08, and when I came back, which was January 1, 2012.

And then before that, I was executive counsel to Sonny Purdue and deputy executive counsel to Sonny Purdue before that. So between about mid 2005 and mid 2008 so about three years I was with Sonny Purdue.

Before that, general counsel to the State

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Department of Education in Georgia. And before that, practice in Birmingham, Alabama as a general commercial litigation practice.

Q Okay. What is a special executive counsel?

A In Georgia under Title 45, the governor is afforded by state law, executive counsel that report to him and have privilege with a governor's office and counsel him directly separate from the law department.

And so the governor has on occasion in addition to his executive counsel appointed outside lawyers as special executive counsel.

Q So special government employees?

A Special -- I think that you wouldn't -- they wouldn't be direct employees in the employment sense. They would be contract but they would have privilege with the governor for -- for legal counsel.

Q Okay. What's Georgia 360 Public Affairs?

A That was the small government affairs firm that we had in addition to the law practice.

Q And Bachman and Garrett was the law practice?

A That was the law practice, yes.

Q Can you tell me what period of time you

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began working on and I'm going to use an acronym here -- we can make sure we agree on what it means -- on ACF issues?

A ACF being?

Q Apalachicola, Chattahoochee, Flint River Basin issues. Is that -- is that how you understand --

A That's how I understand.

Q -- Okay. So the question is: How long ago did you begin working on those issues?

A I started working on those issues really when I took over as executive counsel to Purdue. The previous executive counsel, Rebecca Sullivan, really had that responsibility so that would have been around January 1 of '07.

Q Okay. And when you were executive counsel for Governor Purdue, did you have any role in ACFS issues from 2005 to 2007?

A I had very little. I was deputy counsel and -- and that sort of function related to the water issues that were at various stages at that time. Rebecca Sullivan was point on that. I may have known just very broadly certain things that were going on but I wasn't -- that wasn't in my direct line of responsibility during that time.

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Q Okay. So let's -- what I want to do if I might just here very briefly is understand what types of ACF issues you worked on from '07 until you entered your current role. So can you give me some kind of sense. For example, you might say I was involved in the negotiations with Florida during that period. I was involved in EPD issues. But I want to get a sense from you what that universe was.

MR. PRIMIS: And I'll just caution, be careful about privileged communications but if you can describe generally what you worked on, that's acceptable.

A Sure. I was -- the droughts were really accentuating in '07 and so we -- I was, on behalf of the Governor, working in consultation and in coordination with the outside counsel for the State at the time and the law department on legal matters that were before us, issues related to the Corps of Engineers and the water control manual.

And as the drought increased, and the severity of that became more acute as '07 progressed, I interfaced a fair bit with the Corps of Engineers and certain folks related to Fish and Wildlife related to the issues we were facing in particular as that IOP at the time, interim operating plan, the

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Corps' operating manual.

And so I worked on those things on behalf of the Governor and then was involved in the negotiations that occurred at various stages from that point until I came back to -- to state government.

Q Okay. So, again, just asking you personally. We'll get to the 30(b)(6) issues in just a moment. Did you have any role in 2007, 2008 or 2009 in analyzing the application of the Flint River Drought Protection Act in connection with EPD?

A No.

Q Okay. Sir, if I might invite your attention to what's been marked Exhibit 1 for a moment, please. Do you recognize that document?

A I do.

Q Did you draft that document?

A I believe I drafted this document.

Q Okay. If I might invite your attention to the second page at the top, the first full sentence reads in part, quote, Mr. Turner is responsible for the oversight and management of the State's multi-pronged efforts to increase water supply, while also developing and implementing policies for the sustainable and reasonable use of

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the State's water resources.

Do you see that sentence, sir?

A I do.

Q Okay. Is it Georgia's policy that water uses in this state must be sustainable and reasonable?

A I think it is our goal to develop water policy that is both sustainable and reasonable.

Q Okay. Can you help me define the term sustainable?

A Well, it -- I don't know that I can in overall context so it depends on what context in which you would like to discuss the word sustainable.

Q Okay. That's fair. Can you define it or do you have an understanding of the term with respect to ACF issues?

MR. PRIMIS: Object to form.

A Yeah, I don't -- I don't know that that's -- I still think that's very broad for -- for general commentary about sustainable. It's a word many people use for many purposes. More generally people refer to sustainable but then they're often more specific applications of the word.

BY MR. PERRY:

Q Okay. Let me ask the question this way

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then. When you wrote this sentence, what did you understand sustainable to mean?

A I understood it to mean in the very general sense that we have multiple users. We have multiple changing dynamics both in terms of growth but in terms of climate change and other things. And that we would be working in this coordination and sort of cross-functional way to do our best to be good stewards of the resource.

Q I think you mentioned a moment ago the phrase, a drought that was accentuating in 2007. Do you recall that?

A I do. I said -- I thought I said was getting more acute but maybe I said accentuating at some point but yeah, was getting more acute in '07.

Q Was the '07 drought a severe drought?

A Yes.

Q If I might invite your attention to Exhibit 2 for a moment. And, please, if you haven't already, take a look at Exhibit 2, I'll have a couple questions for you.

A (Witness complies with request of counsel.) Okay.

Q First, congratulations on being tapped as the State water czar.

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had a well installation problem at Elmodel or whether we had -- we really just have a pocket of the Claiborne and Clayton, which is not productive.

And so I hope to move that to save the rest of the money we had designated for that project and find another place to really study ASR to get to some of those answers.

Q Okay. Do you have a timeframe on when you might have a better sense of the feasibility of the larger scale ASR project?

A I do not. I think -- you know, we're talking about a number of the pieces of this puzzle as I've thought about it as a revised Flint River Drought Protection Act.

One is moving people down to alternative sources. Other is -- well, we hadn't talked about it yet, which would be other methods to take certain irrigation out. And the third would be is there an opportunity to augment.

And unlike the Spring Creek augmentation that we have done as a pilot, which is very minor and comes from the Floridan, the ASR concept, we -- we really had a setback at Elmodel so we need to re-site the ASR project.

But I think it takes -- I can answer your

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question this way. Because of the cycle testing that ASR does where you put the water down and you pull it out and you put it back down and you pull it out, you have to do that because the chemistry does change in that part of the aquifer, which will -- you can fine-tune -- from what I -- limited I understand about the literature, the productivity of an ASR well field will change to some degree and you have to do the cycle testing and that usually takes about a year.

Q I see.

A So I think it's a -- it's a couple of year project to really get one in the ground, do all the cycle testing and reach the kind of conclusions we wanted to reach.

Q All right. So let me focus not on ASR but the wells you were talking about that reached down to the Claiborne, Clayton and maybe Cretaceous.

A Correct.

Q All right. I think you told me just a moment ago that you expect to have more information in the fall on that and there might be the prospect of legislation to follow up on that. Is that fair?

A That's fair.

Q Okay. So can you help me understand what

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the legislation that you at least have in mind conceptually would do?

A Well, and my idea has been since I found that the Act was insufficient in 2012 is that we needed to step back and think about this. So starting in late 2012, I had been at it long enough to -- to think that our options, the best initial options were to -- to see if we could go -- not everywhere because the yield in the lower aquifers won't support everywhere number one; and number two, you don't need to for -- for some of these stream flow protections.

But find the right places where we're going to get the most benefit for those streams and see if we can't move those people down. So that would be one key aspect, not the only one, but one.

That would be very costly, but the State might find a way to participate with local farmers in that. And that -- that public policy balance would be different between surface water and groundwater because of the different interaction and the different impacts that surface water withdrawals -- or some surface water withdrawals in these droughts are pulling out of -- of relatively small tributaries and their water supply was -- was also impacted

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during these droughts.

So they're, you know, it's not as if they have a reliable source of water at the moment either. But that would be one aspect. Another might be related to agriculture easements or conservation easements in which the State would set certain parameters and folks would take irrigation out. And again, this wouldn't be like the annual payouts but rather a permanent removal of acreage.

Q So one time?

A Yeah. I mean one time and then I don't know how long the period would be but it would be for all intents and purposes, permanent.

And then -- then I think augmentation still has a place in this and I don't know if as I have described the timeline for some of the scientific evidence, whether we would be able to add that piece by the time we have some of the other available.

But I think we're -- my goals would be to as soon as we can have more certainty about what we think we can do, move in a -- in an iterative process. In other words, not wait on the augmentation if we can think we can -- we can do some of these other things.

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discussion of commodity prices being very high, that it would cost a lot, that we didn't presently have an appropriation, but it -- but that -- those things were discussed.

But the first question before any of those hurdles would have been tackled was can the Act as it's presently structured be triggered in a way that would produce any appreciable flow benefits, and then we would need to get to those other hurdles.

Q Do you recall anybody else at the meeting -- strike that.

Do you recall anybody at the meeting discussing the possibility of appreciable flow benefits with respect to Ichawaynochaway Creek?

A I do not recall anybody.

(Whereupon, Exhibit No. 34 was marked for identification by the court reporter.)

BY MR. PERRY:

Q Okay. With respect to Exhibit 34, why don't you take a look at it briefly, please.

A (Witness complies with request of counsel.) Okay.

Q Do you recall seeing this version of the --

A No.

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Q -- Okay. I'm sorry, I didn't complete my question and --

A I'm sorry.

Q -- I probably didn't have adequate foundation for my question anyway. So let me try it again.

A Sure.

Q Can you identify what Exhibit 34 is?

A I cannot. There does appear to be some language of -- of a nature we've been discussing related to what might be in a -- in some communication about the 2012 decision. But I don't know who it's from or what the date is or anything.

Q You don't recall drafting this?

A I do not recall drafting this.

Q Okay. Would you agree with me that Exhibit 34 omits the paragraph that appears in Exhibits 33, 32 and 31 about Ichawaynochaway Creek?

A It does omit that paragraph. Seems to be shorter in a number of other areas as well.

(Whereupon, Exhibit No. 35 was marked for identification by the court reporter.)

BY MR. PERRY:

Q Can you identify Exhibit 35 for me, please?

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A I believe this is the press release we issued describing my decision not to declare a drought under the provisions of the Flint River Drought Protection Act in 2012.

Q And this was only maybe two months after you came on as the director, right?

A Correct.

Q Okay. Can I invite your attention to the second paragraph of this particular exhibit, please?

A Okay.

Q Do you see the reference to southwest Georgia experiencing historically low basin inflow within several areas of the Lower Flint Basin for several months?

A I see that.

Q All right. Can you define for me -- strike that.

Do you have an understanding of the term "low basin inflow"?

A I do not have any specific definition of that. I know that we looked at some of those gauges in different spots and -- and, you know, it -- based on that, that's what this sentence is designed to get at.

Q Did you approve this press release before

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it was issued?

A I did.

Q Did you to your knowledge or recollection draft any portion of this press release?

A I could not tell you which portion I drafted, which portion I edited, which portion started with me or started with another staffer. I couldn't tell you that.

Q Well, you agree with me, sir, that the paragraph that we've been discussing about Ichawaynochaway Creek from Exhibits 33, 32 and 31 does not appear in this press release?

A That's correct.

Q All right. Might I invite your attention to the last paragraph on the first page of the press release, please?

A Yes.

Q There are quotation marks around the following sentence, quote: There is no doubt that we need a viable management tool to deal with drought in the Flint River Basin, unquote, said Turner.

Do you see that?

A (Witness nods head affirmatively.)

Q Is that a statement created for this press release or was that a quote of some prior

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statement you've made?
A It was a statement created for the press release, although it then became a subsequent statement I'm sure I made in other contexts.
Q Do you see in the next sentence a reference to crafting tool that increases the effectiveness of the Act in the management of the basin?
A I see that.
Q What did that mean?
A It meant that we -- we -- coming on and looking at the situation, we've got a tool, although well intended in 2000, had been deployed twice to little effect. There was a record of difficulty trying to deploy this annualized prediction accurately in time, the voluntary nature of the auction, the inability to target specifically enough. All of those things demonstrated to me and to the State that we needed to really revamp this Act if we were going to be able to use it to help us deal with this -- these droughts that were -- that were -- that were hitting us.
Q Okay. And then is it fair to say that SB213 was one step in that process to craft an appropriate and usable tool to deal with what you

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just identified?
A It was indeed just one step. But, yes, it was a step in that direction.
MR. PERRY: Okay. Craig, I could go on for a while longer, but in respect for the witness's schedule, I can also stop now and pick up tomorrow morning. But if I do that, I'd ask that we start at 9:15 if that's okay with you.
MR. PRIMIS: That's fine. Let's do that.
THE WITNESS: That's perfectly fine.
MR. PERRY: Okay. Can we go off the record?
MR. PRIMIS: Are we still on?
THE VIDEOGRAPHER: Yes.
MR. PRIMIS: I just want to mark the transcript confidential.
MR. PERRY: That is fine with me.
THE VIDEOGRAPHER: The time is now 5:32 p.m. We're now off the record.
(Whereupon, the video camera was turned off.)
- - -
(Deposition adjourned at 5:35 p.m.)

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E R R A T A S H E E T

Pursuant to Rule 30(7)(e) of the Federal Rules of Civil Procedure and/or Georgia Code Annotated 81A-130(B)(6)(e), any changes in form or substance which you desire to make to your deposition testimony shall be entered upon the deposition with a statement of the reasons given for making them.

To assist you in making any such corrections, please use the form below. If supplemental or additional pages are necessary, please furnish same and attach them to this errata sheet.

- - -

I, the undersigned, JUDSON TURNER, do hereby certify that I have read the foregoing deposition and that to the best of my knowledge said deposition is true and accurate (with the exception of the following corrections listed below).

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NO. 142 Original

IN THE SUPREME COURT OF THE UNITED STATES

STATE OF FLORIDA,
Plaintiff,
vs.
STATE OF GEORGIA,
Defendant.

- - -

Before the Special Master
Hon. Ralph I. Lancaster

Videotaped 30(b)(6) Deposition of

JUDSON TURNER

February 11, 2016
9:15 a.m.

VOLUME II

CARLTON FIELDS JORDEN BURT
ONE ATLANTIC CENTER
1201 WEST PEACHTREE STREET, N.W.
SUITE 3100
ATLANTA, GEORGIA 30303

********CONFIDENTIAL**********

Reported by: Lynne C. Fulwood
Certified Court Reporter

INDEX TO EXAMINATION

P R O C E E D I N G S

- - -

(Whereupon, the video camera was turned on.)

THE VIDEOGRAPHER: This is the beginning of Disk Number 1 in the deposition of Judson Turner in the matter of the State of Florida versus State of Georgia, et al, Case Number 142.

Today's date is February 11th, 2016, and the time on the monitor is 9:16 a.m. My name is Damon Okoro and I'm the videographer. The court reporter is Lynne Fulwood. We're with Huseby Global Litigation.

Counsel, please introduce yourselves after which the court reporter will swear in the witness.

MR. PERRY: Phil Perry from Latham & Watkins representing Florida.

MS. MANGONES: Andrea Mangones from Latham & Watkins for the State of Florida.

MS. BENNETT: Lauren Bennett from Latham & Watkins also for the State of Florida.

MR. KISE: Chris Kise from Foley and Lardner for the State of Florida.

MR. PRIMIS: Craig Primis, Kirkland & Ellis, LLP for Georgia.

MS. LEWIS: Britney Lewis, also from Kirkland & Ellis, for the State of Georgia.

JUDSON TURNER,

having previously been duly sworn, was deposed and examined as follows:

EXAMINATION

BY MR. PERRY:

Q Well, good morning, sir.

A Good morning.

Q The State of Florida thanks you again for your attendance today.

A Sure.

Q If I could invite your attention to Exhibit 36. Have you had a chance to look it over?

A I have.

Q Could you describe what it is, sir?

A I believe this is a document prepared as we were -- it's dated November of 2012 when we were thinking about what we might consider trying to do with the Flint River Drought Protection Act in terms of amendments or different options.

Q Do you recall who prepared this document, sir?

A I think that -- I do not know who prepared it per se. I know the team that we -- you know, sort of discussed it with me and was following up as I would ask for data was Gail Cowie, principally. I believe Wei Zeng and Nat Caldwell would have been involved in work around this.

Q And is it fair to say this paper was an options paper?

A I wouldn't call it an options paper. I would call it a paper containing basin information that might lead to development of options, but we were at a very initial stage. This is very preliminary work that I asked for around ideas that -- that some initial scoping and modeling was done. But, again, I would really stress how initial this was at this time.

Q This is about ten months after you arrived at EPD?

A Ten months after I arrived and based, at some of what we were looking at, wholly different from the Act as it had been designed. So these were -- these were some of my ideas based on advice but very preliminary exploratory questions I was

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asking. So they were getting me sort of a fact paper and then they drilled down on one -- this idea of potentially, you know, trying to look at moving some folks.

Q And by "moving some folks," are you talking about taking surface water users near the Flint River and its tributaries down to groundwater use at lower aquifers than the Floridan?

A That was the concept. And not -- you know, there were -- not just surface water but also we looked at close proximity groundwater and moving that groundwater from the Floridan and connected to -- in some degree connected to surface flow, base flow, to lower aquifers not connected.

Q Could you, if you would, please turn to page nine in Exhibit 36.

A Okay.

Q And do you see option 2A at the top of that page?

A I do.

Q And do you see where it says, quote, actions to support flows for endangered species and basin contribution to state line flows there?

A I do.

Q That was prepared by your staff?

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A That was.

Q Can you describe option 2A for me, please?

A Yes. I had, instead of looking at the whole permit -- permittees in the basin and contemplating, you know, holistically across the board doing something with every permittee, what I knew by this point we -- was of course that the closer to the -- to the streams and surface water withdrawals of course were more directly connected to stream flow. So I really just asked, well, what would the numbers look like if we did some bands where we looked at moving people down, because if you move everybody down, the lower aquifers can't handle that from a yield.

So if we're trying to reduce the population and get the most return on that action, forgetting for a second how we would, you know, sort of make that work financially and otherwise, what are we likely to see in the river if we do this more targeted band work.

So we looked at, as I recall -- you're asking me about option two, but we looked at just -- as I remember just stream flow -- I mean, surface water guys. And then we looked at two mile bands and

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I think a tighter one mile band if I remember. Or maybe it was two on each side or one -- one mile on each side of the main stem Ichawaynochaway Creek and key tribs and Spring Creek and key -- key tributaries.

Q And this was in the context of thinking about changes to the Flint River Drought Protection Act?

A Yes.

Q And SB213 came along the next year or the year after that?

A Well, this is right before this session in which we dropped the changes to SB213. They were more modest than this because the work that needs to support this concept needed to be more developed, particularly around how much room you've got in the lower aquifers.

Q And is it fair to say the work is ongoing in developing what is on Exhibit 36 as options 2A and 2B?

A I believe it is ongoing to see what promise these might have as feasible options.

Q Okay. Did you instruct your staff to consider these options or did they give you ideas and then you gave them further direction?

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A I think my input that was probably new for them was after a lot of input over 2012 to me about, you know, the experience I had sort of wrestling through the act's inability to help in early 2012 because we were so deep into that drought. The suspension that we had done of new permits in the summer and a lot of discussion that I had been having as director around our -- the basin and this situation hydrologically.

I really said to my staff, let's try to think about this differently. Instead of this annual removal of acreage where the prediction is very difficult about the future, the -- there are all these issues we've elaborated on yesterday, but all of the voluntary nature of the auction that, while there's more targeting because of the voluntary nature, you couldn't really target even like we're talking about here.

And so I really started -- and then just the commodity price as high as it was in '11 and '12. All of that showed me the complications with this act's feasibility.

And so I started thinking less about sort of annual things that we just have to do every time there's a drought, but what might we do in a targeted

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fashion that would -- and especially after the suspension of new permits, what might we do that would return to us the best stream flow benefits and what might those costs look like. And the benefit of that being -- one of the benefits of that being, one, time cost, relatively speaking. There might be a phase in. You might need to take it in chunks. But if you laid out something like this and move folks to unconnected alternative sources or just permanently were able to remove some of these acres and then not re permit back in those bands, would that be a better, more durable action.

Q A long-term solution?

A A longer term solution, yeah.

Q And what's your feeling today about the potential for success in pursuing options 2A and then on the next page, option 2B which is also titled Actions to Support Flows For Endangered Species and Basin Contributions to State Line Flows?

A I think these options have promise particularly on the endangered species side, because I do believe they will help us in these critical stretches protect some base flow and some -- you know, some stream flow. I'm concerned about whether the kind of cfs benefits that we've been able to

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model will produce enough cumulative effect to be that large. But as far as, you know, our ideas around -- around -- around this, this, to me, still seems like not the only thing to do in a further revision of the Act, but something, if we can build some greater certainty around our safe yield in these lower aquifers, I think it has -- has promise.

Q Now, I find this a fascinating idea, but I want to understand how you think about this idea in relation to the more traditional use of the Flint River Drought Protection Act auction process. Do you think the ideas could complement each other and in some potential future situation you will have implemented both a long-term solution and then also have the possibility of implementing the auction process?

A My staff and I have agreed -- have really, as we have talked about this option -- and as you probably know from document review I've been pretty vocal about this option as something we need to do the science on. We have not removed the idea of an auction to take out additional acreage periodically.

I will say, however, that when it comes to an expenditure of taxpayer dollars I have believed

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that we would be better off spending those dollars to do something like this than to annually, subject to the vagrancy of the market, be trying to take additional acreage out. I would rather see us spend those resources on -- on a set of actions that would have more long-term durability than the -- than the auction, but we haven't removed it as a consideration.

Q And if I understand you correctly, you're suggesting that the longer term solution that is identified on option 2A and 2B is a more reasonable return on investment, in your judgment?

A And more durable, more lasting. And look, it's a huge lift. This is -- this is -- I mean, I like this idea obviously. I think it holds promise but it's expensive. I mean, we're talking about moving folks down from surface water pump, some of which you know are very proficient from a gallons per minute, unless of course there's a significant drought now on a tributary that's dry or virtually dry, and Floridan water wells which are very close to the ground, very cheap to install. Some of these, Claiborne and Clayton, I know are down significantly and triple the costs. Don't quote me on that. It varies by basin but very -- a lot more expensive.

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And then the ongoing maintenance cost of -- and energy cost to get that water from down there less proficient, you don't get it out as fast. Some of the -- by the way, some of what we were studying contemporaneously with this at Stripling was to put in some of those Claiborne and Clayton wells and actually run the irrigation infrastructure off of those to have the real practical data, not just the sort of water benefits to the resource, but the practical data for that farmer to say, okay, you're going from that cost to this one.

And when we get around to figuring out how to make that work financially at the state level, which would be also the discussion we'd have to have if we were to amend the Act in this way, that's going to be part of that discussion because they're going to have an O&M cost that would be higher than they're accustomed to as well.

Q That would be diesel fuel and other things?

A Right.

Q Let's -- I'm interested in talking about this particular topic, the huge lift piece you just mentioned. But let me ask first, have you looked at what other states who have faced droughts

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historically have done in this type of situation?
A I don't know that I have. I know my team has -- has been involved in looking at the -- the Edwards aquifer in Texas. Mostly that information came in through that HCP plan in process. But as I have said before, I think the Floridan is a unique and rechargeable aquifer. And so I have not thought that going and looking at sort of actions related to states with a different set of sort of water resource and groundwater resource made a whole lot of sense to me. I didn't know -- for instance, I never knew of a hey, you ought to look at your sister state that has almost the exact same aquifer stream relationship and this is what they did. Most of what I know of is sort of a western story or a midwestern story where aquifer depletion is a real issue for them.
Q Texas especially?
A Yeah, recharge takes a lot longer, and so I haven't spent a lot of time trying to learn from their analogy.
Q We'll talk some today about climate change again. I'm sure you're looking forward to that. But have you -- just for now let me ask this: Have you thought or has your staff thought about the potential that change in climate patterns may

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interrupt the recharge cycle you normally see with the Floridan aquifer?
A I don't know that we talked about it, but my initial reaction to that question would be to say -- and this is something that I've said a lot as we talk about climate change in Georgia. The tendency around climate change discussion is to talk about the dry years, but what is very evident are the wet years too. And we -- '09 is a very wet year in Georgia. '13 is a very wet year. Now is a very wet time. And with the rechargeable nature of the aquifer I have not spent a lot of time worrying about that. I got other things to worry about. But that to me seems like it's not the zero sum game that some in the climate change world discuss. I think we have this rechargeable aquifer. Everything I've seen scientifically demonstrates that.
So as we have thought about what is reasonable and what is sensible, it's the interaction and the stream flow problem that's popping up in stretches during these -- these bad droughts that we need to focus on. We don't have a problem, to my understanding, with the aquifer being mined, as that is sometimes said.
Q That was my question.

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A And so we really -- we really believe that as you use that resource, the groundwater resource that's so rechargeable it is a very appropriate thing to do. We're trying to be very targeted to deal with these drought-related concerns that are popping up on the stream flow side.
But overall in terms of use of the Floridan, I don't think we're -- I think that's an -- again, I'm excited about that wonderful resource. I've said it. You asked me about competitive advantage, and everything I see confirms that that's the case.
Q That's growing the cistern among other things I suspect, right?
A Yeah. I mean, you know, again we talk about growing the cistern. I think when we talk about that, I think we're talking about sort of infrastructure things that would increase storage for these wet years.
Q Now, you mentioned the term "huge lift" a little bit ago and I think there you were talking about the financial component --
A I was.
Q -- of moving folks, but -- and I am guessing that the financial component involves some

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potential significant state investment in this move. Can you describe that?
A Well, we really haven't done a ton of work here yet because I really feel like we have to demonstrate, not only to the sort of legislature and the governor what the benefits of any proposed changes are, but also to the stakeholders in the region. So our focus has really first been on what action we could take, what -- and what effect we could hope to bring about in the -- in the benefit to the stream flow.
When we -- when we have that -- well, I mean, again, you have to take action within imperfect information. This isn't about study for study sake. We really are trying to get enough information to say just a couple of things. One, when we move people down we're not going to deplete an aquifer that doesn't recharge because those aren't -- don't see the same recharge rates as the Floridan. And back in the early 2000s we didn't think that that was really an option at all. The state planning work and some of the new models I believe have encouraged us that the way that system equally -- reaches equilibrium under those lower aquifers, when you use them seasonally as we would in -- in irrigation that they

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really do have more yield than we thought before.
So if you go back to 2000, this wasn't an option anybody, Harold Reheis or anybody thought was on the table. You get to me and we think there's promise here. So I'm able to really explore this.
So we are, you know, first trying to figure out what that -- what those scientific benefits would be and the yield, and then we would turn of course to discussions about what portion of that burden the State would bear. What I have said publicly and where I am today is really that we have talked about it as a cost share in most cases. We have not talked about the State bearing all of that burden. We have also wondered whether there was -- were federal funds available. But we have all talked about needing to have the farmers bear some of that cost too.
And, of course, as I said before, there are really two buckets. There's what share of the burden for them to bear to actually move to an alternative source or to take land out of irrigation, and then the other piece would be what carry on maintenance and operation kind of cost do they have going forward.
Q Yeah. Yeah. I was reading into your use

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of the phrase "huge lift" the notion that you'd have a legislative lift you'd have to deal with too?
A Sure. I mean, sure. And again, one of the things that I think -- how I look at -- and I've been in a few legislative things over the years. I mean, you just -- I'm less concerned about the legislative lift when I have good information to describe the benefit we're going to see. To go over there, like obviously I chose not to in 2013, and do this without the science on the lower aquifers without a better, you know, sharpened pencil on some of this, I've chose not to do because I do think it's a responsibility of someone in my job to get as much clarity for those appropriators and the governor as I can on what I'm asking them to do.
Q One thing occurs to me that might be part of your huge lift term and that's with respect to cost share for farmers that are withdrawing from surface water or the Floridan aquifer. How are you going to convince them to participate?
MR. PRIMIS: Object to form.
A Well, I think the consideration for farmers depends on where you are. If you're a surface water withdrawer you've been living through these droughts and you have seen your water supply

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source be interrupted. So I think for you the notion that you might get some help to get down to a secure source of water, even if it's a less proficient source that costs you a little bit more, that's a consideration you might be a little more open to explore.
The Floridan water user that already has their well in the ground that is very proficient, works perfectly well for them, is a groundwater resource. Encouraging them or requiring them to move to a lower aquifer will be met with some level of opposition.
And so, again, I think what we've got to be prepared to do is to say listen, this is -- we're not just -- you happen to be close to these stretches, we're going to help you do that because the system -- the system as a whole benefits from this strategy.
So additionally, you know, again, these are very preliminary thoughts subject of course to further discussion with folks that -- in the legislature and the governor's office I haven't even had yet. But the idea conceptually would be that the greater benefit realized by this targeted moving of people to alternative sources and we should find a

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way for everybody to help us fund and pay for that.
Q So back to the commodity price topic you raised when I asked about the auction. Do you know how many folks in the Flint River Basin engage in dry land farming year to year?
A I don't. I know if you ask about the Flint Basin as a whole it's a lot bigger and goes all the way up to, as we talked about yesterday, south of the airport. Once you get out of the Floridan, there's more of it but then it becomes less of your true row crops. So it's relatively small where the Floridan is prevalent. And -- but I couldn't tell you the numbers.
Q Yeah, before '75 I presume -- 1975 I presume that there was predominantly dry land farming in the Flint River basin; is that right?
A I think that's right. The mid '70s is when center pivot farming really -- irrigation really came in.
Q So when you are thinking about the auction price that you would implement or pay or bid in the auction under the Flint River Drought Protection Act, you're talking about the difference between perhaps what an acre of commodity is worth when irrigated versus when, you know, you use

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the properties of that well, mainly the gallons per minute, the proficiency of that wellhead. They provide that information back to the Tifton office.

I could not tell you how Cliff's team actually works between the applicant and that -- around what other parameters. The permit conditions are added, all the particulars, and then that finds its way up to -- to the director's office for issuance.

Q Okay. So let me understand exactly how the moratorium from July of 2012 worked. Did you direct, with that moratorium, Cliff Lewis's office not to issue any new letters of concurrence for any permit applications that had been pending before?

A No. The way the moratorium worked is if an application came in after the date of the suspension, those -- you couldn't stop somebody from applying sort of as a legal matter. So we didn't say you -- we said we're not going to -- I think if we had the document I think the suspension says --

Q You discouraged it?

A It says some sort of quirky language like "we won't process your application." I can't prevent you from sending me something. Don't, but -- so that was sort of as a technical matter we had to say it

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that way.

But as a practical and real matter, if an application came in the day after, it should not have -- no letter of concurrence should go out on it, no processing of those. The ones that were already in-house from an application, whether it was -- not yet had a letter of concurrence, whether it had a letter of concurrence, wherever it was in that process those were entitled to be processed.

Q In the same way as they would have been before the moratorium?

A Correct.

Q All right. Do you have a sense of what the universe of those permits was that -- where there was an application or there was a letter of concurrence before the moratorium was issued?

A I do not.

Q Do you still play a role in reviewing those that are in that pipeline as they come up?

A Not a -- not a direct role. When we first started after it, as I mentioned in passing, that I caused a bottleneck or two because I'm in my office trying to make sure, when did this application come in. So we then developed some level of protocol within staff to sort of segregate those.

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And I can tell you just anecdotally that I have -- I felt like we got the right sort of protocol in place because I do -- I do, from time to time, hear about these requests for expansions or moratorium -- you know, we had -- when we called people, and we did, we called a lot of people that said, hey, I was going to do this next, and the answer is -- well, I'm sorry.

And so but some of that is -- and I get asked all the time, "when are you going to lift the moratorium?" But I couldn't tell you -- you know, it seems to me like that has diminished in terms of the numbers of the paperwork that's still working its way through, but I couldn't tell you the volume.

Q So what factors are you looking at as to whether you'll at some point lift this 2012 moratorium?

A Well, I will tell you that -- I don't know what factors but I will tell you this: That I have said and think today that we should settle on a revised Flint River Drought Protection Act beyond the 14 amendments before we even take up pulling back the moratorium.

Q And is it fair to say that is -- I'm going to try to paraphrase what you said. Tell me if

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I've got it. You're looking for a long-term solution before you start issuing more permits that could exacerbate the situation?

A I would say that we're looking for a long-term solution and whether or not -- and the degree to which we would consider altering the moratorium in any way will be contingent in part on whether we arrive at an approach that we think is longer term solution for the problem.

Q So you used the word, I think, "protocol" a minute ago?

A Yeah. It's not written, I don't think.

Q Did you mean by that a process in which the permits that are in the actual pipeline are processed and reviewed?

A Yeah. What I -- what I mean by that it's just the quality control that we don't have one of these sort of accidental unintentional deals where the paperwork just happens to get on somebody's desk. I want a couple of eyes along the way confirming for me that this application got filed before the suspension. That's all I mean.

Q Are you familiar with the actual review process and sufficiently that you can describe for me what type of on-the-ground or environmental scrutiny

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challenges with this climactic condition is whether to try to set a flow standard, and we haven't obviously done that yet. We use the 7Q10 as we have described on the water quality side.

Q So let me ask you about Ag permits in or near Bainbridge granted since 2006.

A Okay.

Q All right. I think you previously testified that there are conditions for those permits. Is that fair?

A I don't know about whether they're at or near Bainbridge. I mean, that's a relative term. But the Lower Flint Basin and in those I think red and yellow zones through the plain, I think that there are those extra conditions on those permits.

Q Do you know if conditions set for permits in the Flint River basin for any of the Ag irrigation permits set 7Q10 levels for instream flow requirements?

A I believe, and, again, Cliff Lewis is the source for accurate information on this, but that there were some surface water permits that came later that had some flow conditions that would allow for suspension if -- around a low flow condition, and I'm not sure if it was 7Q10 but --

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Q I think you put your finger on what I'm asking about and my question is whether it was 7Q10 and I think you just said you don't know. Is that right?

A I don't know.

Q Okay. You raised climate change a couple times. We've talked about it even this morning. We've also talked about regulated riparian systems, etcetera. If climate change reduces all flows on the Flint, isn't that going to affect what's reasonable for a farmer to use in terms of irrigation water?

MR. PRIMIS: Object to form.

A In a riparian situation, a regulated riparian situation, it's sort of common law reasonable use doctrine. I'm not sure what you mean by affects the reasonableness.

BY MR. PERRY:

Q If there's less water available for everybody, are folks that are using water only entitled to a reasonable amount in light of all other uses?

MR. PRIMIS: Object to form.

A It's my understanding of the doctrine that reasonable use always requires you to be mindful of other users and downstream folks.

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BY MR. PERRY:

Q Now, we talked a little bit about the term, which is probably used in many contexts, share the pain. Have you used that phrase before in the ACF context?

A It's possible. It doesn't -- the context in which I would have used it, I'm not sure it comes to mind readily.

Q No recollection of using it previously?

A Not directly. Again, I'm not saying I haven't because that's a concept people talk about a lot in different -- you know, in different aspects. But it doesn't -- we talked about, for instance, grow the cistern. That I remembered more directly than -- than this term.

Q And I understand grow the cistern based on what you've told me in the last couple of days to mean your effort since 2012, along with the governor, to find ways to improve the situation that you've sort of inherited. Is that fair?

A Very specifically on the storage side, yes, to increase storage.

Q Practical look at solving the problem?

A Yes. It is a very practical look at solving the problem.

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Q So some of the frustration I think that comes out from these documents that we've been looking at for a long time is that some of the same concerns that you've been addressing and trying to find a solution for have been concerns for 17, 18 years and appear in these documents. Is that fair based on the documents we've looked at over the last two days?

MR. PRIMIS: Object to form.

A You're asking me about an emotion that would be evidenced from a document, and I'm not in a position to agree with you about an emotion coming from a document.

BY MR. PERRY:

Q All right. Let me try to --

A I can talk about my own emotions. I'm perfectly happy --

Q Feel free to talk about your own emotions.

A Right now? No, I'm fine.

Q It's a little bit late in the day. It's almost 5:00. But is it fair to say you've seen some documents in the last two days that reflect the fact that EPD has been previously looking at some of the issues you're trying to grapple with now over the

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last 17 years?
MR. PRIMIS: Object to form.
A I think if you look at the documents as a whole there is evidence that EPD has been working on a -- working on these issues, increasing its understanding of the resource and the challenges that are occurring, starting with suspension of new permits, moving through a metering program we haven't talked about much to get a much better grasp of how much water use is in the basin, studying it through the '06 plan, setting certain conditions on new permits. Also doing the Flint River Drought Protection Act in 2000, triggering it, seeing how it worked and didn't work, all the way through to my efforts.
So I think that's right, that there's been a great deal of work at EPD in particular to try to get handle on this and try to find a way forward.
Q But I think your conclusion has been you're not yet satisfied that a solution has been arrived at?
A Correct. We want to do more and I have an idea where to go. I'm optimistic about that and we're in the process of working on it.
(Whereupon, a discussion ensued off the record.)
(Whereupon, Exhibit No. 71 was marked for identification by the court reporter.)
BY MR. PERRY:
Q Can you identify what's been marked Exhibit 71, please?
A Yes. We refer to this as the -- you know, the 2013 water supply request to the Corps. It's a letter -- cover letter to Assistant Secretary Jo-Ellen Darcy at the Corps from the governor which attaches an affidavit from me and then a series of other attachments to that affidavit with technical information, including a memorandum from Wei, which constituted -- you know, was an answer from the Corps for updated information related to the water control manual process.
Q Okay. Let me first ask if we could focus on paragraph 14 of the affidavit?
A Okay.
Q And you'll see, I think, in paragraph 14 a reference to 705 million gallons per day?
A I see that reference.
Q How does that differ from the current supply of water drawn from Lake Lanier and from the Chattahoochee River by the metro water district?

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MR. PRIMIS: Object to form.
A I do not have those numbers top of mind as to the current utilization numbers.
BY MR. PERRY:
Q Do you have any general sense of whether it's half of that or a third of that?
A I really wouldn't want to speculate on those numbers. It is less than that.
Q Less than half?
A No, less than seven -- I really don't know. You'll get that number off the top of his head when you ask Wei next week.
Q All right.
A We can get that in evidence for you.
Q Well, somebody else will ask Wei, but I'll be looking forward to reading it so --
A I'm sure you will.
Q All right. If you could look down at paragraph 16 with me, please?
A Yes.
Q And it says there, quote: Georgia plans to help meet demands from Lake Lanier with water that will be stored in the proposed Glades Reservoir upstream of Lake Lanier on Flat Creek -- released to Flat Creek and will flow into Lake Lanier to be withdrawn from one or several of the intakes on Lake Lanier.
Do you see that?
A I do.
Q Have plans changed since you submitted this affidavit to the Corps about the Glades Reservoir?
A They've changed slightly in the following way. A Glades permitted in this new way we discussed for -- not for water supply, would still be operated generally as described here. In other words, it would be operated to -- as a pump storage facility north or upstream of Lanier, filled according to a schedule that we would work out so that it is additive of Lake Lanier. And then it would release its water -- instead of having intakes and provide water supply in Glades or even provide water supply through 2050 in the lake, it would release that water when -- when it's needed and when it's beneficial to the lake via Flat Creek. That part's still envisioned by the State.
What has changed is a revised need of water from Lake Lanier such that the region's 2050 demands can be met by Lake Lanier. And we've revised the request and now no longer see Glades as additive

ATTACHMENT 17

Excerpts from the Deposition Transcript of Napoleon Caldwell (Feb. 24-25, 2016)

NO. 142 ORIGINAL

IN THE SUPREME COURT OF THE UNITED STATES

STATE OF FLORIDA,)
)
Plaintiff,)
)
vs.)
)
STATE OF GEORGIA,)
)
Defendant.)
)
)
)
)
)

- - -

Before the Special Master
Hon. Ralph I. Lancaster

Videotaped Deposition of
NAPOLEON CALDWELL
February 24, 2016
10:00 a.m.

VOLUME I

CARLTON FIELDS JORDEN BURT
ONE ATLANTIC CENTER
1201 WEST PEACHTREE STREET, N.W.
SUITE 3100
ATLANTA, GEORGIA 30303

********CONFIDENTIAL**********

Reported by: Lynne C. Fulwood
Certified Court Reporter

INDEX TO EXAMINATION

P R O C E E D I N G S,

- - -

(Whereupon, the video camera was turned on.)

THE VIDEOGRAPHER: This is the beginning of Disk Number 1, in the deposition of Nap Caldwell, in the matter of State of Florida versus State of Georgia, et al., Case No. 142.

Today's date is February 24th, 2016, and the time on the monitor is 9:57 a.m. My name is Damon Okoro and I'm the videographer. The court reporter is Lynne Fulwood. We're with Huseby Global Litigation.

Counsel, please introduce yourselves, after which the court reporter will swear in the witness.

MR. PERRY: Phil Perry, Latham & Watkins, for the State of Florida.

MS. LEE: Jung Eun Lee, Latham & Watkins, for the State of Florida.

MS. ALLON: Devora Allon, Kirkland & Ellis, for the State of Georgia.

MR. ALLEN: John Allen, State of Georgia.

NAPOLEON CALDWELL,

having first been duly sworn, was deposed and examined as follows:

EXAMINATION

BY MR. PERRY:

Q Well, welcome, sir. I appreciate your time today. On behalf of the State of Florida, I want to thank you, and thank you in advance for your patience. It's going to take a little while and we respect people's time, so I like to thank folks in advance before the deposition.

Have you been deposed before?

A No, I don't believe I have.

Q Okay. So I'm going to try to keep this simple, but there's a couple of ground rules that are important, in particular because we're being transcribed, and so it -- it's natural that we might interrupt each other. And I apologize in advance if I ever interrupt you at times.

And I hope you'll let me finish my questions so we don't end up interrupting each other over the next couple of days. What happens, if you do that, is the transcript is hard to follow because you'll have one person talking and then another. So

that's point one.

Point two, there will be times, I guarantee you, in the next two days, where you don't understand my question and that's because I haven't asked a good question or something like that. So I invite you now and, in fact, request that when you don't understand my question, you ask me to clarify it, because what I want to make sure you are doing is answering the question I've asked and not some other question you think I might have asked. And so it's a communication issue.

And so, please ask me to clarify my question if you don't understand it.

Is that fine with you?

A Yes.

Q Okay. Is there any reason you can't give accurate testimony today?

A No.

Q Okay. So, sir, I'd like you to describe your current position, please.

A Currently, I manage the water supply section in the Watershed Protection Branch of the Georgia Environmental Protection Division.

Q And what is your title?

A Section Manager.

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chart that would also fall below the sustainability criterion?
A I do see one that does not fall below, but it has been highlighted.
Q Can you point that one out to me, please?
A That is in the row year 2002. I'm not sure which month that is. Is it October of 2002? It shows 3707.
Q Yeah, that's an error. Thank you for pointing that out.
With respect to 2002, do you see four months that fall below that sustainability criterion for the Bainbridge gauge?
A I do, yes.
Q And for 2006, do you also see four months?
A I do.
Q And likewise for 2007, do you see six months that fall below the sustainability criterion for the Bainbridge gauge?
A I do.
Q And 2008, two months?
A Those months hadn't been highlighted here, but I do see 2196 and I see 2225. I don't believe I see anything else that's below 25, yes.

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Q Thank you.
For 2011, do you see six months below the sustainability criterion for the Bainbridge gauge?
A I do, yes.
Q And for 2012, do you see, I think, eight months below the sustainability criterion for the Bainbridge gauge?
A Yes, I do.
Q All right. Here's my question, sir.
What, if any, action has EPD taken with respect to the Bainbridge gauge to address the fact that there were flows during all those months below the sustainability criterion?
A What, if any, actions?
Q Yes, sir.
A I'm not aware of actions that have been taken, but I'm not aware of a requirement that the agency takes action as a result of the -- the possibility or the eventuality that a flow falls below the so-called sustainability criteria that we use as planning product.
Q Okay. Sir, if I might then invite your attention back to Exhibit 2, and in particular to page 3-9, please?
A Okay. Okay.

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Q And focusing for a moment on table 3-3, do you see that?
A Yes.
Q Can you describe that table for me, please?
A This appears to be a table that was developed to -- for each aquifer within that region from which there are now or might be in the future water withdrawals an estimate of the amount of groundwater that is currently used as well as a -- an estimate of the sustainable yield of those aquifers based upon the criteria that were established in the groundwater assessment for a sustainable yield of aquifers.
Q Sir, I'd invite your attention to the first horizontal row there for the Claiborne aquifer.
Do you see that?
A Yes.
Q Is it fair to say that the estimated current groundwater withdrawal numbers identified there are lower than the sustainable yield for that aquifer?
A I believe so, yes.
Q Okay. Does that suggest to you that there is capacity within the Claiborne aquifer for

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additional agricultural irrigation uses?
A Based upon the sustainable yield criteria, yes.
Q Okay. If you might follow with me down to the row that's labeled "Upper Floridan Aquifer in the Dougherty Plain."
Do you see that?
A Yes.
Q And there, do you see that the estimated current groundwater withdrawal is higher than the sustainable yield for that Floridan aquifer in the Dougherty plain?
A Based upon the sustainable yield criteria, yes.
Q What, if any, conclusion do you reach from that data about whether the current groundwater withdrawals from the Floridan aquifers are consistent with the sustainable yield set forth in this document?
A I can only conclude that the estimated current use of groundwater from the Upper Floridan aquifer in the Dougherty plain is incongruent with the sustainable yield as determined by the sustainable yield criteria used in the groundwater assessment.