No. 143, Original

IN THE
Supreme Court of the United States

STATE OF MISSISSIPPI,
Plaintiff,

v.

STATE OF TENNESSEE, CITY OF MEMPHIS, TENNESSEE,
AND MEMPHIS LIGHT, GAS & WATER DIVISION,
Defendants.

On Bill of Complaint
Before the Special Master, Hon. Eugene E. Siler, Jr.

PRE-HEARING BRIEF OF THE STATE OF TENNESSEE

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MLGW	Memphis Light, Gas & Water Division
Spruill Dep.	Deposition of Richard K. Spruill, Ph.D., P.G., *Mississippi v. Tennessee, et al.*, No. 143, Orig. (Sept. 28, 2017)
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Spruill June Rep.	Expert Report of Richard K. Spruill, Ph.D., P.G. (June 30, 2017)
USGS	United States Geological Survey
Wiley Dep.	Deposition of David Wiley, *Mississippi v. Tennessee, et al.*, No. 143, Orig. (Sept. 26, 2017)

INTRODUCTION

The State of Mississippi filed this original-jurisdiction action claiming that pumping within Tennessee has caused groundwater in the Middle Claiborne Aquifer to flow from Mississippi into Tennessee. The Special Master already has held that Mississippi's claims must fail if that Aquifer is an interstate resource, because Mississippi has disclaimed the sole litigation remedy – equitable apportionment – available for such resources. The evidence at the hearing will demonstrate that Mississippi's claims concern an interstate groundwater resource. Indeed, the Middle Claiborne Aquifer bears all the hallmarks of a classic interstate resource: it is a single hydrogeological unit extending beneath eight States; pumping within one portion of the Aquifer can affect the flow of water in portions of the Aquifer beneath other States; and the Aquifer is hydrologically connected both to interstate surface waters and to other interstate aquifers within the eight-state Mississippi Embayment Regional Aquifer System.

Faced with this overwhelming evidence of the Aquifer's interstate character, Mississippi appears intent on changing the subject. Rather than focusing on the Aquifer's interstate hydrogeological characteristics, Mississippi's proof likely will turn to Memphis's pumping activities, the volume of water allegedly flowing across the border, and the rate of speed at which groundwater typically flows. But those considerations, as the Special Master already has explained, simply cannot convert

an eight-state Aquifer into an "intrastate" resource subject to Mississippi tort law. If groundwater flow patterns are relevant at all, they show merely that groundwater in the Aquifer flowed naturally from Mississippi into Tennessee under pre-development conditions. In fact, every pre-development flow map in the record (including the one prepared by Mississippi's expert) confirms the existence of natural, interstate flow from Mississippi into Tennessee. That further confirms what is apparent from the Aquifer's hydrogeology alone: that it is a shared, multi-state resource that must be divided (if at all) according to equitable-apportionment principles.

Finally, Tennessee also will present evidence that the dominant pre-development flow trajectory in the Aquifer was from Mississippi into Tennessee. Mississippi's experts have underestimated the amount of pre-development interstate flow substantially, and, even under Mississippi's flawed legal theory, the pre-development groundwater flow patterns here make the Aquifer (and the water within it) an interstate resource. But the Special Master need not resolve that dispute. Under the legal framework the Special Master already has articulated in two carefully reasoned opinions, Mississippi's flawed factual arguments are immaterial to the question whether the Aquifer is an interstate resource. The Special Master therefore should recommend that the Supreme Court dismiss Mississippi's claims with prejudice.

ARGUMENT

I. LEGAL FRAMEWORK

A. Mississippi's Claims Fail If They Relate To An Interstate Resource Because Mississippi Has Disclaimed Equitable Apportionment, The Exclusive Judicial Remedy For States Claiming Rights In Interstate Resources

For more than a hundred years, equitable apportionment has supplied the exclusive judicial remedy for a State claiming rights in an interstate resource. *See Kansas v. Nebraska*, 135 S. Ct. 1042, 1052 (2015). States also may negotiate compacts, but they do so "in the shadow of [the Court's] equitable apportionment power – that is, [its] capacity to prevent one State from taking advantage of another." *Id.* As the Special Master twice previously has concluded, equitable apportionment applies to interstate groundwater resources just as it does to interstate surface waters and other interstate resources such as anadromous fish. 2016 Op. 25; 2018 Op. 26; *see Kansas v. Colorado*, 206 U.S. 46 (1907); *Idaho ex rel. Evans v. Oregon*, 462 U.S. 1017 (1983). That conclusion accords with the Supreme Court's past application of the equitable-apportionment framework to cases involving disputed groundwater in the context of surface water disputes. *See, e.g.*, *Washington v. Oregon*, 297 U.S. 517 (1936); *Nebraska v. Wyoming*, 515 U.S. 1, 14 (1995); *Kansas v. Nebraska*, 135 S. Ct. at 1050.

Mississippi filed this original-jurisdiction action against the State of Tennessee, the City of Memphis, and MLGW alleging that MLGW's pumping

within Tennessee has diverted water previously located under Mississippi. But Mississippi has not sought an equitable apportionment. Indeed, Mississippi's Complaint expressly *disclaims* equitable apportionment, Compl. ¶¶ 38, 41, 48-50, and instead pleads tort and restitution claims based on Mississippi's purported "ownership" of the groundwater at issue, *id.* ¶ 46.

That distinction is no mere technicality. "A State seeking equitable apportionment under [the Court's] original jurisdiction must prove by clear and convincing evidence some real and substantial injury or damage," *Idaho ex rel. Evans*, 462 U.S. at 1027, "a burden that is 'much greater' than the burden ordinarily shouldered by a private party seeking an injunction," *Florida v. Georgia*, 138 S. Ct. 2502, 2514 (2018). And "the 'right' a complaining State asserts must be more than 'merely some technical right' and must be 'a right with *a corresponding* benefit.'" *Id.* at 2517 (quoting *Kansas v. Colorado*, 206 U.S. at 109). By disclaiming equitable apportionment, Mississippi seeks to avoid the burden to show "real and substantial" harm to Mississippi's ability to *use* the groundwater at issue.[1] Instead, Mississippi hopes to rely on alternative theories in which it need not allege or prove any actual injury to Mississippi's ability to obtain water; in which it can avoid any scrutiny of

[1] Tennessee believes Mississippi not only would fail to *meet* this burden, but would be unable to *allege* such an injury plausibly. Further, the only relief available to Mississippi would be an equitable decree apportioning the Aquifer; Mississippi would not be able to seek damages.

its own groundwater pumping practices (which would be front-and-center in any equitable-apportionment action); and in which it can demand hundreds of millions of dollars in money damages (which would be unavailable in an equitable-apportionment action). *See Colorado v. New Mexico*, 459 U.S. 176, 184-85 (1982).

As the Special Master has concluded, Mississippi's theories of recovery require it first to prove that the Aquifer is not an interstate resource before it can attempt to establish the alleged invasion of its rights.[2] If this case involves an interstate resource, Mississippi has "only one avenue" for relief in the absence of a compact: "equitable apportionment." 2016 Op. 35. Thus, "by rejecting equitable apportionment, Mississippi might have abandoned the only mechanism for relief." 2018 Op. 27; *see also, e.g.*, *Kansas v. Nebraska*, 135 S. Ct. at 1052. Because "the threshold issue in this matter is whether the Aquifer is an interstate resource," the

[2] Mississippi bears the burden of proof as the plaintiff seeking judicial intervention. Some of the Supreme Court's cases suggest that Mississippi must prove that the water is an intrastate resource by clear and convincing evidence. *See, e.g.*, *New York v. New Jersey*, 256 U.S. 296, 309 (1921) ("Before this court can be moved to exercise its extraordinary power under the Constitution to control the conduct of one state at the suit of another, the threatened invasion of rights must be of serious magnitude and it must be established by clear and convincing evidence."). In *New York v. New Jersey*, the Court cited for this proposition *Missouri v. Illinois*, 200 U.S. 496, 521 (1906), a nuisance suit, indicating that this heightened burden applies to tort claims as well as claims for equitable apportionment. However, the Special Master, and ultimately the Court, need not decide whether a heightened burden applies to this question because Defendants will prevail under any standard.

Special Master ordered "an evidentiary hearing" on that "limited issue." 2016 Op. 36.

B. The Hydrological And Geological Characteristics Of A Resource Determine Whether It Is "Interstate" Or "Intrastate" In Character

The Special Master already has articulated the questions relevant to determining whether a resource is interstate. Equitable apportionment is necessary to reconcile the competing "rights of the two states" when "the action of one state reaches, through the agency of natural laws, into the territory of another state." *Kansas v. Colorado*, 206 U.S. at 97-98. The question then becomes whether, as a hydrological matter, "a body of water is such that the removal of water within a State's borders can have a direct effect on the availability of water in another State." 2016 Op. 31. If so, the States have conflicting rights as "a simple consequence of geography," and the resource is interstate water subject to equitable apportionment. *Kansas v. Nebraska*, 135 S. Ct. at 1052.

In addition to hydrological characteristics, the Supreme Court has looked to the geographic extent of the resource, as understood by geographers and other scientists. *See* 2016 Op. 31. In *Kansas v. Colorado*, the Court concluded that a river that seasonally ran dry in the middle was a single interstate resource in part because it was one continuous geological feature that had long been recognized to be a single river. *See* 206 U.S. at 115. The lack of permanent hydrological flow across the state boundary did not transform the river into an "intrastate" resource.

Applying those principles, the Special Master already has concluded that Mississippi cannot separate the groundwater from the geological formation and claim that a portion of the groundwater is intrastate. The Special Master correctly recognized that "'no Supreme Court decision appears to have endorsed one State suing another State, without equitable apportionment, for the depletion of water that is part of a larger interstate resource by limiting its claims to a specific portion of the water.'" 2018 Op. 13 (quoting 2016 Op. 32). If "the water Mississippi claims is part of a larger interstate resource – such as an interstate Aquifer – then the water is likely interstate in nature." *Id.* at 14.

II. THE EVIDENCE WILL SHOW THAT THE AQUIFER AND THE WATER IN IT CONSTITUTE AN INTERSTATE RESOURCE

A. The Aquifer Is An Interstate Resource Because It Underlies Mississippi, Tennessee, And Six Other States

The Special Master already has recognized that "the geological characteristics of a water resource are relevant to whether [the water at issue] should be considered interstate in nature." 2016 Op. 31-32.

Although the Special Master identified a dispute "regarding the extent of the Aquifer at issue," Mississippi manufactured that dispute following the close of discovery. 2018 Op. 14. The evidence will show that there is a single, continuous hydrogeological body that underlies portions of Mississippi, Tennessee, and six other States. Hydrologists and hydrogeologists unanimously agree on the general

extent of the Middle Claiborne Aquifer, and Tennessee's experts will testify that the Aquifer's lateral extent lies beneath those eight States. Even Mississippi's experts cannot deny the extent of the Aquifer. Mississippi itself has stipulated to the existence of a single aquifer underlying Mississippi, Tennessee, and Arkansas, and its claims rely on that fact.

Specially, the evidence will indicate that there is a scientific consensus that the Aquifer at issue[3] extends from the southern tip of Illinois south through Kentucky, Missouri, Tennessee, Arkansas, Louisiana, and Mississippi and then east into Alabama. Every relevant study, including scientific papers referenced or relied upon by all five experts in this case, describes the Middle Claiborne Aquifer as underlying multiple States, including Mississippi and Tennessee. These papers provide substantially identical maps of the Aquifer's boundaries supporting the general geological consensus about the extent of the Middle Claiborne Aquifer.[4] For example, the USGS developed a single, continuous map of the potentiometric surface of the entire extent of the regional Aquifer at issue – underlying all eight States. Ex. 2 (Schrader (2008)). It further confirmed that the Aquifer is the "most

[3] There are a variety of regional names for this Aquifer, including names that apply to a portion of the Aquifer, *see* discussion *infra* pp. 26-28. Tennessee's experts will use the name Middle Claiborne Aquifer.

[4] *See, e.g.*, Ex. 1 (Clark & Hart, *The Mississippi Embayment Regional Aquifer Study (MERAS): Documentation of a Groundwater-Flow Model Constructed to Assess Water Availability in the Mississippi Embayment* at 30, Figure 14 (2009)).

widely used aquifer for industry and public supply . . . in Arkansas, Louisiana, Mississippi, and Tennessee." *Id.*

Further, the evidence will demonstrate that groundwater is able to flow continuously through the Middle Claiborne Aquifer across the Mississippi-Tennessee border and all other political boundaries overlying the Aquifer. Tennessee's experts will testify that the state borders do not influence the Aquifer's hydraulic conductivity, storage coefficients, transmissivity, or water level. Indeed, there is no barrier (geological, hydrological, or otherwise) in the Aquifer preventing or impeding the lateral flow of water within the Aquifer across the Mississippi-Tennessee border or elsewhere.

Mississippi's experts acknowledged in their reports and at their depositions that there is a single hydrogeological body underlying the relevant area. Mississippi's experts repeatedly referred to the Sparta Sand or "[t]he Sparta-Memphis Sand, also known as the Middle Claiborne Aquifer or the Memphis Aquifer," as extending beneath both "northwestern Mississippi and southwestern Tennessee." Ex. 3 (Spruill June Rep. 2). And, when questioned, Mississippi's experts agreed that the extent of the Middle Claiborne Aquifer was "not really disputed." Ex. 4 (Wiley Dep. 12:4-8). At his deposition, Mr. David Wiley agreed that "the Memphis Sparta Aquifer is a primary source of fresh water for Northwest Mississippi and Shelby County[, Tennessee]" and that it also lies beneath Arkansas, Kentucky, Missouri,

Alabama, and Louisiana. *Id.* at 12:13-13:12. More importantly, Mississippi's experts' testimony repeatedly confirmed that there is a single hydrogeological unit extending between both Mississippi and Tennessee. Both Mr. Wiley and Dr. Spruill testified that there are no physical barriers within the Aquifer preventing the flow of water beneath the Mississippi-Tennessee border. *Id.* at 108:2-16; Ex. 5 (Spruill Dep. 37:20-38:9). And both experts presented potentiometric surface maps indicating that the potentiometric elevation of water continues without interruption across the Mississippi-Tennessee border. Ex. 3 (Spruill June Rep. Figure 10); Ex. 6 (Wiley June Rep. Figure 8).

Mississippi's entire case is premised on the fact that there is a single hydrogeological unit underlying both Mississippi and Tennessee. In its Complaint, it expressly alleges that the "Sparta Sand formation underlies both Mississippi and Tennessee." Compl. ¶ 50; *see also id.* ¶ 41 (alleging that "[t]he geologic formation in which the groundwater is stored straddles two states"). In response to a Request for Admission, Mississippi stipulated "that the general geologic formation known as the Sparta Sand underlies several states, including Mississippi, Tennessee and Arkansas." Ex. 7 (Miss. Response to RFA No. 1).[5] If there were not a single

[5] Therefore, this fact has been "conclusively established," *see* Case Management Plan ¶ 4(b) (Dkt. No. 57) (adopting Fed. R. Civ. P. 36(b)), and Mississippi should not now be permitted to argue that there is not a single Aquifer that extends under all three States. *See generally* Dkt. No. 78.

hydrogeological unit extending beneath both States, Tennessee would not be able to pump entirely within the State of Tennessee[6] and divert water from Mississippi at the volumes and rates that Mississippi alleges.

At the hearing, Mississippi likely will argue that the Aquifer is heterogeneous and displays hydrogeological variations among its various portions. But Tennessee's experts agree that the Aquifer, like virtually all aquifers, is not entirely homogenous. For example, Tennessee's experts will testify that there is a facies change within the Middle Claiborne Aquifer a few miles south of the Mississippi-Tennessee border. At the facies change, some of the more permeable sands of the Middle Claiborne Aquifer gradually transition to the less permeable clay of the Lower Claiborne confining unit. But, contrary to Mississippi's claims, the sands of the Middle Claiborne in Tennessee, Northern Arkansas, and Northern Mississippi do not "disappear[]" south of the facies change. Miss. SJ Opp. 5-6. Rather, the sands of the Middle Claiborne continue uninterrupted past the newly present Lower Claiborne confining unit.

The Middle Claiborne Aquifer unquestionably is thicker north of the facies change where the sands are not interrupted by a clay confining unit, but this variation in thickness and the identity of the underlying confining layer does not transform the unit into two separate aquifers. The evidence will demonstrate that the

[6] Joint Statement at 106, Stipulated Fact No. 34.

hydrogeological properties of the Middle Claiborne sands – including the potentiometric elevation of water in the sands – do not change on either side of the facies change. Therefore, water flows within the sands of the Middle Claiborne Aquifer past the facies change without interruption. It is not atypical for the physical characteristics of interstate resources to vary throughout their extent. For example, a river may start as a shallow stream with a sandy riverbed and become a deep river with a solid rock bed, or even combine with another river along the way, but if the river continues without interruption across a state border, it is an interstate resource.[7]

B. The Aquifer Is An Interstate Resource Because The Effects Of Pumping In The Aquifer Cross State Borders

As the Special Master has recognized, the Supreme Court considers a resource to be interstate if "'the removal of water within a State's borders can have a direct effect on the availability of water in another State.'" 2018 Op. 14 (quoting 2016 Op. 31). The record will show that pumping within the Middle Claiborne Aquifer in one State "'reaches through the agency of natural laws into the territory of another State.'" *Id.* at 15 (quoting *Kansas v. Colorado*, 206 U.S. at 97-98). The resulting cross-border effects are in fact "the basis of Mississippi's claim." *Id.* at 14.

[7] Even under Mississippi's theory that the Memphis Sand and the Sparta Sand are two separate aquifers, it is undisputed that MLGW is pumping entirely within the Memphis Sand and that the Memphis Sand extends beneath both Mississippi and Tennessee. Because the facies change is located close to the Mississippi-Tennessee border in Mississippi, the different names frequently are used to refer to the sections of the Aquifer on either side of the Mississippi-Tennessee border.

Tennessee's expert Steven Larson will testify that, because there is a single, interconnected hydrogeological unit underlying both Mississippi and Tennessee, the effects of pumping are able to propagate across the state border. Indeed, experts for all parties agree that pumping groundwater from the "Aquifer from wells in one state can impact the groundwater in that same aquifer in another state." Ex. 4 (Wiley Dep. 16:4-8). The evidence will demonstrate that there is a cone of depression in the Middle Claiborne Aquifer that extends beneath the Mississippi-Tennessee state border into both Mississippi and Tennessee, which results from pumping in both southwestern Tennessee and northern Mississippi. *Id.* at 86:6-16. Moreover, Tennessee's expert Steven Larson will testify that there are multiple other cones of depression within the Middle Claiborne Aquifer that extend across state borders. Mr. Larson will explain that, as of 2007, there was a cone of depression in Union County, Arkansas, that extended into Louisiana and a cone of depression in Sharkey and Issaquena Counties, Mississippi, that extended into Louisiana. In fact, because the Middle Claiborne Aquifer is a single hydrogeological unit extending beneath eight States, any time there is pumping in the Middle Claiborne Aquifer near a state border, the cone of depression will extend across the border and into an adjoining State.

Mississippi has not denied that pumping in one State in the Middle Claiborne Aquifer "reaches through the agency of natural laws" into the territory of another

State. 2018 Op. 15. Instead, it argues that this analysis does not apply because pumping is not "natural" and that water would remain beneath Mississippi under natural conditions and not flow into Tennessee. That argument is both unresponsive and incorrect. The removal of water from the Aquifer does not need to be natural for the resource to be interstate. Indeed, *removal* of water from a resource *cannot* be "natural": as the Special Master rightly has recognized, "nearly every water dispute involves some type of 'unnatural' action by a state." *Id.* at 16. The key question is whether natural laws cause the *effects* of the action within one State to propagate into the other. The evidence will demonstrate that the natural laws of physics and hydraulics enable pumping in the Middle Claiborne Aquifer in one State to affect water in another State.

C. The Aquifer Is An Interstate Resource Because It Is Hydrologically Interconnected With Interstate Surface Water

"[T]he Supreme Court has indicated that equitable-apportionment principles govern disputes between States over a body of interstate surface water with a groundwater component." 2016 Op. 20 (citing *Texas v. New Mexico*, 462 U.S. 554, 556-58 & n.2 (1983)). The evidence will demonstrate that the Middle Claiborne Aquifer is hydrologically interconnected with other interstate aquifers and, moreover, interstate rivers.

Tennessee's experts will testify that the Middle Claiborne Aquifer is part of a larger groundwater system called the Mississippi Embayment Regional Aquifer

System, which contains multiple aquifers stacked on top of each other and separated vertically by confining layers. The evidence further will demonstrate that these confining layers restrict but do not eliminate the flow of groundwater between aquifers. Therefore, the groundwater in the Middle Claiborne Aquifer is able to discharge to and recharge from the adjoining aquifers, which themselves extend over multiple States.

Experts for both sides will testify that the Middle Claiborne Aquifer is also hydrologically connected to interstate surface streams in the region. Rivers and streams throughout the area directly connect to the alluvial aquifer, which is part of the Mississippi Embayment Regional Aquifer System. The Middle Claiborne Aquifer also comes to the ground surface, or outcrops, along the edges, and water is able to directly discharge to or recharge from the streambeds. Mississippi's experts have agreed that the Middle Claiborne Aquifer is hydrologically connected to the Wolf River, which begins in Mississippi and flows into Tennessee, and other tributaries of the Mississippi River. *See* Ex. 4 (Wiley Dep. 188:17-190:21); Ex. 5 (Spruill Dep. 40:2-41:10). And all of the experts have agreed that under natural conditions much of the water in the Mississippi Embayment Regional Aquifer System discharged into the Mississippi River, the definitive interstate river. The Middle Claiborne Aquifer's connections to other interstate aquifers and groundwater resources further support the conclusion that it is an interstate groundwater resource.

III. ATTEMPTS TO RECONSTRUCT PRE-DEVELOPMENT FLOW PATTERNS IN THE AQUIFER SHOW SUBSTANTIAL CROSS-BORDER FLOW ACROSS MULTIPLE STATES, FURTHER DEMONSTRATING ITS INTERSTATE CHARACTER

Hydrologists' attempts to reconstruct pre-development conditions in the Aquifer provide further support for the conclusion that the Aquifer is an interstate resource.

A. Under The Proper Legal Framework, The Interstate Character Of The Aquifer Does Not Depend On Pre-Development Flow Patterns

As an initial matter, determining the direction, speed, and volume of pre-development flow in the Aquifer is not necessary to resolving the question whether the Aquifer and the water in it constitute an interstate resource. The evidence will show that the Aquifer is an interstate resource for more fundamental reasons: it extends beneath many States, *see supra* pp. 7-12, and pumping in one State can affect the availability of water in another State, *see supra* pp. 12-14. And all parties' experts will agree that the Aquifer is hydrologically connected to interstate surface waters, *see supra* pp. 14-15, providing a further basis for finding the water interstate and subject exclusively to equitable apportionment.

None of those characteristics depends on how water flowed in the Aquifer before the commencement of significant pumping operations in 1886. Even if – contrary to all evidence – the groundwater in the Aquifer were perfectly still and static under natural conditions, each of the fundamental facts discussed above still

would make the Aquifer an interstate resource. Thus, the Special Master, and ultimately the Court, need not make any factual determinations about the pre-development direction, velocity, and volume of groundwater flow in the Aquifer.

Avoiding the need to determine precise pre-development conditions in the Aquifer has significant practical benefits, as well. As the hearing will make clear, developing an accurate picture of water levels in the Aquifer more than 130 years ago is a complex and difficult undertaking. Tennessee's expert witness, Dr. Brian Waldron, will testify about his own effort to map pre-development water levels in the Aquifer, which resulted in a 2015 article he co-authored with a colleague from the University of Memphis and published in a peer-reviewed academic journal. Although Dr. Waldron conducted a thorough investigation using the best available data, he will acknowledge that there is inherent uncertainty in any attempt to reconstruct historical conditions based on limited data. Mississippi's theory, in which a State "owns" water that would not travel outside its borders within some (unspecified) period of time, therefore depends on an inherently uncertain assessment of pre-development conditions. In contrast, the doctrine of equitable apportionment does not rely on inherently uncertain historical reconstructions of predevelopment flow in assigning valuable water rights to sovereign States.

The prospect of assigning water rights worth hundreds of millions or even billions of dollars based on studies of pre-development groundwater conditions appears absurd when considering some of the criticisms Dr. Spruill leveled at Dr. Waldron's work during expert discovery. Among other things, Dr. Spruill suggested that water-level data from early wells were untrustworthy because wells might not be properly grouted. *See* Ex. 8 (Spruill July Rep. 18). Leaving aside the merits of such critiques, *see generally* Dkt. No. 79, the Supreme Court should not be assigning a billion dollars' worth of water rights based upon hydrologists' views of the construction quality of a few dozen nineteenth-century wells. Dr. Spruill also contended that Dr. Waldron's data, which were recorded between 1886 and 1906, were not early enough to accurately reflect pre-development conditions. *See* Ex. 8 (Spruill July Rep. 7-10). Of course, those are the *earliest existing* data, so Dr. Spruill's suggestion appears to be that accurate historical reconstruction is impossible. Hewing closely to the Supreme Court's existing framework for what constitutes an interstate resource – which does *not* require historical reconstruction of pre-development conditions – has the added advantage of avoiding these complex disputes.

B. Every Reconstruction Of Pre-Development Conditions In The Aquifer Shows Interstate Flow From Mississippi To Tennessee, Mississippi To Arkansas, And Tennessee To Arkansas

Every attempt to reconstruct pre-development conditions in the Aquifer shows groundwater naturally flowing from Mississippi to Tennessee, from Mississippi to Arkansas, and from Tennessee to Arkansas. And every expert in the case, Mississippi's as well as Defendants', will agree that there was natural flow across the Mississippi-Tennessee border. As discussed, these facts are not necessary to the determination that the Aquifer is an interstate resource. But this natural interstate flow emphasizes the continuity of the Aquifer beneath multiple States and the hydraulic connection between groundwater in Mississippi and that in Tennessee.

Both Mr. Larson and Dr. Waldron will testify about the available contour maps of pre-development water levels in the Aquifer in the Memphis area. Some of these maps are stand-alone estimates of conditions prior to commercial pumping, while others are derived from computer models that simulate conditions in the Aquifer over time for predictive purposes. The maps include two early efforts by USGS scientists, Reed (1972) and Criner & Parks (1976), as well as Dr. Waldron's recent study, Waldron & Larsen (2015). Ex. 9; Ex. 10; Ex. 11. The models include the Brahana & Broshears (2001) model, which Mississippi's expert Mr. Wiley has used, and the Clark & Hart (2009) model, on which Tennessee expects Dr. David Langseth to testify, as well as a model described in Arthur & Taylor (1998). Ex. 12

(pre-development conditions simulated by the Brahana & Broshears model, as run by Mr. Wiley); Ex. 13 (pre-development conditions simulated by the Clark & Hart model, as run by Mr. Langseth); Ex. 14. As the evidence will show, these six depictions of pre-development conditions vary in a number of ways. But there are broad similarities, including that, as every expert will agree, all six depict interstate flow from Mississippi to Tennessee, Mississippi to Arkansas, and Tennessee to Arkansas. Some of these contour maps include larger areas than Shelby County and its neighboring counties. These maps also depict natural interstate flow from, respectively:

- Mississippi to Louisiana (Arthur & Taylor; Reed; Clark & Hart)
- Mississippi to Alabama (Arthur & Taylor; Clark & Hart)
- Arkansas to Louisiana (Arthur & Taylor; Reed; Clark & Hart)
- Kentucky to Missouri (Arthur & Taylor; Clark & Hart)
- Kentucky to Tennessee (Arthur & Taylor; Clark & Hart)
- Tennessee to Missouri (Arthur & Taylor; Reed; Clark & Hart)
- Missouri to Arkansas (Arthur & Taylor; Clark & Hart)
- Tennessee to Mississippi (Reed; Clark & Hart)
- Arkansas to Mississippi (Arthur & Taylor; Reed; Clark & Hart)
- Louisiana to Arkansas (Arthur & Taylor; Reed)

See Ex. 14; Ex. 9; Ex. 13. These estimates of natural interstate flow over so many borders emphasize the interstate character of the Aquifer. At the same time, the variations among these regional maps demonstrate the inherent uncertainty in attempting to reconstruct pre-development conditions in the Aquifer. The Special Master need not explore that uncertainty, however, because all scientific analyses of the issue agree that groundwater in the Aquifer naturally flowed across multiple state borders, including the Mississippi-Tennessee border.

C. To The Extent It Is Relevant, The Most Reliable Estimate Of Pre-Development Conditions In The Aquifer Shows Significant Natural Flow From Mississippi Into Tennessee

If the Special Master finds that the exact natural state of the Aquifer is material, the evidence will show that the single best re-creation of pre-development conditions is the Waldron & Larsen (2015) paper. As Dr. Waldron will testify, that investigation relied on better data than any other analysis and focused exclusively on pre-development conditions. The paper concluded that there was substantial flow from Mississippi (Desoto and Marshall Counties) into Tennessee (Shelby and Fayette Counties) under pre-development conditions. Indeed, the data suggested that there was actually a *greater* volume of water flowing across the border before pumping began than there was in 2007. If so, Mississippi's entire theory – that MLGW's pumping has caused more groundwater to flow across the border than did under natural conditions – is in error.

Dr. Waldron will explain why his methodology was superior to other attempts to reconstruct pre-development conditions. Most centrally, Dr. Waldron used far better data than the other papers had. In order to draw an accurate and reliable contour map of an aquifer at a particular time, a hydrologist uses as many data points as possible (i.e., wells demonstrating the aquifer's water levels at particular locations, or "control points") close in time to the depicted period (minimizing the distorting effects of changes over time). As Dr. Waldron will explain, the two prior pre-development maps, Criner & Parks (1976)[8] and Reed (1972), are problematic in this respect. Reed does not explain what data he used; nor do the articles Reed cites reference any control points. Thus, it is impossible to assess the accuracy or reliability of his map. Criner and Parks used a total of four data points, the earliest of which measured water levels more than 40 years post-development, and the latest of which dated from more than 70 years post-development. Further, all of the authors' data points were in the northern half of Shelby County; the southern-most control point was more than 10 miles north of the Tennessee-Mississippi border. In effect, Criner and Parks were attempting to map 1886 water levels at the state border using a handful of measurements taken 10 or 20 miles away, and 40, 50, or 70 years later. As Dr. Waldron will explain, the resulting map is unreliable.

[8] Criner & Parks (1976) is the map from which Mr. Wiley has derived his famous "yellow triangle" map, which was (among other things) attached to Mississippi's Complaint. *See* Ex. 15.

Dr. Waldron will testify about how he improved upon these earlier attempts. Rather than relying on data gathered 40 to 70 years later, he used water-level measurements taken no later than 1906, just 20 years after the start of commercial pumping in the Aquifer. Dr. Waldron used three early USGS publications from 1903 and 1906, which recorded water levels throughout the Memphis area in Tennessee, Mississippi, and Arkansas. And, unlike Criner and Parks, who used only four data points far north of the Mississippi-Tennessee border, Dr. Waldron used data from 27 wells that included multiple wells in Mississippi and Arkansas and wells in Tennessee close to the border. The Waldron & Larsen map therefore is based on substantially more and earlier data than the Criner & Parks map (and it is impossible to assess whether the Reed map is based on valid data).

Further, two of the models use the problematic maps discussed above as part of the model inputs. The Clark & Hart model uses the Reed map as part of its initial inputs, and the Brahana & Broshears model relies in part on the Criner & Parks map. The pre-development results of those two models will be heavily influenced by the pre-development maps used in their creation – which, as described above, are unreliable. Thus, no depiction of pre-development Aquifer conditions is likely to be as accurate as the Waldron & Larsen map. And to the extent the Special Master is inclined to consider the issue, the Waldron & Larsen paper suggests that, although

there is substantial uncertainty, more water likely traversed the Mississippi-Tennessee border under pre-development conditions than in the modern era.

IV. MISSISSIPPI'S EVIDENCE WILL FAIL TO DEMONSTRATE THAT THE AQUIFER LACKS AN INTERSTATE CHARACTER

A. Mississippi's Evidence Concerning Groundwater Velocity And Residence Time Cannot Change The Interstate Character Of The Aquifer

Mississippi's proffered evidence on flow rates within the Aquifer and "groundwater residence time" is not relevant to the question whether the Aquifer is interstate. It is relevant only to Mississippi's repeated attempts to claim that some of the water in the Aquifer is intrastate because it would remain beneath Mississippi for some unspecified period of time. The Special Master already twice has rejected Mississippi's attempts to separate out the groundwater from the Aquifer and claim that a portion of the water beneath Mississippi is intrastate. As the Special Master has explained, this "line-drawing finds no support in the case law." 2018 Op. 14. Supreme Court precedent indicates "that the geological characteristics of a water resource are relevant to whether it should be considered interstate in nature, even going so far as to reject a claim that a river that periodically ran dry between two points in different States was 'two rivers.'" 2016 Op. 31 (quoting *Kansas v. Colorado*, 206 U.S. at 115). Because the evidence will demonstrate that the Aquifer is interstate for multiple independent reasons, its water is also interstate.

In addition to being unsupported by the case law, Mississippi's attempt to carve out some of that water as intrastate – because it entered the Aquifer in Mississippi and would remain in the State – will fail for three reasons. *First*, it is hydrologically unsound to distinguish between the geological formation and the groundwater within it. In fact, the parties have stipulated that an Aquifer is a formation that is *saturated* with water. Joint Statement at 102, Stipulated Fact No. 17. Tennessee's experts will explain that an aquifer, by definition, includes the water in it. The same geological formation without the groundwater is no longer an aquifer.

Second, Mississippi's claim that some portion of the water that enters the Aquifer in Mississippi would remain in Mississippi is incorrect. The evidence will demonstrate that no water within the Aquifer beneath Mississippi will remain in Mississippi indefinitely. All of the experts agree that water within an Aquifer is constantly flowing and is not static. If an Aquifer is in equilibrium, then the volume of water within the Aquifer will remain relatively stable, but water always is flowing into and out of the Aquifer. The evidence further will demonstrate that every conception of pre-development conditions within the Aquifer indicates that all of the water was on flow paths to leave Mississippi eventually, either by flowing into an adjoining State or by discharging from the aquifer, for example into an interstate river system.

Third, because all of the water is constantly flowing and all of it will eventually leave Mississippi, there is no principled way to distinguish between intrastate and interstate water based on residence time. All experts will agree that groundwater moves slowly, and no one will dispute that at least some groundwater in the Aquifer takes thousands of years to travel through Mississippi, depending on its particular path. But, as Tennessee's experts will explain, there is no scientific basis for distinguishing one portion of the water in the Aquifer from another. Indeed, not only would it be completely arbitrary to attempt to lay claim only to water that would remain in Mississippi for some chosen period; it would be impossible, as a practical matter, to determine which water qualifies, given the inherent uncertainties of hydrology.

The Special Master therefore should reject Mississippi's repeated attempts to claim the portion of the groundwater that allegedly would remain beneath Mississippi for an (unspecified) period of time as intrastate water.

B. The Evidence Will Show That Mississippi's Two-Aquifer Theory Is An Attempt To Mischaracterize The Hydrogeology Of The Middle Claiborne Aquifer And Confuse The Issues

Mississippi's new theory – revealed for the first time after the close of discovery and some 12 years after it filed the *Hood* complaint – is that the case actually involves "two separate geologic formations with different hydrogeologic

constituents" that "interface" in the relevant area.[9] Miss. Opp. to Mot. in Limine on Two Aquifers 3. This new characterization of the relevant hydrogeological framework is not based on new science, however; Mississippi instead is using a semantic device to create the false impression that there is some kind of barrier or impediment to interstate flow. At bottom, all Mississippi's argument shows is that scientists use various local naming conventions to refer to the Middle Claiborne Aquifer. Tennessee's experts will show that those naming conventions are just different ways of referring to the same, interstate Middle Claiborne Aquifer.

Mississippi's two-aquifer theory is centrally focused on the "facies change" that occurs in the Middle Claiborne Aquifer south of the Mississippi-Tennessee border. As discussed, both of Tennessee's experts will explain that the facies change is entirely consistent with the scientific consensus that the Aquifer extends beneath parts of eight States. Mississippi focuses on the fact that some publications have referred to the portion of Middle Claiborne south of the facies change as the Sparta Sand Aquifer, while calling the portion north of the facies change the Memphis

[9] Mississippi's initial theory of its case was that there is a single interstate Aquifer underlying Mississippi and Tennessee, but that portions of the water were intrastate. The Special Master has now twice rejected the idea of separating the water from the geological formation that is its matrix. In an attempt to keep its claim alive, Mississippi is now retreating from its earlier admission that there is a single interstate Aquifer by falsely creating the impression that the Sparta Sand and Memphis Sand are not a single interconnected hydrogeological unit.

Aquifer.[10] That naming convention, however, is irrelevant because the evidence will show that the two "separate" aquifers are an uninterrupted layer of (primarily) sand that, for all intents and purposes, acts as a single hydrogeological unit – one aquifer, the Middle Claiborne. Mississippi will be unable to muster any evidence that the name change relates to some kind of barrier between two "separate" aquifers that would limit or impede flow across the supposed boundary.

The issue is also, as Mississippi itself has pointed out, a "red herring." Miss. SJ Opp. 11-12. The evidence will demonstrate conclusively that the water resource at issue is interstate, *see supra* pp. 7-15, regardless of whether it is described as one aquifer or two aquifers. The same evidence that establishes the interstate character of the resource, however, also should lead the Special Master to conclude that the whole resource is best described as a single aquifer.

C. The Special Master Should Ignore Mississippi's Continued Effort To Litigate Issues Other Than The Threshold Question Whether The Aquifer Constitutes An Interstate Resource

Mississippi has demonstrated that it intends to attempt to refocus the hearing away from the question of whether the Aquifer is an interstate groundwater resource. Mississippi has designated large swaths of evidence about Tennessee's regulatory

[10] Other publications simply refer to the Middle Claiborne as the "Sparta" or similar south of the *States' border*, and the "Memphis" or similar north of the border. The fact that the name change may occur in different places simply reflects that the name given to the Aquifer makes no hydrogeological difference.

practices, MLGW's groundwater management practices, MLGW's pumping volumes, and the amount of water MLGW has supposedly diverted across the boundary. *See generally* Defs.' Jt. Mot. in Limine to Exclude Irrelevant Evidence. Such evidence is irrelevant to the threshold issue of whether the Aquifer constitutes an interstate water resource. *See id.* The Special Master already has determined that Mississippi's other theories are not viable unless Mississippi first proves that the Aquifer is not an interstate resource. Admitting evidence on these issues at this "threshold" hearing will both defeat the efficiencies the Special Master sought to create through phased litigation and prejudice Defendants, which relied on the Special Master's order for limited discovery. *See id.* The Special Master should reject this evidence as irrelevant to the extent it becomes part of the record.

D. Mississippi's Evidence On Groundwater Management Practices Emphasizes That Mississippi's Theory, If Accepted, Would Unsettle National Water Policy And Impose Arbitrary Restrictions On The Appropriate Development Of Groundwater Resources

As discussed, the Special Master should reject Mississippi's proffered evidence on groundwater management practices as irrelevant to the threshold question whether the Aquifer is interstate. However, that evidence does shed significant light on the serious consequences of accepting Mississippi's theory that one State may sue another State (or its groundwater users) in tort based on the cross-border effects of pumping entirely within the defendant State.

In its Complaint, Mississippi asserted that this was a matter of state sovereignty and that Mississippi was asking the Supreme Court only to "limit Tennessee's sovereign rights to groundwater resources stored naturally within, or naturally flowing through, its boundaries." Compl. ¶ 51. In fact, however, Mississippi's proffered evidence makes clear that, if its legal theory is correct, Tennessee will be *unable* to fully exercise its sovereignty over the groundwater naturally flowing beneath it. At his deposition, Dr. Spruill criticized Tennessee agencies for not providing a sufficiently "specific regulatory framework" for well-field design. Ex. 5 (Spruill Dep. 94:9-95:18); *see id.* at 102:3-10 ("I would like to see them strengthen those regulatory requirements."). Indeed, Dr. Spruill suggested that, in his expert opinion, well fields that are near state borders "should be pretty extensively regulated" by state agencies, because such well fields are "incredibly problematic." *Id.* at 105:7-8, 136:6. In effect, Dr. Spruill's opinion is that Tennessee ought to regulate groundwater pumping in its own State in a particular way.

In its recent briefing, Mississippi has made explicit that it intends to argue that Tennessee is liable because it has "ceded its responsibility to manage groundwater pumping to the City of Memphis, Shelby County, Tennessee, and MLGW." Miss. Opp. to Mot. in Limine on Relevance 7. Mississippi's argument and proffered evidence demonstrate that the unavoidable consequence of its legal theories is *not*, as it asserts, that each State will have the right to regulate within its borders. Instead,

to avoid liability, a State will have to either prohibit groundwater pumping near any state border or regulate it in the manner demanded by a neighboring State's expert. That would be true even if, for example, the most reasonable and sustainable use of groundwater involved drilling wells near a state border. The threat of liability to a neighboring State for the – unavoidable – resulting cone of depression would overcome the economic and environmental benefits of developing the resource in a sustainable way.

Nor is this concern limited to the present case. The evidence, including USGS publications, will show that multi-state aquifers are the rule, not the exception. Until now, States have formulated water policy with the understanding that the Supreme Court's equitable-apportionment doctrine prioritizes "existing economies" and seeks to avoid "disrupting established uses." *Colorado v. New Mexico*, 459 U.S. at 187. Mississippi's theory would require every State to reassess its water regulations in light of the threat of liability – in addition to facing potentially hundreds of millions of dollars in retrospective liability.

Mississippi has argued that, by having few regulations, "Tennessee is imposing its policy on the State of Mississippi." Miss. Opp. to Mot. in Limine on Relevance 9. As Mississippi observes, "no 'state can legislate for or impose its own policy upon another.'" *Id.* at 7 (quoting *Kansas v. Colorado*, 206 U.S. at 95). But the solution to Mississippi's grievance is not to allow Mississippi, through a tort

action, to legislate Tennessee's new well regulations. The solution is equitable apportionment – if Mississippi could prove that it met the requirements.

CONCLUSION

The evidence will demonstrate that this case involves an interstate resource, and the Special Master therefore should recommend that the Supreme Court dismiss Mississippi's claims with prejudice except as to a new complaint solely seeking equitable apportionment.

Respectfully submitted,

/s/ *David C. Frederick*

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December 20, 2018

CERTIFICATE OF SERVICE

Pursuant to Paragraph 3 of the Special Master's Case Management Plan (Dkt. No. 57), I hereby certify that all parties on the Special Master's approved service list (Dkt. No. 26) have been served by electronic mail, this 20th day of December 2018.

/s/ *David C. Frederick*

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