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.

PLAINTIFF'S RESPONSE TO DEFENDANTS' JOINT MOTION TO EXCLUDE THE TESTIMONY AND OPINIONS OF DAVID A. WILEY

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I. INTRODUCTION

Defendants have moved to exclude *all* testimony and opinions of Mississippi's expert David A. Wiley. *See* Dkt. No. 77. The Court should deny Defendants' Motion. As discussed further below, Defendants' Motion fails to paint an accurate (or complete) picture of Mr. Wiley's expert reports and anticipated testimony. Cursory review of his reports and deposition testimony show they are replete with opinions directly relevant and helpful for the upcoming evidentiary hearing—*i.e.*, whether the groundwater at issue is interstate in nature. Additionally, Defendants' criticisms of alleged fatal "errors" in Mr. Wiley's expert reports are unfounded and immaterial. Defendants are certainly free to cross-examine him on these points, but there is no basis for the wholesale exclusion of his testimony.

II. BACKGROUND

This Court has ordered that "an evidentiary hearing should be held on the limited issue of whether *the water that is at issue in this case* is interstate in nature." Dkt. No. 56, 8/12/16 Case Management Order at 1 (emphasis added). "Evidence that would likely be relevant to this determination includes the nature and extent of hydrological and geological connections between the groundwater in Memphis and that in Mississippi, the extent of historical flows in the Aquifer between Mississippi in Tennessee, and similar considerations." Dkt. No. 69, 8/12/19 Memorandum of Decision at 36.

Thus, the stated purpose of the upcoming evidentiary hearing is to take evidence of the geological, hydrological, and other relevant facts necessary to make this legal determination. Expert testimony, of course, is essential in making this determination. *See* Fed. R. Evid. 702.

III. ARGUMENT

A. Wiley's Opinions Are Directly Relevant to the Intrastate Nature of the Water at Issue

Defendants blatantly misrepresent the scope of Mr. Wiley's testimony by implying his opinions are limited *solely* to the amount of water MLGW pumped from its wells and diverted from Mississippi into Tennessee. *See* Dkt. No. 77 at 4. This implication is false. Although such topics are certainly *among* the subjects of Mr. Wiley's expert testimony, the actual scope of his opinions is much broader.[1] For example (and without limitation), Mr. Wiley's reports reflect the following relevant evidence:

- "The Sparta Sand is a thick, variable sand and sandstone formation made up of fine to very coarse sand with lenses of clay and silt (Graham and Parks, 1986). In north Mississippi, the Sparta Sand occurs at a depth of 0 to 600 feet, and varies in thickness between 200 to 900 feet." Ex. 1, Wiley Report at 9.

- "Within north Mississippi and along the common border with Tennessee, the Sparta Sand formation has a dominant, gentle dip from eastern outcrops

[1] The scope of Mr. Wiley's expert testimony is detailed in his June 30, 2017 expert report ("Wiley Report") (Ex.1) and his July 31, 2017 addendum report ("Rebuttal Report") (Ex. 2).

to the west/southwest across north Mississippi and Tennessee to the Mississippi River." *Id*.

- "The Sparta Sand is confined above by the Jackson Formation and the upper part of the Claiborne Group which consist primarily of clay, silt and fine sand. This serves as a confining bed retarding vertical groundwater flow between the unconfined Surficial aquifer above and the Sparta Sand." *Id*.

- The Sparta Sand "is saturated and stores groundwater collected over thousands of years . . . ." *Id*. at 10.

- "The primary source of any new groundwater for collection and storage in the Sparta Sand is the recharge that occurs from rainfall. This groundwater recharge generally occurs east of Shelby County, Tennessee, east of Memphis, and in east Marshall County, Mississippi . . . . Within this outcrop belt, recharge occurs by infiltration of rainfall directly into the Sparta formation or by downward seepage of water from the overlying Surficial aquifer." *Id*.

- The hydrogeologic formations in the Memphis and northwestern Mississippi area "are dipping generally from east to west and the Sparta outcrop occurs in the eastern portion of the area." *Id*.

- "As rain falls on the outcrop area of the Sparta it slowly percolates downward and then under gravity and the weight of the water accumulated above it in the formation slowly provides recharge as it seeps through the tiny pore spaces of the sandstone down gradient following the dip of the formation in a slightly west to southwesterly direction under natural conditions." *Id*.

- "The groundwater recharge is exceedingly slow under natural conditions seeping through the sandstone at a rate of about 1 inch per day. At this rate, groundwater naturally collected resides in the Sparta Sand for thousands of years as it gradually moves down gradient towards the Mississippi River." *Id*.

- "[W]ater naturally moves from the outcrop areas on the eastern side of the embayment westward through the aquifer, then eventually upward through the confining units into the Mississippi River Alluvial aquifer." *Id*. at 11.

- "[S]tructural geology in northwest Mississippi influences the shape of potentiometric surface contours and direction of groundwater flow, which is westward." *Id.*

- "[A]ll but a very small portion of the groundwater flow in northern Mississippi stays in Mississippi under pre-development conditions until its natural discharge at the Mississippi River Alluvial aquifer system near the river. Only a very small area in northeastern DeSoto County has groundwater flow entering Tennessee under pre-development conditions . . . ." *Id.*

- Continual groundwater withdrawals by MLGW "has lowered the potentiometric surface of the aquifer and pressure within the formation, and [changed] the groundwater flow direction and hydraulic gradients which are represented by [a] cone of depression." *Id*. at 12.

- "Water levels in the Sparta Sand under northern DeSoto County, Mississippi, have been estimated from a USGS model developed by Arthur and Taylor, 1990, to have declined by up to 90 feet." *Id*. at 13.

- "While the natural movement of the groundwater in the Sparta Sand is east to slightly southwest, the recent potentiometric maps all show that the groundwater flow in northwest Mississippi is now drawn radially to the north toward the center of Memphis where the lowest water levels are observed in the aquifer. This large cone of depression . . . has been created by the cumulative groundwater pumping (hundreds of wells) in Tennessee, primarily from the MLGW wellfields." *Id*.

- "[G]roundwater pumpage occurring in the Memphis area is affecting groundwater flow conditions in DeSoto County . . . . [T]he groundwater flow direction has been altered and groundwater . . . continues to be diverted from its natural path in Mississippi northward into Tennessee due to the Memphis pumpage." *Id*. at 14-15.

- "The total volume of groundwater taken from Mississippi due to MLGW pumpage since 1965 is calculated to be approximately 411.9 billion gallons." *Id*. at 20.

- "Under pre-development conditions Sparta aquifer water resides in Mississippi for approximately 4,000 years to 22,000 years . . . and moves at a rate of approximately 13 to 53 feet per year . . . ." Ex. 2, Wiley Rebuttal at 4.

- "The phrase 'interstate aquifer' has no known technical reference in USGS literature or from other scientific professional organizations." *Id*. at 5.

- "Flow paths under natural pre-development conditions create a flow boundary. In most of . . . northwest Mississippi, groundwater flows from east to west/southwest below the state line. [A small] portion of pre-development flow is northwest from Mississippi to Tennessee. Due to MLGW pumpage, this natural east to west flow path in Mississippi has been altered to a northwesterly direction into Tennessee . . . ." *Id*. at 6.

- Statements by MLGW's expert David Langseth imply "that a large volume of groundwater flowed from the Sparta sands in DeSoto, Marshall and Benton Counties, Mississippi, to Tennessee during pre-development times. In reality, the MERAS model used by [Mr. Langseth] indicates that there was a net flow from Mississippi to Tennessee within the entire MSSA of less than 6 mgd; which is only 2.6 percent of the simulated areal recharge to the state of Mississippi. Furthermore, the MERAS [model] indicated that there is a net flow from Tennessee into Desoto County, Mississippi of 2.3 mgd during pre-development times . . . ." *Id*. at 6-7.

- "[D]ata derived [from] the USGS MERAS model shows that during the pre-development period approximately 84 percent of the simulated recharge to Mississippi would flow across the state for a period of time ranging from approximately 4,000 to 22,000 years." *Id*. at 8.

Such evidence will clearly help the Special Master "to understand the evidence or to determine a fact in issue." Fed. R. Evid. 702(a).

Ignoring the scope (and obvious relevance) of the testimony outlined above, Defendants instead assert that Mr. Wiley's opinions are "not helpful" because: (1) he is not going to offer a specific opinion on whether the aquifer at issue is an "interstate resource"; and (2) he replied in the negative when defense counsel asked if there was anything in his report that might address or be a factor "in determining whether the Memphis Sparta Aquifer or the groundwater in it is an interstate or intrastate resource." Dkt. No. 77 at 5.

Defendants' arguments miss the point. First, Mr. Wiley is not going to offer an opinion on whether the Aquifer or the groundwater in it is an interstate resource—*because that is a legal question and not the proper subject of expert testimony*. *See* Dkt. No. 76 (Mississippi's Motion to Exclude Defendants' Experts). Second, as to whether Mr. Wiley believes there is anything in his expert reports that might be a factor in resolving the threshold legal issue, it is simply not his job to know or determine what is relevant. That is for the lawyers to argue and the Court to decide.

Regardless of Mr. Wiley's knowledge of the purpose of the upcoming evidentiary hearing, his testimony is directly relevant to the threshold issue and should be considered by the Court. *See* Dkt. No. 69, 8/12/19 Memorandum of Decision at 36. Moreover, Special Masters "have been advised to err on the side of over-inclusiveness in the record for the purpose of assisting the Court in making its ultimate determination." *Id.* at 35-36; *see also* "Mississippi's Response to

Defendants' Joint Motion to Exclude Evidence Irrelevant to the Limited Evidentiary Hearing" (served November 20, 2018). The Court should deny Defendants' Motion and allow Mr. Wiley to offer his expert testimony at the upcoming evidentiary hearing.

B. Defendants' Criticisms of the Summaries and Figures in Wiley's Reports are Unfounded and Immaterial

Defendants' arguments about alleged errors in Wiley's expert report are simply points for cross-examination—not a basis for wholesale exclusion of his testimony. These selective criticisms also relate to only a handful of matters—not the entirety (or even a majority) of Mr. Wiley's opinions. Moreover, these alleged errors are easily explained and immaterial. Nor do they have anything to do with Mr. Wiley's expert opinions about the nature of the water at issue. There is no basis for excluding Mr. Wiley's testimony on these grounds.

Defendants first hinge their argument on slight discrepancies in pumping volumes included in Wiley's 2007 Expert Report (filed in the initial *Hood* proceeding) and those included in his 2017 Expert Report in this proceeding. *See* Dkt. No. 77 at 8-9. As explained in the accompanying Affidavit, clerical errors were made when preparing the 2007 Report—errors that were *corrected* in the 2017 Expert Report. *See* Ex. 3, Wiley Aff. at ¶ 4. Nor is the 2007 Expert Report even at issue in this case—what matters is that the 2017 Expert Report is not erroneous.

Defendants next point to alleged discrepancies in pumping volumes in Wiley's 2014 Expert Report and his 2017 Expert Report. *See* Dkt. No. 77 at 8-10. In the 2014 Expert Report (prepared as part of Mississippi's Motion for Leave to File this original action), Wiley used pumping data obtained from the Tennessee Department of Environment and Conservation ("TDEC"). *See* Ex. 3, Wiley Aff. at ¶ 5. During discovery, Mississippi subsequently obtained pumping data *from MLGW*—and Mr. Wiley incorporated these figures into his 2017 Expert Report. *See id.* Put another way, Wiley used MLGW's own data in lieu of the TDEC data used in his 2014 Expert Report. This is not an "error." It is an intentional, reasonable, and prudent change based on Wiley's procurement of additional data from a party to this proceeding. *See id.*[2]

Defendants also argue there are unexplained differences between the "gallons per day" pumping volumes contained in Tables 1-2 in Mr. Wiley's 2017 Expert Report. *See* Dkt. No. 77 at 9-10. As explained in the accompanying Affidavit, this difference is related primarily to unit conversions and rounding. *See* Ex. 3, Wiley Aff. at ¶¶ 6-9. There is simply no material error in these tables. *See id.*

[2] Although Wiley could not recall the reasons for the differences between these reports during his depositions, Mississippi's counsel provided this explanation (and relevant source documents) to Defendants on November 7, 2017. *See* Ex. 4, 11/7/17 E-mail.

Finally, Defendants point to one misstatement in one sentence of the 2017 Expert Report (concerning Mr. Wiley's *description* of one of his figures) and a handful of labeling errors on a few demonstrative figures. *See* Dkt. No. 77 at 11. These oversights are immaterial, do not affect the substance of Mr. Wiley's expert opinions, and were explained and corrected during his deposition. Such trivial errors do not justify the exclusion of his testimony. *See, e.g.*, *Computer Assocs. Int'l v. Quest Software, Inc.*, 333 F. Supp. 2d 688, 694-95 (N.D. Ill. 2004) (mathematical and typographical errors in expert's report, which he admitted at his deposition, go to weight, not admissibility). Moreover, Defendants are free to cross-examine Mr. Wiley about these inconsequential oversights should they desire to do so. *See Tate & Lyle Americas, LLC v. Glatt Air Techniques*, 2016 WL 9711281, at *4 (C.D. Ill. Apr. 11, 2016) ("A recognized and admitted error in calculations does not affect [an expert's] qualifications . . . or the admissibility of the evidence. Any mistakes may be explored . . . on cross-examination, and the jury may weigh the evidence accordingly.").

This is not a "plethora of errors" as Defendants allege. *See* Dkt. No. 77 at 11. Simply put, this is nothing like the cases cited by Defendants. *See E.E.O.C. v. Freeman*, 778 F.3d 463 (4th Cir. 2015) (finding that expert reports contained a "plethora" of "analytical fallacies," reflected "cherry-picked" data, produced "a meaningless, skewed statistic," and included "a mind-boggling number of errors");

In re Viagra Prods. Liab. Litig., 658 F. Supp. 2d 936 (D. Minn. 2009) (finding that 11 out of 38 responses to medical survey had developed vision problems before taking drug alleged to cause those problems). Wiley's two Expert Reports comprise 24 pages of analysis and 34 tables and figures discussing multiple facts directly relevant to the issues pending before this Court. His deposition in 2017 was extensive and comprises 217 pages of testimony, which directly addresses complex matters of geology, hydrogeology, pre-development flow direction/velocity, the hydrogeological changes and cone of depression caused by MLGW's pumping, groundwater modeling, etc. Defendants do not challenge any of the material portions of his Expert Report, yet seek to exclude his opinions based on alleged "errors" that either do not exist or immaterial. The breadth of these expert reports and Mr. Wiley's testimony dwarfs the minimal errors asserted by Defendants.

Courts uniformly recognize that the types of issues raised by Defendants go to the weight of expert testimony—not its admissibility—and that such criticisms should simply be addressed through cross-examination. *See, e.g., United States v. Bonds*, 12 F.3d 540, 561, 563 (6th Cir. 1993) (holding that disputes about specific techniques used or accuracy of results generated go to weight, not admissibility, of evidence); *Baldwin v. Bader*, 539 F. Supp. 2d 443, 445-46 (D. Me. 2008) (ruling that expert's inadvertent miscalculations do not undermine reliability of testimony and

go to weight, not admissibility, of opinions).[3] The Court should hear the Parties' evidence (including Mr. Wiley's testimony) and give it the appropriate weight. *See Montana v. Wyoming*, No. 137, Dec. 29, 2014 Special Master Report at 31-33 (denying motion to exclude expert testimony in favor of "address[ing] the issues at the conclusion of the trial");[4] *Nebraska v. Colorado*, No. 126, Nov. 15, 2013 Special Master Report at 13 ("[T]he parties were allowed to submit objections to any pre-filed testimony or expert reports. Because there was no jury, I discouraged the filing of so-called *Daubert* motions. Simply put, it made the most sense to hear the expert testimony and to determine whether or not it was relevant and persuasive, thereby mooting any need to make the more refined determination of whether it was so inadequate as to be inadmissible.");[5] *see also New Jersey v. New York*, No. 120, Mar. 31, 1997 Special Master Report at 30 (stating that the Supreme Court's rules require "a generous view of the admission of evidence and factual development" and

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[3] *See also Cummings v. Standard Register Co.*, 265 F.3d 56, 65 (1st Cir. 2001) ("We agree with the district court that whatever shortcomings existed in [the expert's] calculations went to the weight, not the admissibility, of the testimony and uphold the district court's decision to allow it."); *Donatelli v. Unumprovident Corp.*, 350 F. Supp. 2d 288, 292, n.4 (D. Me. 2004) ("UnumProvident's critique of mathematical errors contained in Dr. Fox's estimate of what Donatelli could have earned had he remained at UnumProvident goes to weight, not admissibility.").

[4] Available at: https://www.supremecourt.gov/SpecMastRpt/137Orig_122914.pdf.

[5] Available at: https://www.supremecourt.gov/SpecMastRpt/Org%20126%20Jan%2013%20Special%20Master%20Report.pdf.

"favor[] a principle of inclusion over exclusion in creating a record" (citing *United States v. Texas*, 339 U.S. 707, 175 (1950)).[6]

IV. CONCLUSION

For the foregoing reasons, the Court should deny Defendants' Joint Motion to Exclude the Testimony and Opinions of Mississippi's Expert David A. Wiley (Dkt. No. 77).

Dated: November 20, 2018

Respectfully submitted,

THE STATE OF MISSISSIPPI

/s/ C. Michael Ellingburg
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[6] Available at: https://www.supremecourt.gov/SpecMastRpt/Orig120033197.pdf.

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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 the 20th day of November, 2018.

/s/ C. Michael Ellingburg
C. Michael Ellingburg

Counsel for Plaintiff

UPDATE REPORT ON DIVERSION AND WITHDRAWAL OF GROUNDWATER FROM NORTHERN MISSISSIPPI INTO THE STATE OF TENNESSEE

Prepared For:

Jim Hood, Attorney General of the State of Mississippi

June 30, 2017

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INTRODUCTION

This report was prepared at the request of the Attorney General of the State of Mississippi. It updates and confirms previous work performed for the Attorney General to determine the effect of Memphis Light, Gas & Water's (MLGW's) consistent, significant expansion of the commercial water well pumping operations between 1965 and our last report on Mississippi's natural groundwater flow and storage. This report incorporates updated pumpage information from MLGW and the Mississippi DEQ.

This report presents the results of our evaluation of the effects of MLGW's long term groundwater pumpage on the natural groundwater flow and storage within the confined Sparta Sand within northwest Mississippi. The area of study for the report is shown in **Figure 1**. The tasks performed for this update report by LBG to support our opinions include: confirming existing information regarding the natural pre-development direction of groundwater movement in the Sparta Sand within Mississippi; collecting additional data on the Sparta Sand formation, and updated groundwater modeling to show the change in direction of groundwater movement beneath Mississippi caused by changes in the natural hydraulic gradients caused directly by MLGW pumping; and, performance of calculations to determine the volume of groundwater pumped into the Shelby County, Tennessee, area by MLGW out of Mississippi's natural groundwater flow and storage in the Sparta Sand. These calculations were performed using an existing groundwater flow model developed by the USGS. It is our opinion that the results obtained are within the expected range, and consistent with information developed and conclusions presented by other reliable scientific evaluations. Those analyses, and ours, clearly demonstrate that MLGW pumping has withdrawn billions of gallons of Mississippi groundwater from storage in the Mississippi Sparta Sand, permanently taking it out of Mississippi into Tennessee for sale and use in Tennessee.

BACKGROUND

The primary source of fresh water supply for most of northwest Mississippi and the Memphis, Tennessee areas is the deep confined Sparta Sand formation, referred to as the Memphis Sand in Tennessee within the Claiborne Geological Group. The confined Sparta Sand formation beneath northwest Mississippi and southwest Tennessee is a discrete geological formation which has existed for thousands of years. Since its formation, a significant but not unlimited quantity of high quality groundwater was collected and was stored under hydrostatic pressure from rainwater falling on outcrops within each state's current borders. Because it allows the transmission and storage of groundwater in usable quantities and is overlaid by a confining layer, the Sparta Sand is classified as a confined aquifer. But the fact that the geological formation underlies both states does not mean that any meaningful quantity of the groundwater stored and flowing over time within either state has ever been naturally shared between the states.

Substantially all of the groundwater naturally flowing, collected and stored within the Sparta Sand in each state originated, and was stored inside that state's borders over thousands of years. As a confined aquifer, the natural groundwater flow and storage in each state has resided in the current borders of that state because it naturally seeped from the outcrops in the state and moved exceedingly slowly in a predominantly east to west/southwest direction in Mississippi and an east to west/northwest direction in Tennessee.

The water supply in Shelby County, Tennessee, is primarily provided by groundwater, and most of the groundwater pumped in the county is pumped by MLGW, a public utility owned by the City of Memphis. Since its creation in 1939, MLGW has relied exclusively on groundwater from what was originally called the "500-foot Sand" or Memphis Sand. In the mid-1960's Tennessee learned that the upper part of the "500-Foot Sand" was correlated with the Sparta Sand (Moore, 1965). Based on available records since 1965, MLGW has consistently, annually increased its groundwater pumping for governmental use and sale in Shelby County and surrounding areas over the next several decades. Between 1965 and 2000, MLGW developed one of the largest artesian water pumping operations in the world, with over 170 commercial water wells located in 10 well fields. Three of these well fields are within 2 to 3 miles of the

Mississippi State line just above DeSoto County, Mississippi. **Figure 1** shows the location of MLGW's ten well fields pumping from the Sparta Sand and the approximate quantities pumped in 2016.

Using their very large artesian groundwater pumping and distribution system, between 1965 and 1985 MLGW pumping increased from approximately 72 million gallons per day (MGD) to 132 MGD. As of 1985 (Brahana & Broshears, 2001), Shelby County, Tennessee, groundwater pumping had increased to a rate of approximately 200 MGD. This rate of MLGW pumping continued to increase after 1985 until 2000, and the Sparta Sand in Tennessee has been continuously pumped at a higher rate than it can be naturally recharged based on its geology. As a result, the natural static head pressure within the aquifer has been drawn down by MLGW's pumping in the form of a funnel which reaches into Mississippi as far as south DeSoto County, Mississippi. This area in which the MLGW wells have reduced the pressure and changed the hydraulic gradients can be described as the area of influence of the MLGW wells and is further described in groundwater movement terms as a "cone of depression". This "cone of depression" is centered in and drawing groundwater into MLGW wells and expands outward from there into northwest Mississippi, pulling groundwater into Tennessee which would never have resided within Tennessee under natural conditions. **Figure 2** shows generalized hydrogeological cross sections and has been prepared to distinguish the natural pressure (pre-pumping conditions) in the aquifer from the current pumping conditions. The non-pumping groundwater pressure will raise the water to the level shown as the horizontal dashed blue line labeled pre-development or pre-pumping potentiometric surface. Potentiometric surface is defined in the literature: For a well penetrating a confined aquifer the potentiometric surface is the elevation to which the water rises due to the natural pressure within the aquifer. The upper figure shows several wells pumping with each of their respective potentiometric surface (groundwater level) drawdown cones. This drawdown of the groundwater level around the well forms a cone of depression as shown in the figure. This cone of depression is actually in the shape of a cone or funnel as would be seen three dimensionally and draws the water toward the low point.

While all wells create a cone of depression, the shape and extent, or size, of the cone depends on the rate and duration of the pumping, and the hydraulic properties of the

aquifer (groundwater system). If pumping exceeds the rate of recharge, the depth to which a pump is lowered will have to be increased, and the area drained by the cone of depression will continue to grow. The upper part of **Figure 2** with only a few wells pumping shows that the cones of depression for each well do not overlap by exceeding the pre-pumping potentiometric surface causing a regional cone of depression. The lower part of **Figure 2** shows a greater number of wells closer together and their respective cones of depression. In this figure the cones of depression for these wells overlap and stay below the pre-pumping potentiometric surface causing a regional cone of depression. Historically recorded observations show that potentiometric surface (water levels) for the Sparta Sand have declined (dropped) by as much as 100 feet under Memphis since 1886 as a result of MLGW pumping, forming a large cone of depression extending into substantially all of DeSoto County, Mississippi. As a result, recorded water levels in the Sparta Sand under north DeSoto County, Mississippi have been estimated from a USGS model (Arthur and Taylor, 1990) to have declined by up to 90 feet. In a deposition on March 27, 2007 of Charles H. Pickel, a retired MLGW water manager, he confirmed that the cone of depression created by MLGW pumpage extended into northern Mississippi. This current large cone of depression only exists because of the continuous, cumulative increases in groundwater pumping in Shelby County, Tennessee, primarily in MLGW's 170+ commercial wells. Essentially, the ten significant MLGW well field cones of depression overlap forming one, large oval-shaped cone of depression centered in Memphis from which MLGW draws groundwater. **Figure 1** illustrates the area of the larger and somewhat oval-shaped cone of depression that occurs from the cumulative MLGW well field pumping. The Davis, Palmer and Lichterman well fields, which are located near the Mississippi state line, more readily withdraw groundwater out of the Sparta Sand in Mississippi.

Figure 3 is a three-dimensional illustration showing the approximate total area from which the MLGW cone of depression withdraws groundwater. The Arthur and Taylor model shows that Mississippi groundwater has been pulled out of storage and from its natural west/southwest direction of seep and drawn north into Tennessee by the MLGW cone of depression. These conditions were recognized by David Feldman from the University of Tennessee, prompting the publishing of a report titled "Water Supply

Challenges Facing Tennessee: Case Study Analyses and the Need for Long-Term Planning (June 2000), David Lewis Feldman, Ph.D., and Julia O. Elmendorf, J.D." In this report the author states that, at a groundwater pumping rate of approximately 145 MGD from the MLGW cone of depression, 20-40 MGD is taken from beneath DeSoto County, Mississippi. The MLGW cone of depression can also be seen in potentiometric surface contour maps presented by Moore, 1960; Criner and Parks, 1976; and Parks, 1990. Copies of these maps were presented previously in the LBG, April 2014, Update Report On Diversion And Withdrawal Of Groundwater From Northern Mississippi Into The State Of Mississippi.

HYDROGEOLOGY OF SPARTA SAND

There are a number of aquifers and confining units in the northwestern Mississippi and southwestern Tennessee area. The major aquifers are the Sparta/Memphis Sand and the Fort Pillow Sand. The Sparta Sand is a distinct geological formation and primary source of groundwater in northwest Mississippi and Shelby County, Tennessee. **Figure 4** is a generalized hydrogeologic cross section showing the Sparta Sand and lower Fort Pillow confined aquifers.

The Sparta Sand is a thick, variable sand and sandstone formation made up of fine to very coarse sand with lenses of clay and silt (Graham and Parks, 1986). In north Mississippi, the Sparta Sand occurs at a depth of 0 to 600 feet, and varies in thickness between 200 to 900 feet. The formation is thinnest at outcrops at or near the surface in the eastern Shelby County and northwestern Fayette County, Tennessee, and in north Mississippi beginning in east Marshall County. The outcrops continue in a north and south strike along the edge of the Mississippi Embayment in both states. An outcrop is defined as the location where a laterally extensive dipping subsurface rock formation is exposed at or near land surface. **Figure 5** shows the outcrop area of the Sparta Sand. The formation descends from the outcrops. Getting progressively thicker, and is thickest near the Mississippi River in Shelby County, Tennessee, and in DeSoto County, Mississippi. Within north Mississippi and along the common border with Tennessee, the Sparta Sand formation has a dominant, gentle dip from eastern outcrops to the west/southwest across north Mississippi and Tennessee to the Mississippi River.

The Sparta Sand is confined above by the Jackson Formation and the upper part of the Claiborne Group which consist primarily of clay, silt and fine sand. This serves as a confining bed retarding vertical groundwater flow between the unconfined Surficial aquifer above and the Sparta Sand. Except in areas where the upper confining bed is breached, it protects the high quality of the stored water from surface pollution. The thickness of this confining bed is variable in the Tennessee and northwestern Mississippi areas, ranging from 0 to 360 feet (Graham and Parks, 1986). The Flour Island Formation is a confining bed consisting primarily of silty clay and sandy silt that underlies the Sparta Sand and separates it from the deeper Fort Pillow Sand. The Fort Pillow Sand is comprised of fine to medium-grained sand in the subsurface throughout the Memphis

area and is the second most used aquifer by MLGW. The Sparta Sand formation has allowed the transmission and accumulation of high quality water stored under hydrostatic pressure over a long period time within each states border.

The Sparta Sand is one of the principal and most productive aquifers in Shelby County, Tennessee, and northwestern Mississippi. It is reported that the aquifer provides about 95 percent of the water used for all municipal and industrial water supplies in the Memphis area. Aquifer is defined as: A subsurface geologic formation capable of storing and transmitting usable amounts of water. This sandstone formation is saturated and stores groundwater collected over thousands of years, and very slowly transmits usable amounts of water within the formation, classifying it as an aquifer. The primary source of any new groundwater for collection and storage in the Sparta Sand is the recharge that occurs from rainfall. This groundwater recharge generally occurs east of Shelby County, Tennessee, east of Memphis, and in east Marshall County, Mississippi at the outcrop areas as shown on **Figure 5**. Within this outcrop belt, recharge occurs by infiltration of rainfall directly into the Sparta formation or by downward seepage of water from the overlying Surficial aquifer. **Figure 6** is a 3-dimensional diagram showing a cross-section of the hydrogeologic formations in the Memphis and northwestern Mississippi area. This diagram shows that the formations are dipping generally from east to west and the Sparta outcrop occurs in the eastern portion of the area. As rain falls on the outcrop area of the Sparta it slowly percolates downward and then under gravity and the weight of the water accumulated above it in the formation slowly provides recharge as it seeps through the tiny pore spaces of the sandstone down gradient following the dip of the formation in a slightly west to southwesterly direction under natural conditions. The groundwater recharge is exceedingly slow under natural conditions seeping through the sandstone at a rate of about 1 inch per day. At this rate, groundwater naturally collected resides in the Sparta Sand for thousands of years as it gradually moves down gradient towards the Mississippi River. **Figure 7** is an idealized hydrogeologic section from east to west across the Mississippi Embayment that shows the general relationship between the aquifers, confining units, topography and general flow patterns (Arthur & Taylor, 1998). Water levels in the aquifer outcrop areas on the eastern side of the embayment are higher than on the western side of the embayment due to higher land

surface altitudes. The Middle Claiborne aquifer, where the Sparta Sand occurs underlies the Mississippi Alluvial Plain near the Mississippi River, where the water level is lower than the outcrop areas as shown on **Figures 7 and 8** (Arthur& Taylor, USGS,1990). As a result of these water-level differences in the potentiometric surface, water naturally moves from the outcrop areas on the eastern side of the embayment westward through the aquifer, then eventually upward through the confining units into the Mississippi River Alluvial aquifer. The eastern boundary of Mississippi Alluvial Plain aquifer in western Mississippi which overlies the Middle Claiborne aquifer runs north-south in northwest Mississippi as shown on **Figure 8** (Arthur& Taylor, USGS, 1990) and receives discharge from the Middle Claiborne aquifer. This causes potentiometric surface levels to equilibrate in a north-south direction through northwest Mississippi forcing groundwater to flow east to west from the recharge area on the east side of Mississippi Embayment in northwestern Mississippi under pre-development conditions. As a result, structural geology in northwest Mississippi influences the shape of potentiometric surface contours and direction of groundwater flow, which is westward.

Figure 9 shows the pre-development potentiometric surface under natural conditions generated from groundwater modeling and shows this generally east to west/southwest groundwater directional movement perpendicular to the contours in northwest Mississippi consistent with information presented by Arthur & Taylor of the USGS. As shown on **Figure 9** in blue, all but a very small portion of groundwater flow in northern Mississippi stays in Mississippi under pre-development conditions until its natural discharge at the Mississippi River Alluvial aquifer system near the river. Only a very small area in northeastern DeSoto County has groundwater flow entering Tennessee under pre-development conditions as shown in green in **Figure 9**.

HYDROLOGIC EVALUATIONS

Background Conditions

Groundwater conditions can be affected by a number of things that include climatic conditions, hydrogeologic characteristics and pumping from wells. For the purposes of this evaluation, pumpage from Shelby County, Tennessee wells, primarily in MLGW's well fields, has the greatest impact on Mississippi groundwater conditions. This is shown by an evaluation of available hydrologic data.

As discussed in the **BACKGROUND** section of this report, Memphis began using the Sparta Sand as its municipal water supply in 1886. There is no data to suggest that the initial usage had any impact on Mississippi groundwater. However, by the 1970s, available data shows that MLGW pumpage began increasing significantly from year to year, and by the late 1990s total Shelby County pumpage had increased to a rate of approximately 200 MGD (Brahana & Broshears, 2001). Approximately 75% of the pumpage was from MLGW wells. The continual increase in groundwater withdrawals in the Memphis area has drawn out groundwater faster than recharge is possible, lowering the potentiometric surface of the aquifer and pressure within the formation, and changing the groundwater flow direction and hydraulic gradients which are represented by the cone of depression. This has resulted in a long-term decline in groundwater levels in the Sparta Sand. This groundwater level condition is observed in hydrographs from observation wells monitored by the Tennessee USGS. Hydrographs were developed from actual water-level measurements collected in the field by USGS personnel and presented in the LBG, May 2007 Report On Diversion Of Ground Water From Northern Mississippi Due To Memphis Area Well Fields. These hydrographs show that water levels have declined from approximately 20 to 50 feet in these area observation wells since 1958. **Figure 10** included in this report contains two hydrographs representative of those presented previously in the LBG May 2007 report.

The USGS has also prepared groundwater elevation maps of the potentiometric surface for the Sparta Sand that shows the declining water-level conditions across the southwest Tennessee and northwest Mississippi. The potentiometric surface is the groundwater level that water in an aquifer will rise to in a tightly cased well.

Potentiometric surface maps illustrate the groundwater hydraulic gradient across a given area. Potentiometric surface maps were prepared for the following years; 1960, 1970, 1980, 1988, 1990, 1995, 2000 and 2005 and are presented in the May 2007 LBG report. **Figure 11** shows the potentiometric surface for year 2000, which has a similar and representative pattern as the potentiometric surface for the other seven years. As with the hydrographs, the potentiometric surface maps are based on actual water-level measurements. Water levels in the Sparta Sand in Shelby County, Tennessee, have declined by approximately 100 feet since 1886 forming a large cone of depression. Water levels in the Sparta Sand under northern DeSoto County, Mississippi have been estimated from a USGS model developed by Arthur and Taylor, 1990, to have declined by up to 90 feet.

These potentiometric surface maps provide information regarding groundwater hydraulic gradient showing the flow direction which is always perpendicular to contours. While the natural movement of the groundwater in the Sparta Sand is east to slightly southwest, the recent potentiometric maps all show that the groundwater flow in northwest Mississippi is now drawn radially to the north toward the center of Memphis where the lowest water levels are observed in the aquifer. This large cone of depression seen on **Figure 11** has been created by the cumulative groundwater pumping (hundreds of wells) in Tennessee, primarily from the MLGW well fields.

Groundwater Modeling Simulations

The Brahana and Broshears (2001) model has been for this for these diversion evaluations because it includes both the Sparta Sand and contributing aquifers in Shelby County including the Fort Pillow aquifer. A detailed description of the groundwater flow model prepared by the USGS;

> ***Hydrogeology and Ground-Water Flow in the Memphis and Fort Pillow Aquifers in the Memphis Area, Tennessee, Water-Resources Investigations Report 89-4131 by J.V. Brahana and R.E. Broshears. U.S. Geological Survey. 2001.***

was presented previously in the May 2007 and April 2014 LBG reports. Following is a brief summary description of the model.

This is a regional groundwater model constructed by Brahana and Broshears to determine changes in regional flow from pre-development time to 1980 due to changes in pumpage in Sparta/Memphis Sand and Fort Pillow aquifers. The report includes the hydrogeology of the Sparta Sand and the Fort Pillow aquifers in the Memphis, Tennessee and northwestern Mississippi area. The model grid consists of three-layers, which are, from top to bottom: a) Fluvial Deposits; b) Sparta Sand Aquifer; and c) Fort Pillow Aquifer. The model is a transient groundwater model with hydrologic data from 1886 to 1980. The model was developed using the USGS finite difference groundwater flow code, MODFLOW (McDonald and Harbaugh, 1988). For our analysis, water-level conditions of the Sparta Sand were of primary interest.

Pre-development simulation was conducted by turning off the well package of MODFLOW. **Figure 12** included in this report**,** shows the model-computed potentiometric surface of the Sparta/Memphis Sand aquifer prior to 1886, which is considered to represent pre-development or pre-pumping conditions. This figure shows that the pre-development groundwater flow direction for the Sparta Sand was generally from east to west/southwest toward the Mississippi River in Mississippi. This pre-development potentiometric surface map was presented by Brahana, 2001 and has been published by others who have performed hydrologic analyses in the region. Post-development modeling scenarios were initially conducted from 1924 to 1980. The post-development includes changes in hydraulic stress due to pumpage in the Sparta Sand and Fort Pillow aquifers. **Figure 13** contained in this report, shows the potentiometric surface at the end of the 1980 stress period in the Sparta/Memphis Sand aquifer. During the post-development stage, i.e., in the year 1980, the potentiometric surface in the Memphis area was significantly altered due to pumpage in the Sparta/Memphis Sand aquifer as evidenced by the shapes of the contours on the figure. The “bull’s-eye” areas in the figure are indicative of significant drawdown or cones of depression. The bending of the potentiometric contours in northwest Mississippi (DeSoto County) indicates that groundwater pumpage occurring in the Memphis area is affecting groundwater flow conditions in DeSoto County. This same effect on groundwater levels in northwest

Mississippi can be seen from work performed by others including Arthur and Taylor, 1990; Kinley, 1993; and Outlaw, 1994. Information on these groundwater levels and flow conditions was presented previously in the May 1007 and April 2014 LBG reports. All of the information contained in these sequential reports confirms a cone of depression originating under MLGW well fields and extending south into northwest Mississippi. A comparison of **Figure 12**, pre-development potentiometric surface vs **Figure 13,** 1980 potentiometric surface, the cone of depression shows that the groundwater flow direction has been altered and groundwater is continues to be diverted from its natural path in Mississippi northward into Tennessee due to the Memphis pumpage.

Since the original Brahana and Broshears model was developed only through 1980 it was determined to update the model in order to evaluate more current conditions. These updates were accomplished in both the May 2007 and April 2014 LBG reports. For this report, it was decided to further update the model. In order to further update the model, pumpage data was obtained from MLGW and the Mississippi DEQ. **Table 1** lists the historical pumpage from the MLGW well fields from 1965 through 2016. **Table 2** lists the historical pumpage for both MLGW and Desoto County, Mississippi. The model was then further updated through 2016 by including several additional stress periods. Drawdown and potentiometric surface maps for 2013 through 2016 are shown respectively, on **Figures 14 – 21** using the updated model. These maps are similar to potentiometric surface maps presented previously, which are based on actual water-level data collected by the USGS. These comparisons provide additional confidence in the updated model.

Groundwater drawdown at the end of each modeled stress period was determined by subtracting the groundwater heads after each stress period from the pre-development groundwater heads. There is a slight decrease in drawdown from 2013 through 2016 as shown in **Figures 14-17**. The shapes of the drawdown contours in these maps are similar to the shapes presented in the two previous LBG report in May 2007 and April 2014. In the Memphis area, drawdown in some places was as much as 100 feet in the Sparta Sand. These drawdown figures show the extent of the cone of depression formed in the Sparta Sand as a result of the groundwater pumpage which continues to be mostly by MLGW. The drawdown contours in the Sparta Sand tend to be longitudinally oriented, between

the Mississippi River and the aquifer outcrop in the east. Due to the higher heads of the Mississippi River (simulated in the model as a constant head in layer -1), an effective hydrologic boundary is created that prevents the drawdown cone of depression from moving past the river into Arkansas. The Sparta Sand outcrops to the east in Tennessee and Mississippi, and in many places it gets direct recharge from precipitation, keeping the cone of depression from moving further out in the east. The cone of depression on all of these drawdown maps shows that the natural groundwater flow has been diverted from Mississippi to the Memphis area of Tennessee due to Memphis pumpage.

Potentiometric surface maps for 2013 through 2106 using the updated model are shown on **Figures 18 – 21**. The shapes of the potentiometric surface contours in these maps are similar to the shapes presented in the two previous LBG report in May 2007 and April 2014. A comparison of **Figure 12**, pre-development potentiometric surface vs **Figures 18 - 21,** shows that the groundwater flow direction continues to be altered and groundwater is being, and will continue to be, diverted northward from Mississippi into Tennessee due to the Tennessee pumpage.

Groundwater Budget Analysis

A groundwater budget analysis was conducted using the updated Brahana and Broshears model which includes the time period from 2013 through 2016. The groundwater budget represents the components of inflows, outflows and changes in storage to the aquifer. Groundwater budget analysis for the Memphis area was conducted using the same U.S. Geological Survey MODFLOW model (Brahana and Broshears, 2001). Once the model simulations were completed the cell-by-cell flow data for each of the zones was calculated for a specified time interval, which provides the amount of inflow and outflow such as pumping wells, constant heads, and storage out and into the county. The groundwater budget also provides amount of net flow being contributed by one county to another county due to stress in the system such as pumping wells. The net flow indicates the difference of flow from the developmental conditions to pre-development conditions (i.e., prior to any pumpage).

The focus of the budget analysis was to determine the net groundwater flow to the Shelby County, Tennessee area, from DeSoto and Marshall Counties, Mississippi.

Figure 22 included in this report shows a plot of net flow of groundwater to the Shelby County area under the influence of MLGW pumpage. The contribution or diversion of groundwater to Shelby County, Tennessee, from DeSoto and Marshall Counties has steadily increased with time as MLGW pumpage increased. From both **Figure 22 and Table 3**, in 1965 the diversion from DeSoto and Marshall Counties was 12.9 MGD, whereas in 1988 the diversion was 27.2 MGD. This increased flow from DeSoto and Marshall Counties to Shelby County is attributed to an increase in pumpage from the MLGW wells. The high pumpage creates a cone of depression that stretches as far south as DeSoto County with pronounced drawdown near the political boundary between Shelby County and DeSoto County. Some of the largest well fields of Shelby County, such as Davis and Lichterman well fields operated by MLGW are very close to the state boundary between Tennessee and Mississippi, causing significant drawdown and groundwater flow from DeSoto County to Shelby County, Tennessee. Moore in 1960 also presented a groundwater budget for the Memphis area. His analysis, which was based on 1960 data, shows that 25 MGD of groundwater is derived as underflow through the Sparta Sand from Mississippi. The results depicted in **Figure 22** are in the same range of values reported by Moore in 1965, Criner in 1964, Feldman in 2000, Gentry in 2000 and Arthur in 2006.

After 1988 to the current (2016), the contribution from DeSoto and Marshall Counties to Shelby County decreased to 13.5 MGD. This decrease can be observed on **Figure 22 and Table 3**. Even though pumpage in Shelby County increased during most of this period from approximately 143 MGD to a high of approximately 162 MGD as shown in **Table 1**, the decrease in contribution from DeSoto and Marshall Counties likely resulted from increases in pumpage from DeSoto County, which reduces the amount of groundwater available to flow into Shelby County. Upon further review of **Table 2**, MLGW pumpage has been on a decreasing trend from approximately 150 MGD in 2006 to approximately 124 MGD in 2016. **Table 2** also shows a steady increase in pumpage from DeSoto County. The decrease in pumpage from MLGW and increases in pumpage from DeSoto County explain the shape of the plot in **Figure 22**. However, with these pumpage changes, groundwater is still being diverted from the Mississippi flow path into Shelby County, Tennessee from MLGW pumpage. In fact, the total volume of

groundwater taken from Mississippi due to MLGW pumpage since 1965 is calculated to be approximately 411.9 billion gallons.

It is our opinion that based on our hydrologic evaluation and from the review of technical reports, groundwater pumpage from the MLGW has created a large cone of depression that has altered natural groundwater flow paths in the Sparta Sand in northwest Mississippi, and as a result is diverting, and will continue to divert, and take groundwater from Mississippi that only naturally occurs within the state of Mississippi. The Mississippi groundwater gradient in the Sparta Sand has been altered from its natural generally east to west/southwest flow direction to a northerly direction. **Figures 23 and 24** are potentiometric surface maps for pre-development and 2016, respectively. Each of these maps also shows groundwater flow direction. The pre-development flow direction shown in **Figure 23** in northwestern Mississippi is generally from east to west/southwest in Mississippi with a very small flow component into Tennessee. The 2016 flow direction in **Figure 24** shows that the natural flow has been significantly changed and diverted towards Tennessee as a result of MLGW pumpage.

CONCLUSIONS

The primary purpose of our investigation as presented in this report is the evaluation of the effects on natural groundwater flows and availability in northwestern Mississippi caused by the unregulated groundwater pumpage in Shelby County, Tennessee, primarily by MLGW, which has been taking groundwater from Mississippi for decades without permission. This update evaluation included the review of existing technical reports and hydrologic data from the USGS, University of Memphis GWI, MLGW and the MDEQ and the performance of calculations to determine the volume of groundwater that is diverted from its natural flow in Mississippi by pumping in the Memphis, Tennessee area, focusing on MLGW through 2016. These calculations were performed using the existing groundwater flow model developed by the USGS and updated previously by LBG in May 2007 and April 2014.

It is clear from our review of a number of technical reports described previously that a large cone of depression of the potentiometric surface for the Sparta/Memphis Sand aquifer has been created by the groundwater pumpage in the Memphis, Tennessee area. Most of this pumpage that is diverting Mississippi's groundwater is attributable to MLGW. This cone of depression extends into northern Mississippi and has altered the groundwater gradient. The groundwater gradient of the Sparta Sand has been altered from its natural east to west/southwest flow direction and diverted to a northerly direction by this continued pumping. This finding is also confirmed from our review of water-level data associated with potentiometric surface maps prepared by the USGS and from groundwater flow modeling. Observations have shown that water levels in the Sparta/Memphis Sand aquifer have declined (dropped) by as much as 100 feet since 1886 forming the center of this large man made cone of depression. This cone of depression had dropped water levels under northern DeSoto County, Mississippi, as estimated by a USGS model (Arthur and Taylor, 1990), by up to 90 feet. In a deposition on March 27, 2007 of Charles H. Pickel, a retired MLGW water manager, he indicated that the cone of depression created by MLGW pumpage extended into northern Mississippi**.** These conditions were recognized by David Feldman from the University of Tennessee prompting the publishing of a report titled **"**Water Supply Challenges Facing Tennessee: Case Study Analyses and the Need for Long-Term Planning (June 2000), David Lewis

Feldman, Ph.D., and Julia O. Elmendorf, J.D." In this report the author states that, at a groundwater pumping rate of approximately 145 million gallons per day (MGD) from the Memphis area a cone of depression is formed and 20-40 MGD is derived from beneath DeSoto County which is located in northwestern Mississippi. The cone of depression of the Sparta Sand can also be seen in potentiometric surface contour maps presented by Moore, 1960; Criner and Parks, 1976; and Parks, 1990.

Groundwater flow modeling was performed for calculating groundwater flow contribution or diversion from Mississippi as a result of Memphis area pumpage. The modeling exercises were performed utilizing the USGS model prepared by Brahana and Broshears (2001). **Table 3** in this report list the diversion volumes calculated from the updated modeling for 1965 through 2016 as a result of the MLGW pumpage that has averaged approximately 21.7 MGD. These quantities are in the same range of values reported by Moore in 1965, Criner in 1964, Feldman in 2000, Gentry in 2000 and Arthur in 2006. From the review of **Table 2** contained in this report, which shows the pumpage amounts from MLGW and DeSoto County, an increase in pumpage from DeSoto County can be observed over time, while a decrease in MLGW pumpage occurred. This corresponds with a decrease in the flow diversion from DeSoto County to Shelby County calculated from the model. As a result, the increased pumpage in DeSoto County and decrease in MLGW pumpage is reducing the amount of groundwater being diverted from the northern Mississippi area.

Based upon the original Brahana Model, potentiometric surface mapping, updated groundwater modeling by LBG, and our review of studies by other reputable scientists and water policy analysts (as discussed herein), it is our opinion that Memphis area pumpage, primarily by MLGW, has altered the natural flow path and created a cone of depression in the Sparta Sand, resulting in the diversion of Mississippi's groundwater. The total volume of groundwater taken from Mississippi due to MLGW pumpage since 1965 is calculated to be approximately 411.9 billion gallons.

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TABLES

Table 1

MEMPHIS LIGHT, GAS AND WATER DIVISION

CITY OF MEMPHIS

Water Pumpage By Stations

Gallons Per Day

1965-2012

	Sheahan	Mallory	Allen	Lichterman	McCord	Davis	Palmer	Morton	LNG	Shaw	TOTAL	Starting	Ending	Monthly	Comments (If not raw pumpage data)
Row	41	41	45	44	33	50	48	33	26	33		Bates #	Bates #	or Yearly	
Column	25	17	21	29	25	17	24	18	26	32					
1965	17,773,000	13,268,000	22,519,000	4,220,000	14,181,000						71,961,000	MLGW 66416		Yearly	Net Pumpage
1966	16,991,000	12,618,000	22,969,000	9,697,000	13,472,000						75,747,000	MLGW 66417		Yearly	Net Pumpage
1967	15,870,000	12,364,000	22,592,000	13,277,000	13,599,000						77,702,000	MLGW 66417		Yearly	Net Pumpage
1968	15,961,000	12,582,000	23,430,000	14,621,000	14,487,000						81,081,000	MLGW 66417		Yearly	Net Pumpage
1969	15,063,000	11,961,000	23,934,000	16,192,000	15,495,000						82,645,000	MLGW 66418		Yearly	Net Pumpage
1970	15,556,000	11,231,000	27,167,000	16,775,000	16,211,000	3,258,000			101,000		90,299,000	MLGW 66418		Yearly	Net Pumpage
1971	18,332,000	12,953,000	25,420,000	15,585,000	15,930,000	7,487,000			151,000		95,858,000	MLGW 66418		Yearly	Net Pumpage
1972	15,927,000	15,973,000	22,024,000	16,373,000	15,491,000	10,204,000	2,801,000		249,000		99,042,000	MLGW 66419		Yearly	Net Pumpage
1973	17,167,583	18,880,000	21,578,667	18,084,333	17,281,583	10,867,333	2,776,333	1,660,000	174,166		108,469,998	MLGW 67682	MLGW 67741	Monthly	
1974	17,579,833	20,101,500	22,193,750	18,142,667	15,353,667	10,617,083	2,944,833	2,354,083	255,750		109,543,166	MLGW 67622	MLGW 67681	Monthly	
1975	18,130,916	19,148,583	21,276,750	17,378,916	19,111,750	11,688,416	3,047,666	160,500	243,833		110,187,330	MLGW 67562	MLGW 67621	Monthly	
1976	19,007,000	20,641,000	19,947,000	18,148,000	18,721,000	11,370,000	3,158,000	3,000	260,000		111,255,000	MLGW 66420		Yearly	Net Pumpage
1977	18,564,000	22,114,000	21,680,000	18,809,000	19,986,000	13,226,000	3,360,000	5,000	268,000		118,012,000	MLGW 66420		Yearly	Net Pumpage
1978	16,055,000	20,785,000	21,316,000	20,517,000	21,086,000	13,779,000	3,545,000	34,000	361,000		117,478,000	MLGW 67562	MLGW 67848	Monthly	
1979	17,419,000	20,294,000	19,867,000	22,645,000	22,164,000	14,125,000	2,869,000	4,000	327,000		119,714,000	MLGW 67831	MLGW 67835	Monthly	
1980	20,744,000	20,953,000	21,591,000	23,151,000	20,700,000	13,262,000	3,186,000	53,000	343,000		123,983,000	MLGW 67818	MLGW 67882	Monthly	
1981	21,229,000	20,375,000	19,305,000	21,633,000	21,556,000	11,526,000	3,425,000	20,000	339,000		119,408,000	MLGW 67805	MLGW 67809	Monthly	
1982	21,465,000	17,526,000	20,508,000	22,524,000	19,124,000	11,591,000	2,850,000	5,618,000	421,000		121,627,000	MLGW 67791	MLGW 67795	Monthly	
1983	22,914,000	17,338,000	20,947,000	22,163,000	17,269,000	12,705,000	179,000	10,874,000	465,000		124,855,983	MLGW 67778	MLGW 67782	Monthly	
1984	20,743,000	18,693,000	21,102,000	21,850,000	20,772,000	12,244,000	724,000	11,091,000	460,000		127,680,984	MLGW 67765	MLGW 67769	Monthly	
1985	20,499,000	21,784,000	23,607,000	21,550,000	20,764,000	11,294,000	255,000	11,402,000	500,274	-	131,655,274	MLGW 0003		Yearly	Net Pumpage
1986	20,310,411	20,834,795	24,906,027	24,151,781	20,575,068	12,620,548	138,904	12,447,671	554,247	-	136,539,452	GWI 013666	GWI 013684	Monthly	
1987	18,876,438	20,218,082	24,590,411	24,483,562	20,714,795	12,785,753	293,425	12,953,425	530,411	-	135,446,301	GWI 013685	GWI 013722	Monthly	
1988	21,445,479	21,059,178	24,733,973	25,466,575	20,743,562	12,714,521	1,681,096	14,218,082	526,849	-	142,589,315	GWI 012946	GWI 013051	Monthly	
1989	19,761,096	19,727,397	21,925,753	24,121,370	20,559,726	11,349,589	3,776,712	13,705,753	397,260	-	135,324,658	GWI 013082	GWI 013208	Monthly	Some Net pumpage used for Nov - MLGW 00005
1990	21,005,205	19,690,959	24,137,260	23,247,945	19,839,178	10,447,671	4,101,644	12,236,712	434,247	5,867,397	141,008,219	GWI 01321	GWI 013384	Monthly	Net pumpage used for Jan - MLGW 00005
1991	20,998,082	20,714,795	21,012,603	21,771,507	18,516,438	10,135,890	5,079,178	10,465,753	393,151	10,983,562	140,070,959	GWI 012341	GWI 012487	Monthly	
1992	20,023,836	20,626,849	20,444,110	21,130,685	19,223,562	9,701,918	5,337,534	10,458,904	423,014	11,872,603	139,243,014	GWI 012490	GWI 012636	Monthly	
1993	19,548,219	20,222,192	21,248,767	21,801,644	18,483,836	9,960,000	4,808,767	12,719,726	497,534	10,325,479	139,616,164	GWI 012639	GWI 012785	Monthly	
1994	20,627,397	15,901,370	21,576,712	21,936,438	17,695,890	11,866,027	4,938,356	14,360,548	477,260	12,982,466	142,362,466	GWI 012787	GWI 012943	Monthly	
1995	20,570,137	16,029,315	22,800,548	21,915,342	17,398,082	12,569,863	4,903,562	17,106,301	529,589	14,177,260	148,000,000	GWI 011938	GWI 012085	Monthly	
1996	20,170,137	17,329,589	22,532,055	21,929,041	17,373,425	14,135,616	4,668,767	18,168,767	515,342	13,058,630	149,881,370	GWI 012087	GWI 012235	Monthly	
1997	19,556,438	15,529,315	22,114,521	21,377,534	15,968,493	14,602,466	4,284,658	16,915,068	444,384	14,880,000	145,672,877	GWI 012239	GWI 012337	Monthly	Net pumpage used for Sept-Dec - MLGW 00009
1998	21,355,068	17,229,863	22,910,137	23,288,767	15,794,795	15,442,466	4,090,411	17,976,986	419,726	17,894,795	156,403,014	GWI 011534	GWI 011631	Monthly	Net pumpage used for Jan-Apr - MLGW 00009
1999	21,441,370	18,560,548	25,246,575	23,447,397	16,404,932	12,718,356	5,067,945	18,886,027	493,425	19,609,863	161,876,438	GWI 011632	GWI 011767	Monthly	Some Net pumpage used - MLGW 00010
2000	21,641,370	17,321,096	24,287,123	22,502,466	17,129,589	13,992,603	4,998,082	19,012,329	369,315	20,854,521	162,108,493	GWI 011773	GWI 011911	Monthly	Net pumpage used for May - MLGW 00010
2001	19,443,014	17,588,767	19,972,329	19,626,575	16,318,904	17,500,548	4,785,205	17,477,260	446,301	20,248,493	153,407,397	MLGW 00011		Yearly	Net Pumpage
2002	18,140,000	17,300,000	22,000,000	18,550,000	15,550,000	19,000,000	4,525,000	18,000,000	475,000	20,983,333	154,523,333	MLGW2 03771 **CD**		Monthly	
2003	15,616,666	15,708,333	22,383,333	18,133,333	16,066,667	19,508,333	5,108,333	18,941,667	334,167	20,100,000	151,900,832	MLGW2 03771 **CD**		Monthly	
2004	15,775,000	16,075,000	21,858,333	17,700,000	16,341,667	19,641,667	5,150,000	18,741,667	400,000	22,666,667	154,350,001	MLGW2 03771 **CD**		Monthly	
2005	15,266,667	17,141,667	21,675,000	19,158,333	17,700,000	20,225,000	3,383,333	18,783,333	558,333	23,000,000	156,891,666	MLGW2 03771 **CD**		Monthly	
2006	16,658,333	16,575,000	21,358,333	19,550,000	17,458,333	20,566,667	4,166,667	18,341,667	358,333	21,200,000	156,233,333	MLGW2 03771 **CD**		Monthly	

Table 2 - Pumpage Amounts From MLGW and DeSoto County

Year	Shelby County (MGD)	DeSoto County (MGD)
1965	72.1	0.90
1966	75.9	0.90
1967	77.8	0.90
1968	81.2	0.90
1969	82.8	0.90
1970	90.5	1.23
1971	96.0	1.23
1972	99.2	1.23
1973	108.7	1.23
1974	109.7	1.23
1975	110.4	4.18
1976	111.4	4.18
1977	118.2	4.18
1978	117.7	4.18
1979	119.9	4.18
1980	124.2	4.18
1981	119.6	4.18
1982	121.8	4.18
1983	125.1	3.60
1984	127.9	3.60
1985	131.9	3.60
1986	136.8	3.60
1987	135.7	3.60
1988	142.8	3.60
1989	135.6	3.60
1990	141.3	3.60

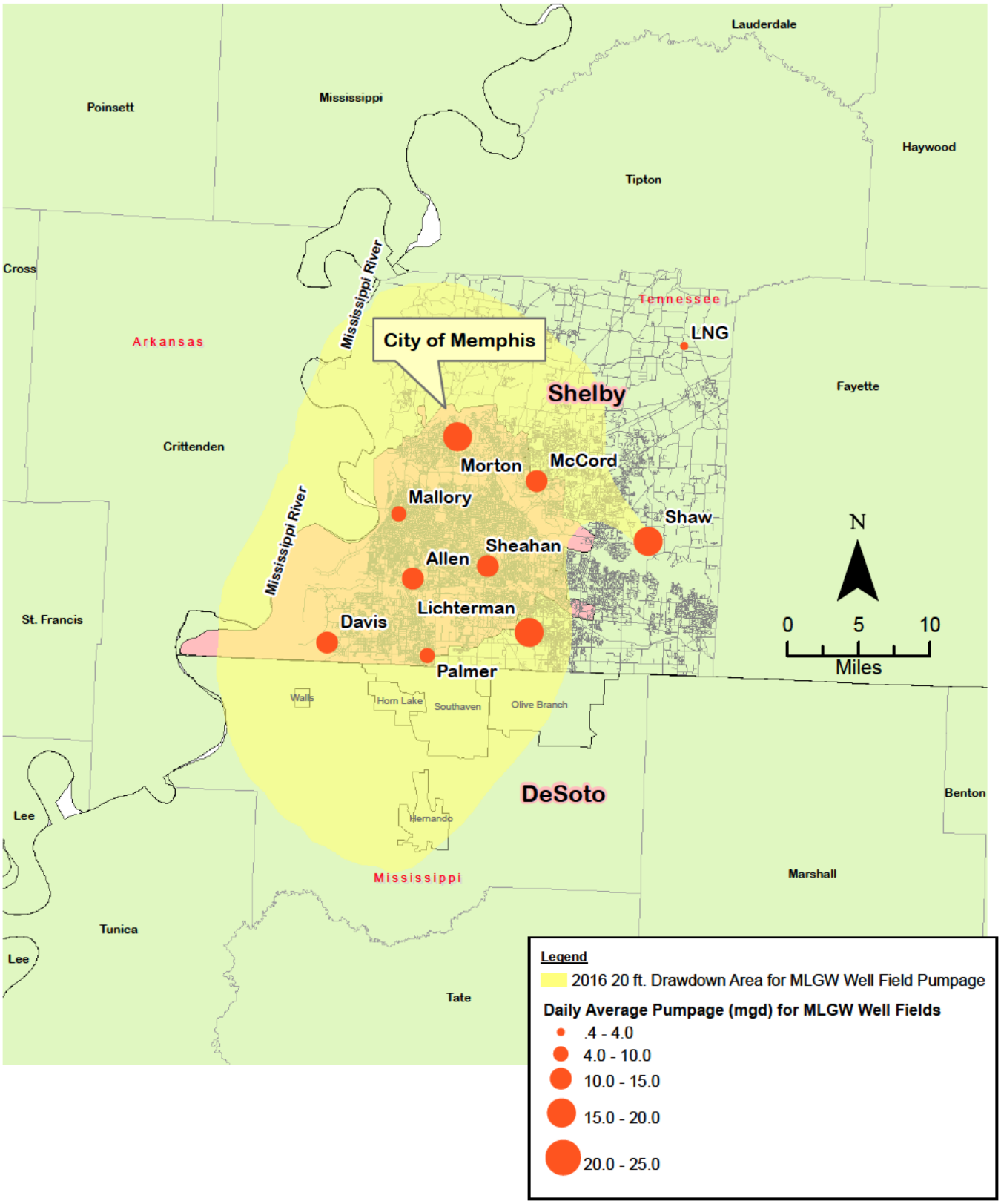
Year	Shelby County (MGD)	DeSoto County (MGD)
1991	140.3	3.60
1992	139.5	3.60
1993	139.9	3.60
1994	142.6	3.60
1995	148.3	13.04
1996	150.1	13.04
1997	145.9	13.04
1998	156.7	13.04
1999	162.2	13.04
2000	162.4	13.43
2001	153.7	13.43
2002	154.8	13.43
2003	152.2	13.43
2004	154.6	13.43
2005	157.2	13.97
2006	149.8	14.47
2007	151.9	11.09
2008	142.6	10.68
2009	135.9	12.44
2010	147.6	14.44
2011	147.6	13.37
2012	140.7	15.31
2013	132.4	18.27
2014	132.3	17.35
2015	125.6	19.83
2016	123.9	19.83

Table 3 - Volume of Groundwater Taken From Mississippi Due to MLGW Pumpage

Year	MGD
1965	12.9
1966	14.5
1967	15.3
1968	16.0
1969	16.5
1970	18.6
1971	19.8
1972	21.1
1973	22.5
1974	22.9
1975	21.8
1976	21.9
1977	23.5
1978	23.6
1979	24.0
1980	25.1
1981	23.6
1982	23.8
1983	23.9
1984	23.9
1985	24.3
1986	25.8
1987	25.6
1988	27.2
1989	25.8
1990	26.1

Year	MGD
1991	25.1
1992	24.5
1993	24.8
1994	25.3
1995	23.1
1996	23.5
1997	22.7
1998	24.3
1999	24.8
2000	24.4
2001	22.9
2002	23.2
2003	23.0
2004	22.9
2005	22.7
2006	21.6
2007	22.3
2008	20.5
2009	18.6
2010	19.8
2011	20.2
2012	18.6
2013	15.7
2014	16.2
2015	14.1
2016	13.5

FIGURES



UPDATE REPORT ON DIVERSION AND WITHDRAWAL OF GROUNDWATER FROM NORTHERN MISSISSIPPI INTO THE STATE OF TENNESSEE

PROJECT AREA

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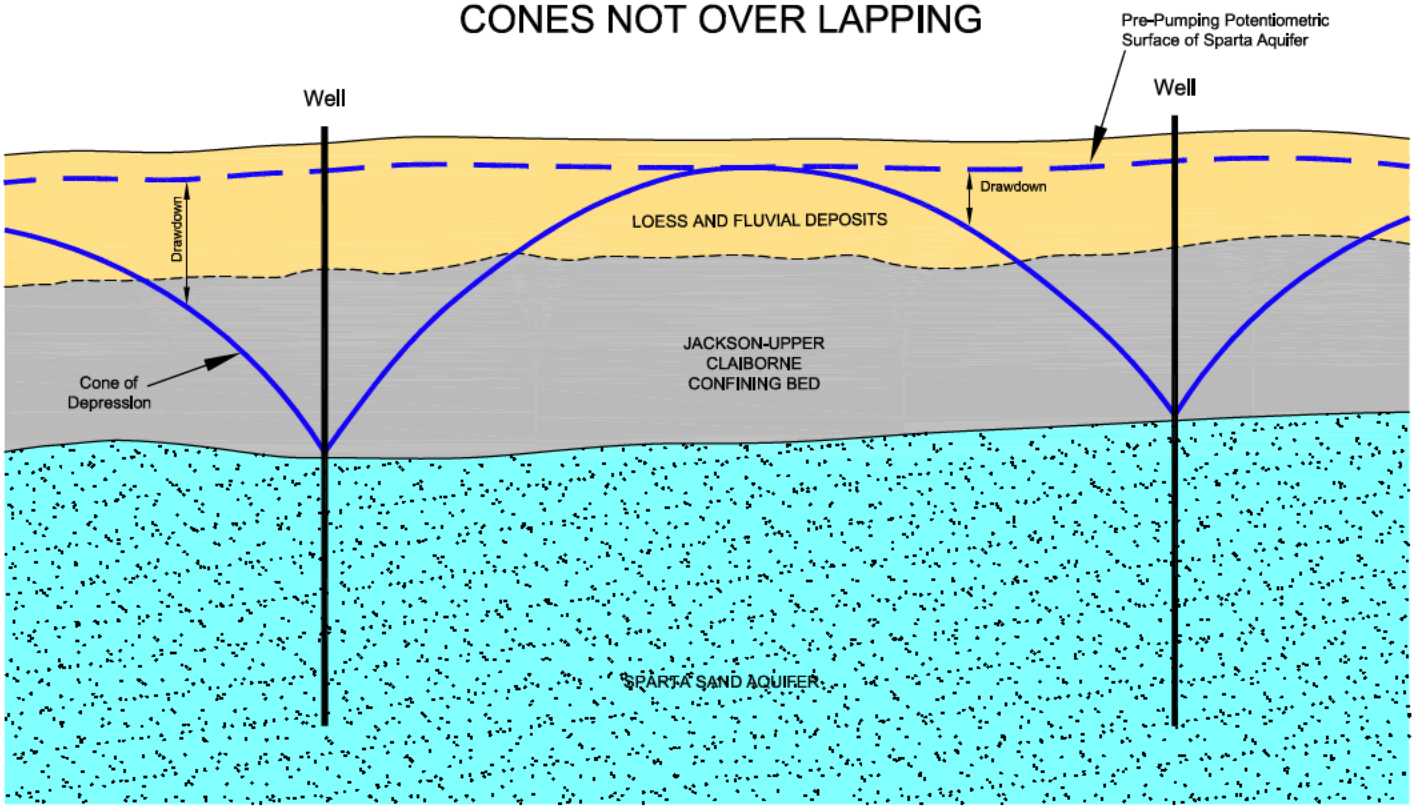
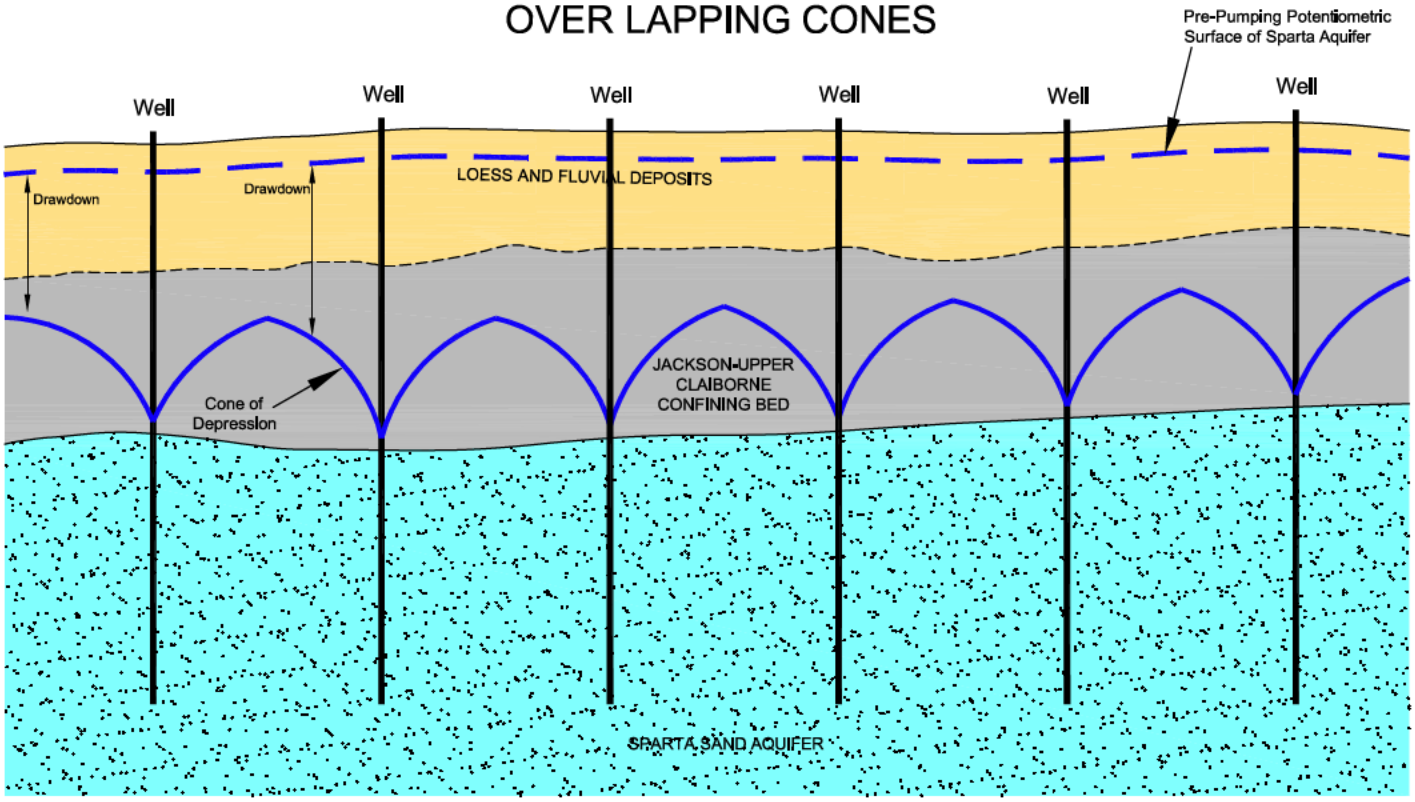
DATE:	June 2017
FILE NAME:	Figure01.MXD
FIGURE NO.:	1

CONES NOT OVER LAPPING



Not to Scale & Vertically Exaggerated

OVER LAPPING CONES



Not to Scale & Vertically Exaggerated

DATE	REVISED			
		UPDATE REPORT ON DIVERSION AND WITHDRAWAL OF GROUNDWATER FROM NORTHERN MISSISSIPPI INTO THE STATE OF TENNESSEE	PREPARED BY: LEGGETTE, BRASHEARS & GRAHAM, INC. Professional Ground-Water and Environmental Engineering Services Cypress Point Office Park 10014 North Dale Mabry Highway - Suite 205 Tampa, FL 33618 (813) 968-5882	DRAWN: TDH
				CHECKED: DAW
		HYDROGEOLOGIC CROSS SECTION SHOWING AN EXAMPLE OF CONES OF DEPRESSION		DATE: Jun. 2017
				FIGURE: 2
FILE NAME: FIGURE02.DWG				

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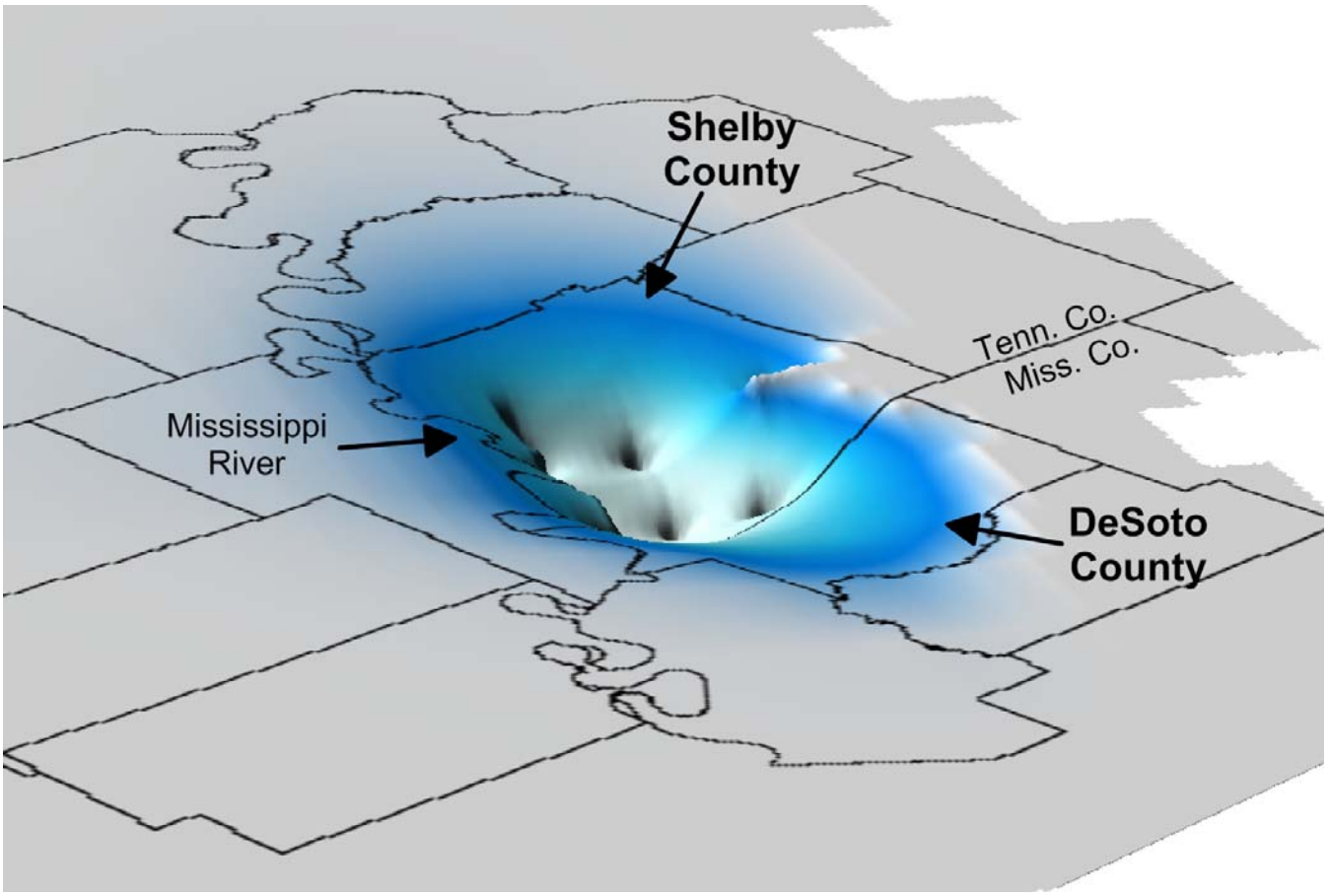

UPDATE REPORT ON DIVERSION AND WITHDRAWAL OF GROUNDWATER FROM NORTHERN MISSISSIPPI INTO THE STATE OF TENNESSEE

THREE-DIMENSIONAL ILLUSTRATION
SHOWING CONE OF DEPRESSION

PREPARED BY:

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FIGURE NO.:	*3*

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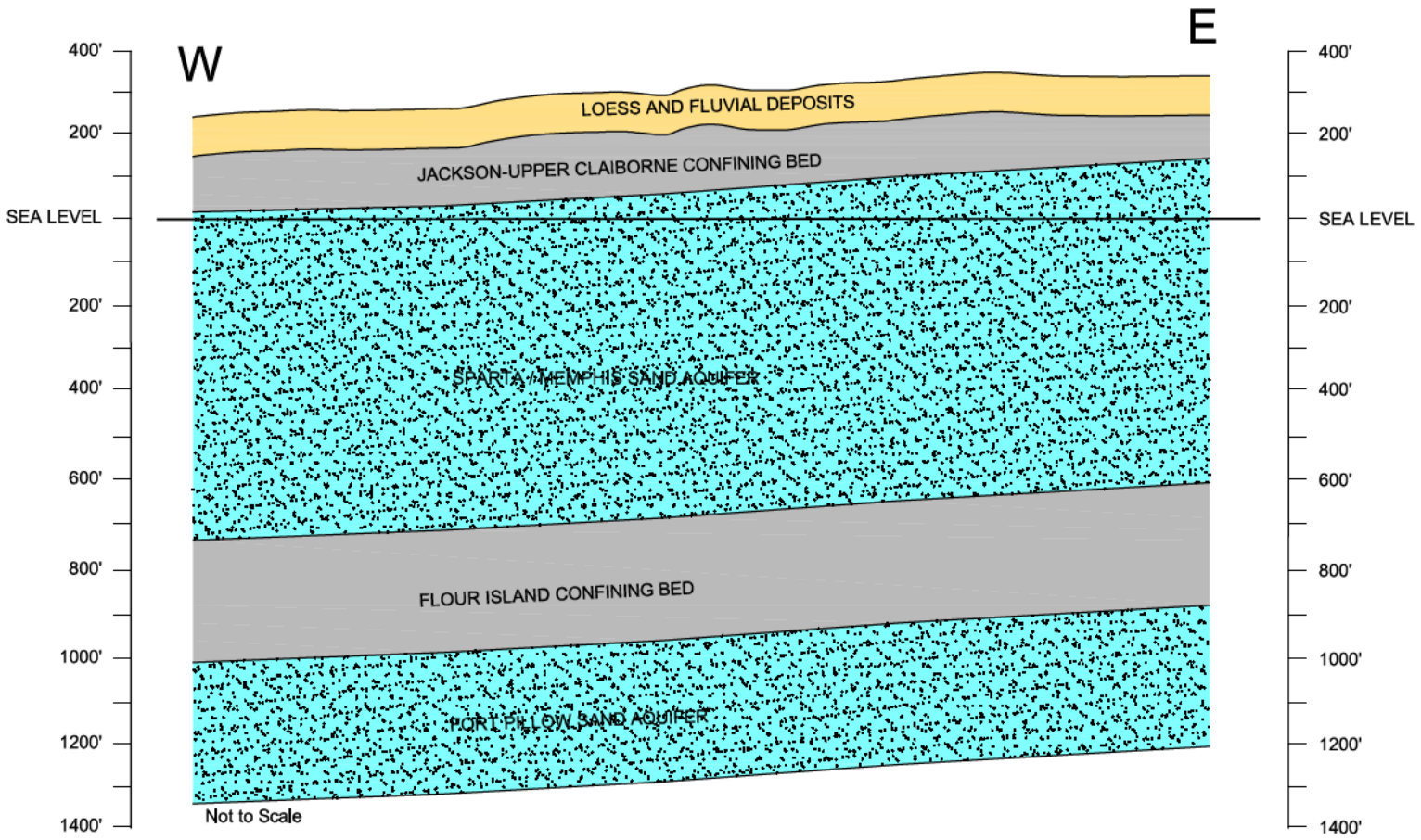

DATE	REVISED
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UPDATE REPORT ON DIVERSION AND WITHDRAWAL OF GROUNDWATER FROM NORTHERN MISSISSIPPI INTO THE STATE OF TENNESSEE

HYDROGEOLOGIC CROSS SECTION SHOWING THE PRINCIPAL AQUIFERS AND CONFINING BEDS IN THE STUDY AREA

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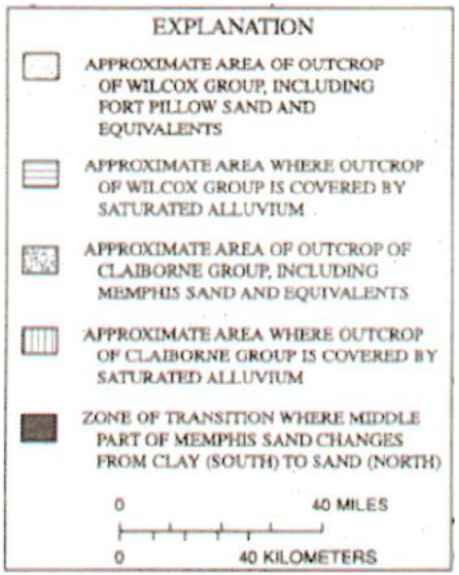
FIGURE:	4



Map of the northern Mississippi Embayment (NME) showing approximate distribution of outcrop and subcrop of the Wilcox and Claiborne group sediments (From Brahana and Broshears, 2001). Dashed line shows trace of cross-section shown in Figure 3.

DATE	REVISED

FILE NAME: FIGURE05.MXD

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UPDATE REPORT ON DIVERSION AND WITHDRAWAL OF GROUNDWATER FROM NORTHERN MISSISSIPPI INTO THE STATE OF TENNESSEE

MAP FROM THE NORTHERN MISSISSIPPI EMBAYMENT

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FIGURE NO.:	5

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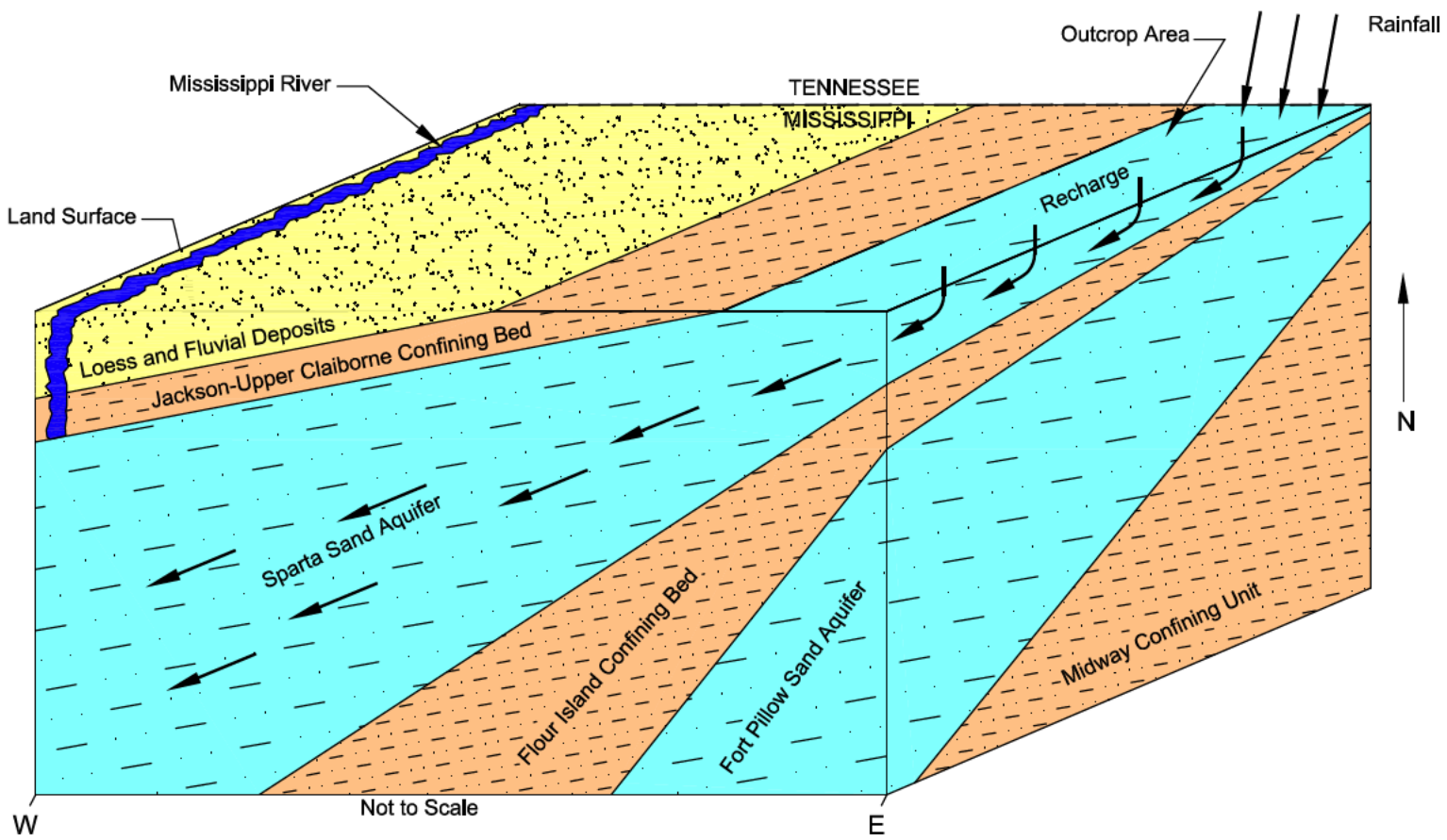

DATE	REVISED
FILE NAME: FIGURE06.DWG	

UPDATE REPORT ON DIVERSION AND WITHDRAWAL OF GROUNDWATER FROM NORTHERN MISSISSIPPI INTO THE STATE OF TENNESSEE

HYDROGEOLOGIC CROSS SECTION ILLUSTRATING RECHARGE AT OUTCROP AND GROUNDWATER FLOW

PREPARED BY:
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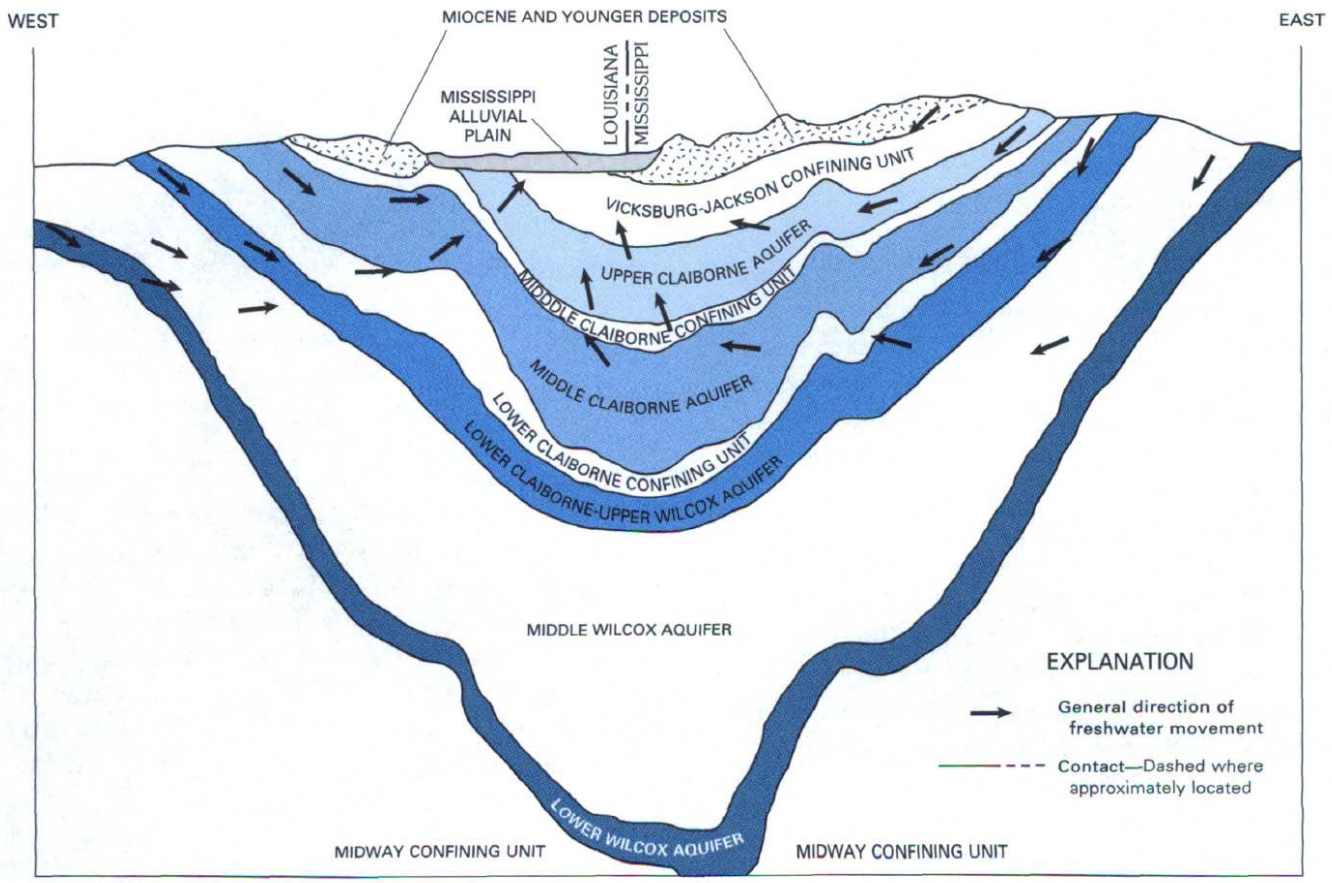
FIGURE:	6



Source: Arthur & Taylor, 1998; USGS Paper 1416-I

UPDATE REPORT ON DIVERSION AND WITHDRAWAL OF GROUNDWATER FROM NORTHERN MISSISSIPPI INTO THE STATE OF TENNESSEE

HYDROGEOLOGIC SECTION OF PRINCIPAL AQUIFERS AND CONFINING UNITS EAST TO WEST THROUGH THE MISSISSIPPI EMBAYMENT WITH GROUNDWATER FLOW DIRECTION

PREPARED BY:

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FILE NAME:	Figure07.MXD
FIGURE NO.:	7

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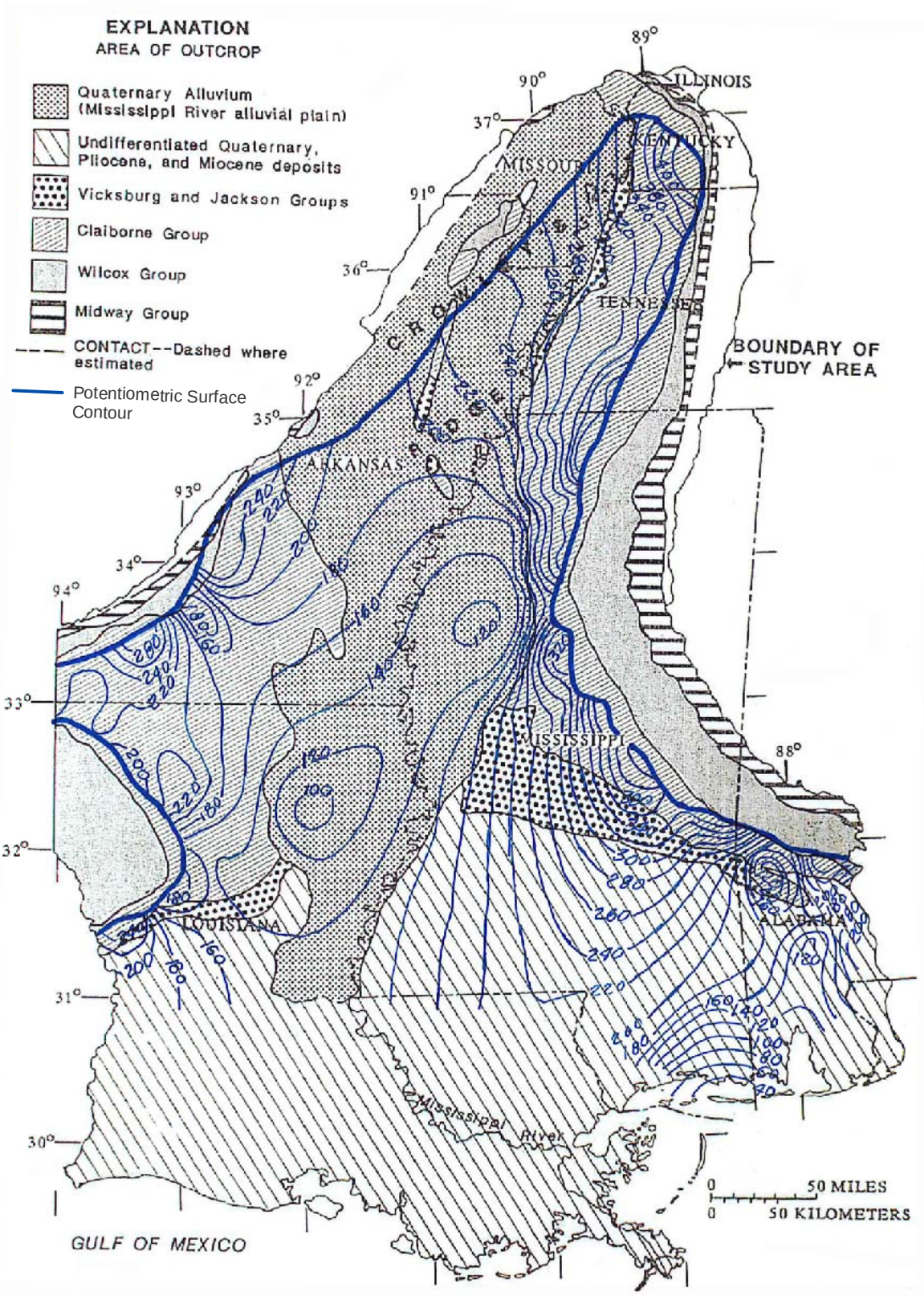

Source: Arthur & Taylor, 1990

UPDATE REPORT ON DIVERSION AND WITHDRAWAL OF GROUNDWATER FROM NORTHERN MISSISSIPPI INTO THE STATE OF TENNESSEE

GENERALIZED GEOLOGY OF ENBAYMENT AND PRE-DEVELOPMENT POTENTIOMETRIC SURFACE OF MIDDLE CLAIBORNE AQUIFER

PREPARED BY:

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FILE NAME:	Figure08.MXD
FIGURE NO.:	8

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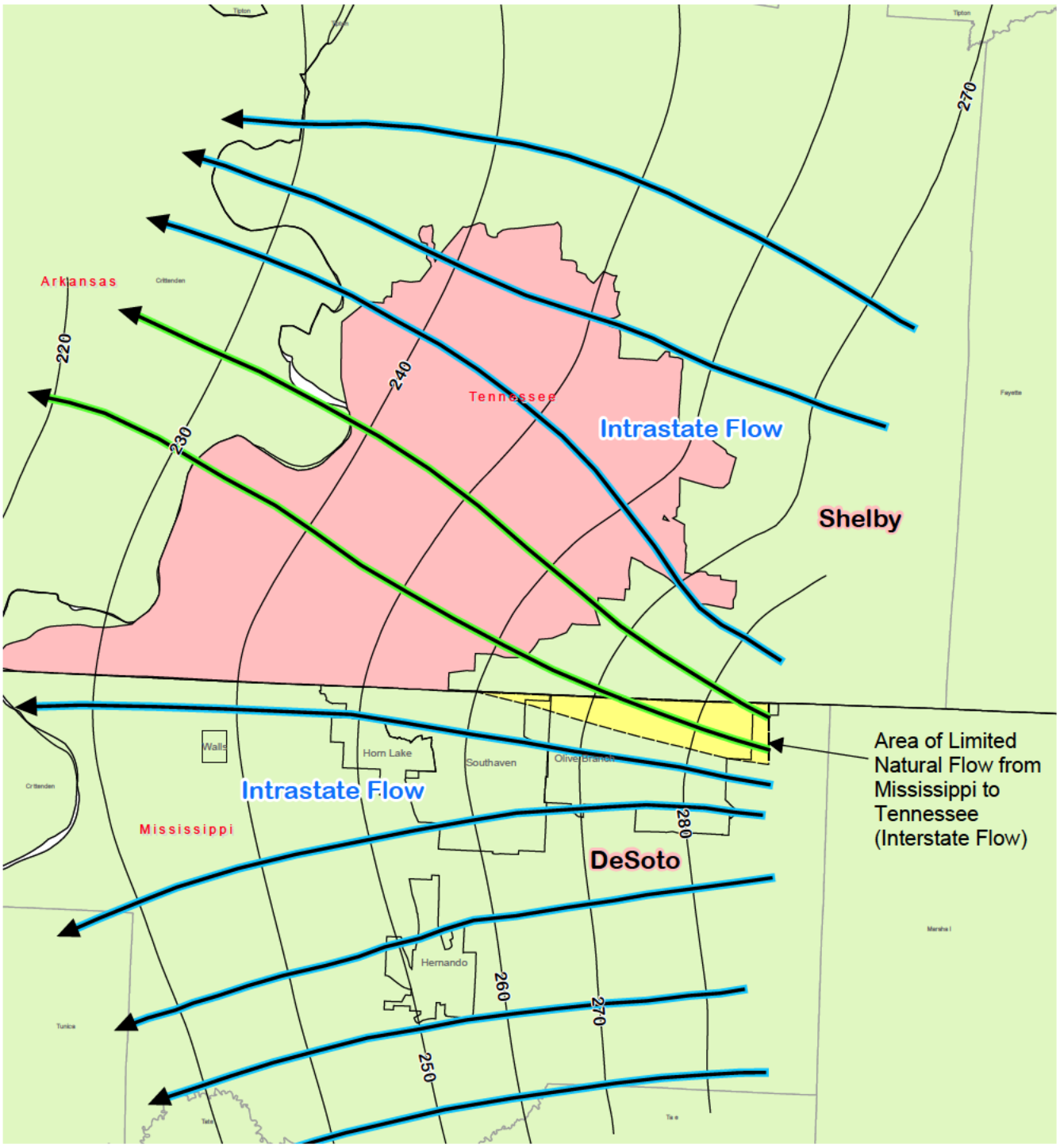

SOURCE: BRAHANA WRI 89-4131

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Miles

Flow Lines Showing Pre-Development Groundwater Flow Direction

Interstate Flow

Intrastate Flow

Potentiometric Surface Contour Lines

UPDATE REPORT ON DIVERSION AND WITHDRAWAL OF GROUNDWATER FROM NORTHERN MISSISSIPPI INTO THE STATE OF TENNESSEE

1886 ESTIMATED POTENTIOMETRIC SURFACE MAP FOR PREDEVELOPMENT CONDITIONS

PREPARED BY: LEGGETTE, BRASHEARS & GRAHAM, INC.

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DATE:	Feb. 2017
FILE NAME:	Figure09.MXD
FIGURE NO.:	9

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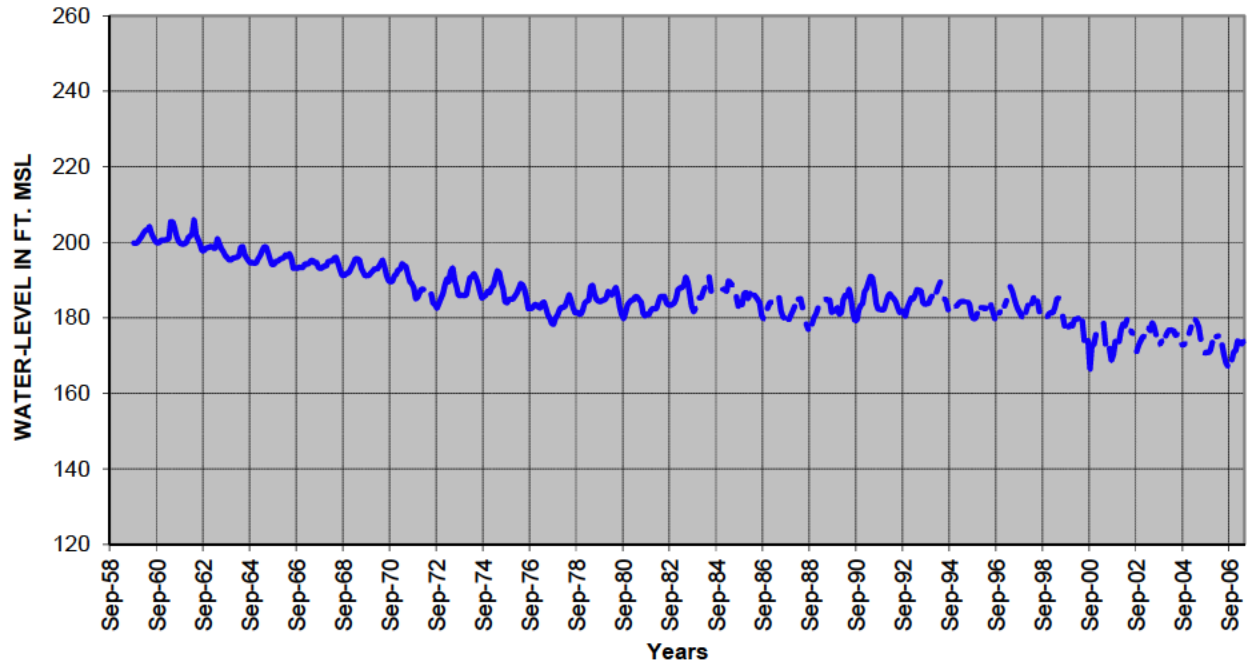
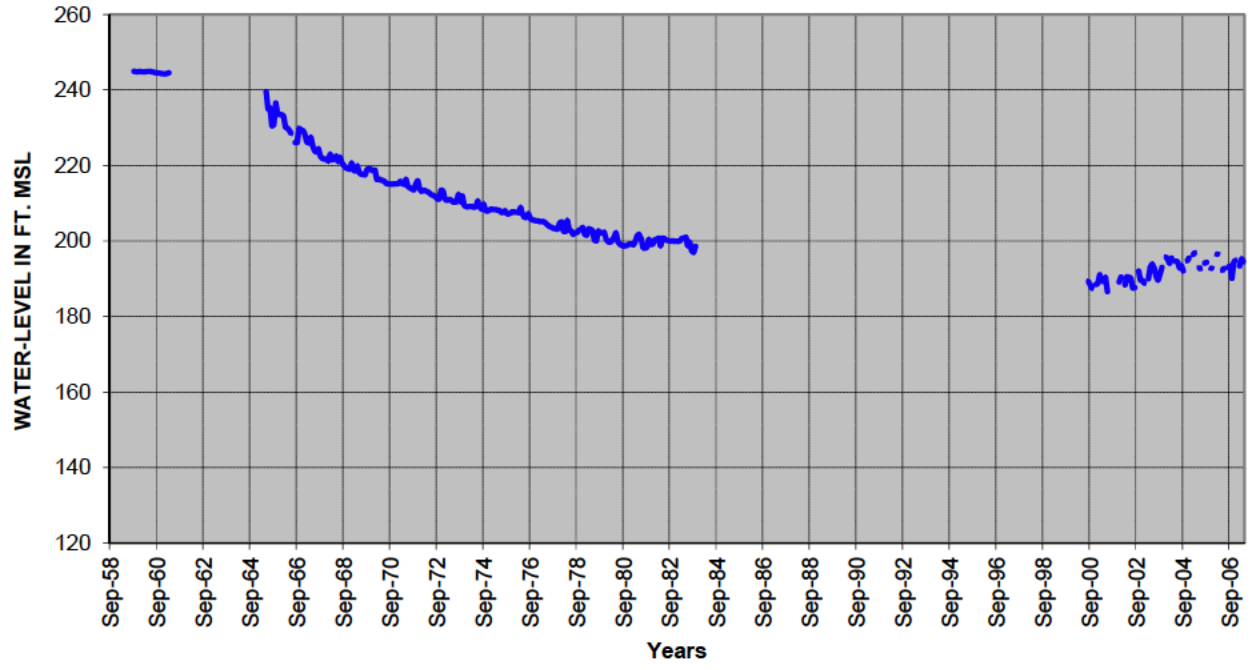
WELL J-1 - SHELBY COUNTY, TN



WELL L-39 - SHELBY COUNTY, TN



UPDATE REPORT ON DIVERSION AND WITHDRAWAL OF GROUNDWATER FROM NORTHERN MISSISSIPPI INTO THE STATE OF TENNESSEE

SPARTA / MEMPHIS SAND AQUIFER HYDROGRAPHS

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DATE:	Jun. 2017
FILE NAME:	Figure10.xls
FIGURE NO.:	10

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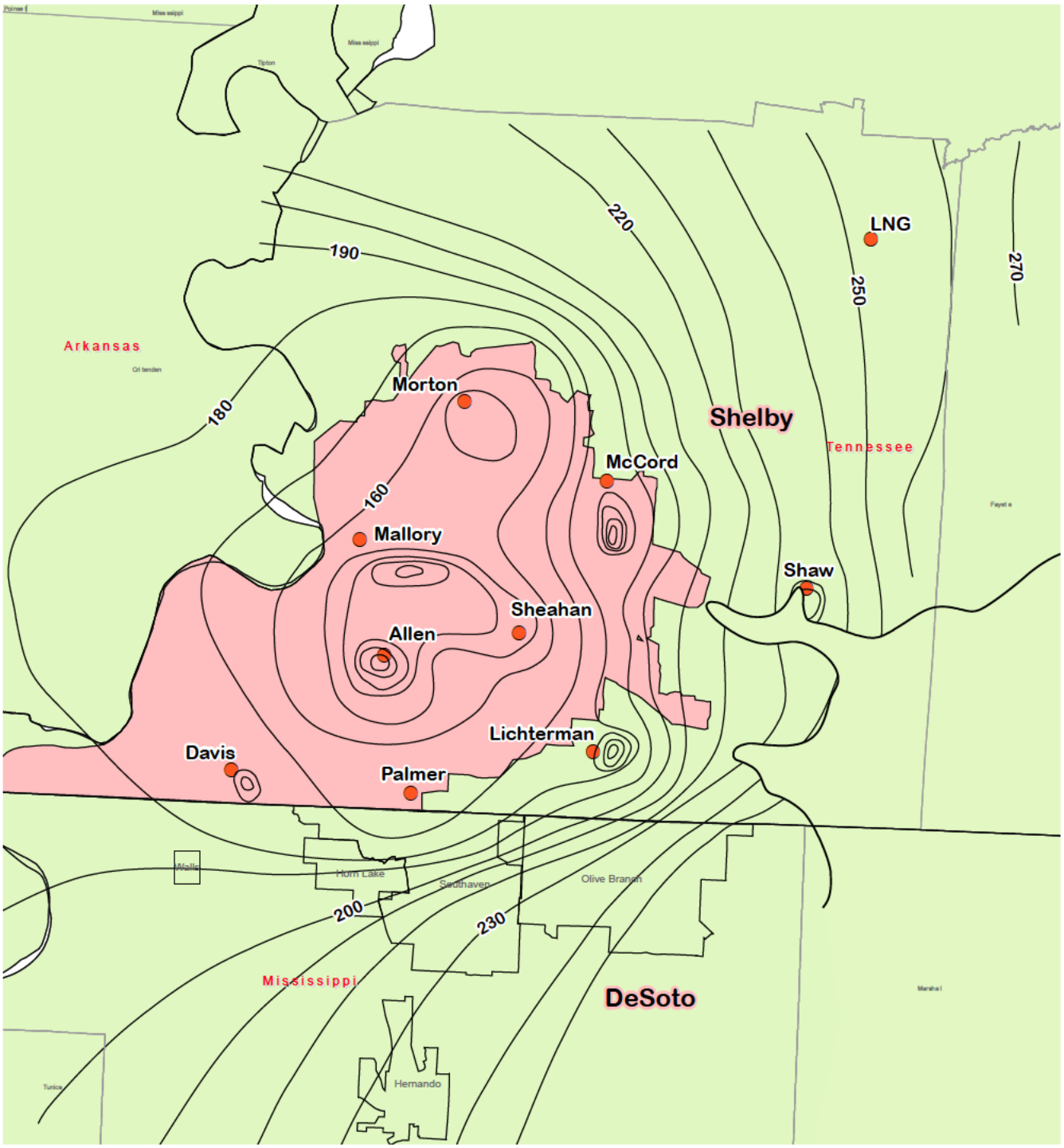

Source: Tenn., USGS

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Miles

Legend

Potentiometric Surface Contour Lines

MLGW Well Fields

UPDATE REPORT ON DIVERSION AND WITHDRAWAL OF GROUNDWATER FROM NORTHERN MISSISSIPPI INTO THE STATE OF TENNESSEE

USGS 2000 POTENTIOMETRIC SURFACE MAP

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DATE:	Jun. 2017
FILE NAME:	Figure11.MXD
FIGURE NO.:	11

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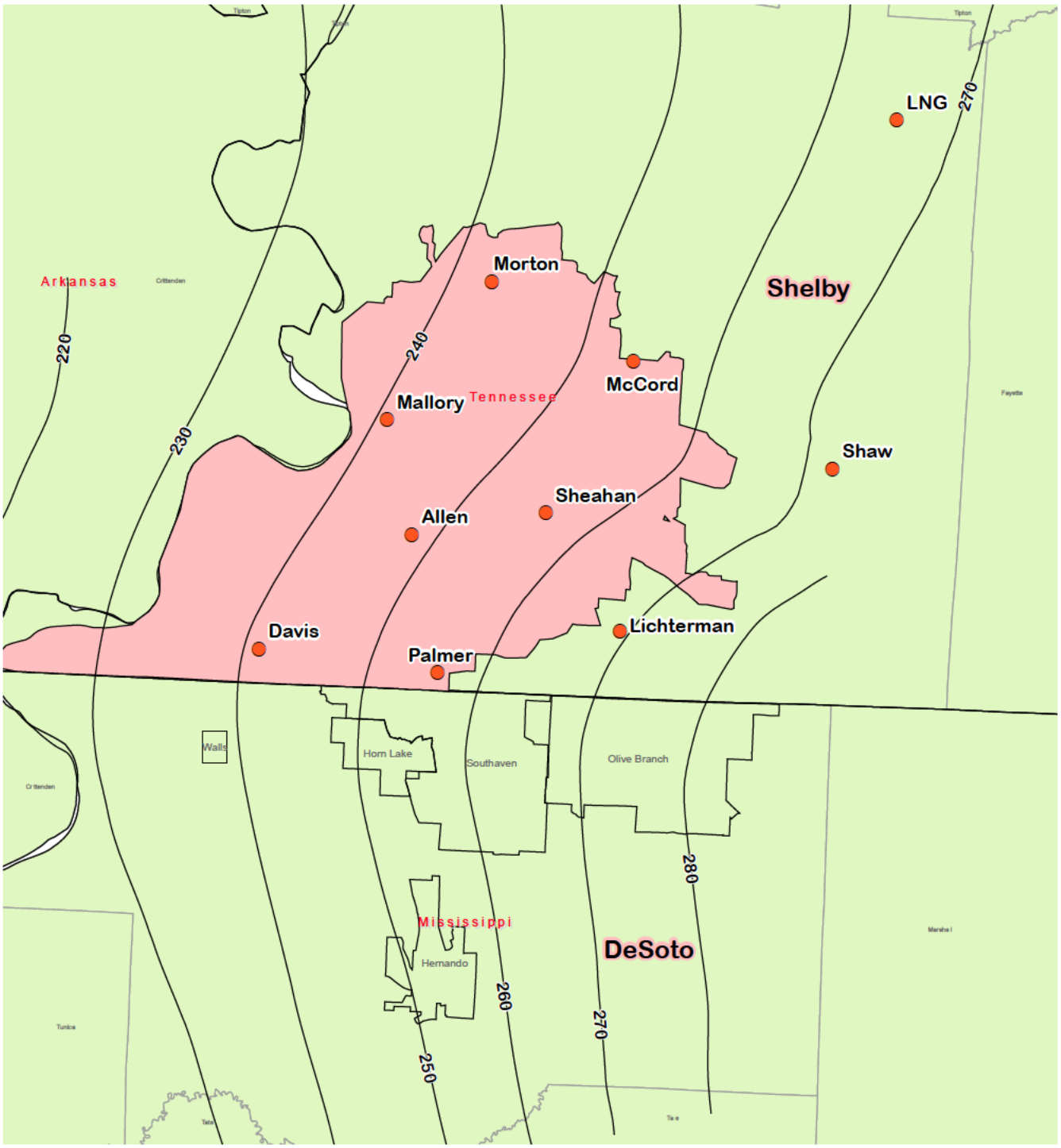

SOURCE: BRAHANA WRI 89-4131

N

0 3 6

Miles

MLGW Well Fields

UPDATE REPORT ON DIVERSION AND WITHDRAWAL OF GROUNDWATER FROM NORTHERN MISSISSIPPI INTO THE STATE OF TENNESSEE

1886 ESTIMATED POTENTIOMETRIC SURFACE MAP FOR PREDEVELOPMENT CONDITIONS

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DATE:	Apr. 2014
FILE NAME:	Figure12.MXD
FIGURE NO.:	12

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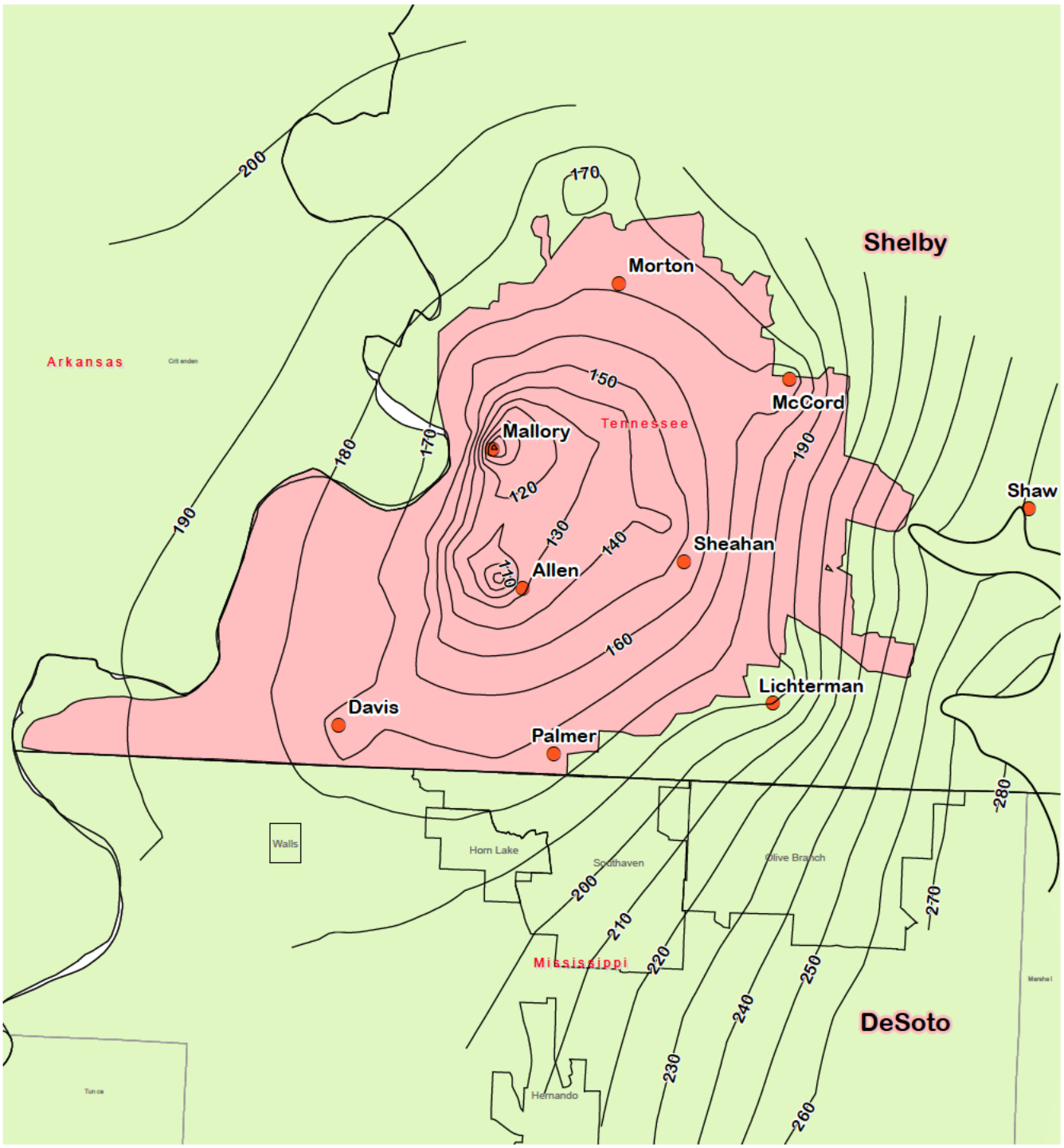

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Miles

Legend

Potentiometric Surface Contour Lines

MLGW Well Fields

UPDATE REPORT ON DIVERSION AND WITHDRAWAL OF GROUNDWATER FROM NORTHERN MISSISSIPPI INTO THE STATE OF TENNESSEE

1980 POTENTIOMETRIC SURFACE MAP
DEVELOPED FROM GROUNDWATER MODEL

PREPARED BY:

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DATE:	Jun. 2017
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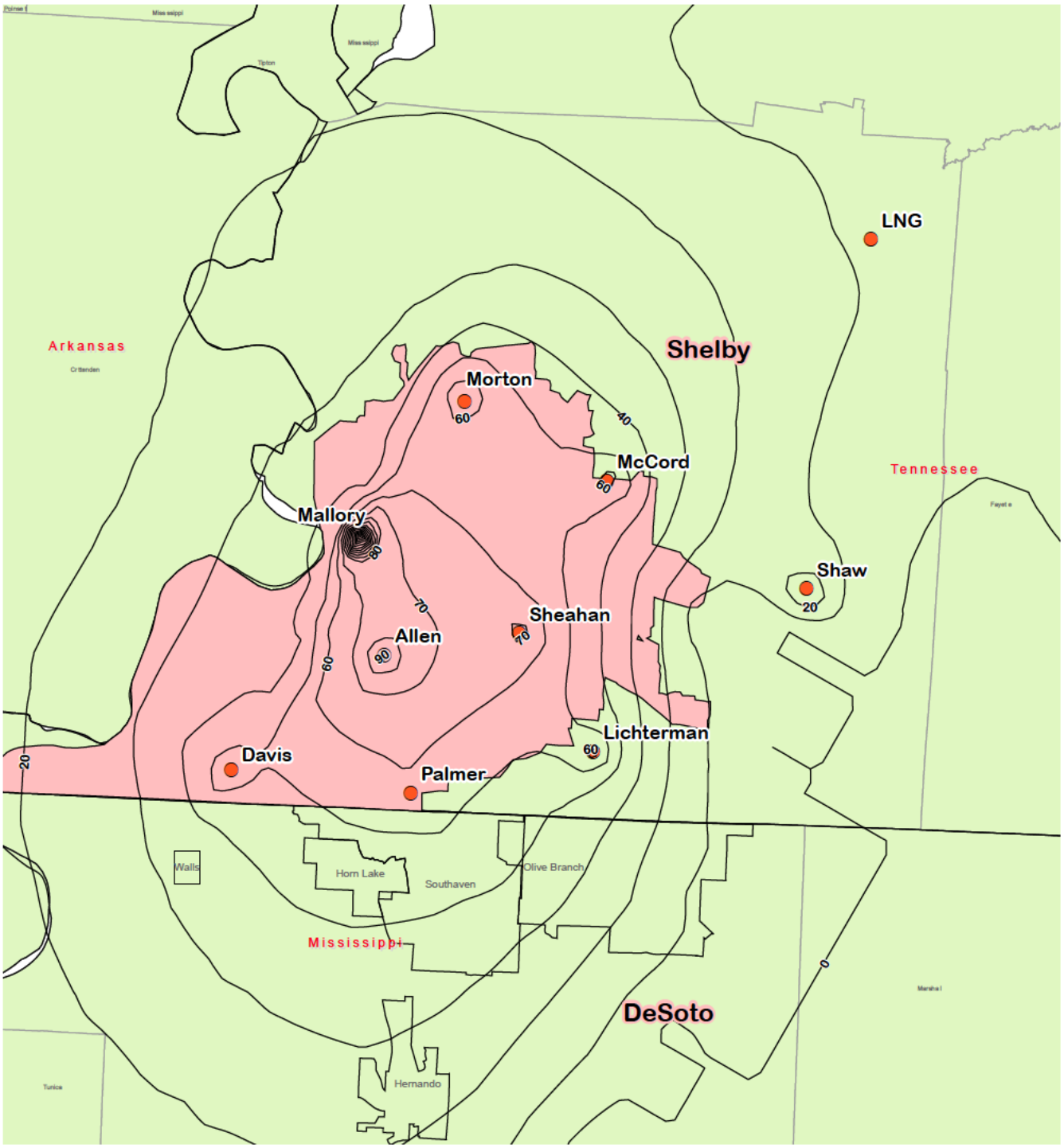

UPDATE REPORT ON DIVERSION AND WITHDRAWAL OF GROUNDWATER FROM NORTHERN MISSISSIPPI INTO THE STATE OF TENNESSEE

2013 DRAWDOWN CONTOUR MAP
DEVELOPED FROM GROUNDWATER MODEL

PREPARED BY:

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DATE:	June 2017
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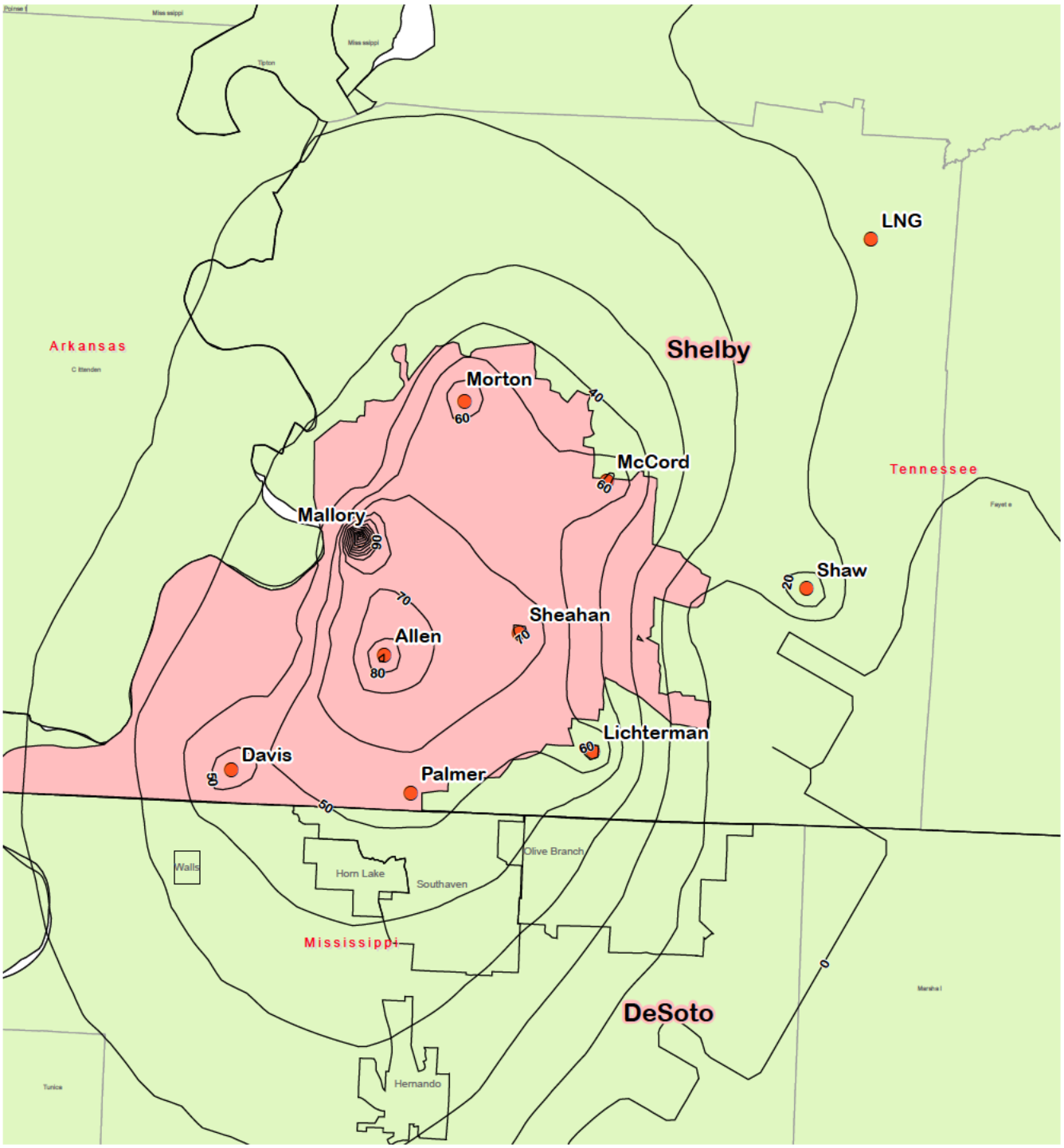

Source: Tenn., USGS

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Miles

Legend

Drawdown Contours

MLGW Well Fields

UPDATE REPORT ON DIVERSION AND WITHDRAWAL OF GROUNDWATER FROM NORTHERN MISSISSIPPI INTO THE STATE OF TENNESSEE

2014 DRAWDOWN CONTOUR MAP
DEVELOPED FROM GROUNDWATER MODEL

PREPARED BY:

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DATE:	June 2017
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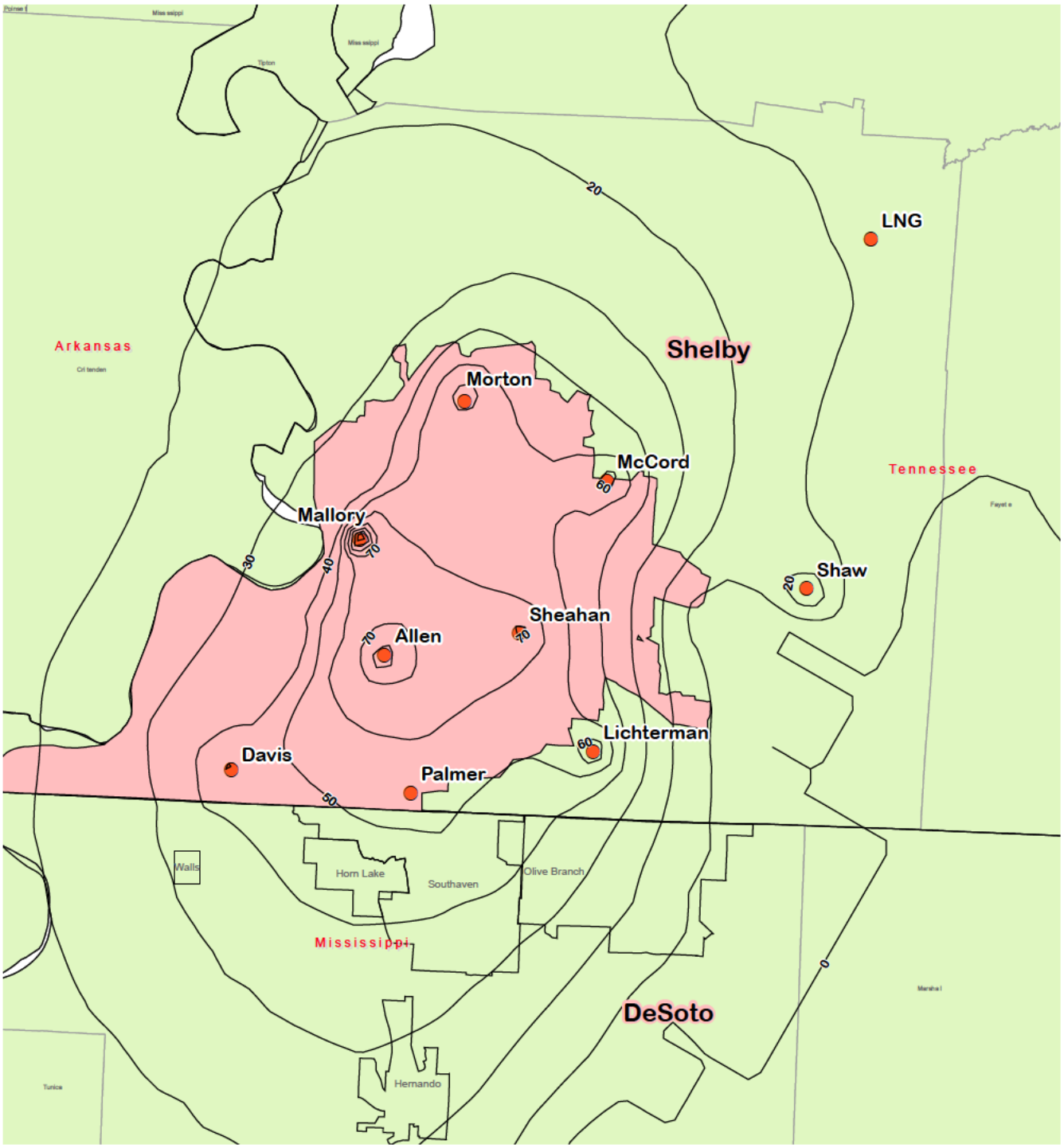

Source: Tenn., USGS

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Miles

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Drawdown Contours

MLGW Well Fields

UPDATE REPORT ON DIVERSION AND WITHDRAWAL OF GROUNDWATER FROM NORTHERN MISSISSIPPI INTO THE STATE OF TENNESSEE

2015 DRAWDOWN CONTOUR MAP
DEVELOPED FROM GROUNDWATER MODEL

PREPARED BY:

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DATE:	June 2017
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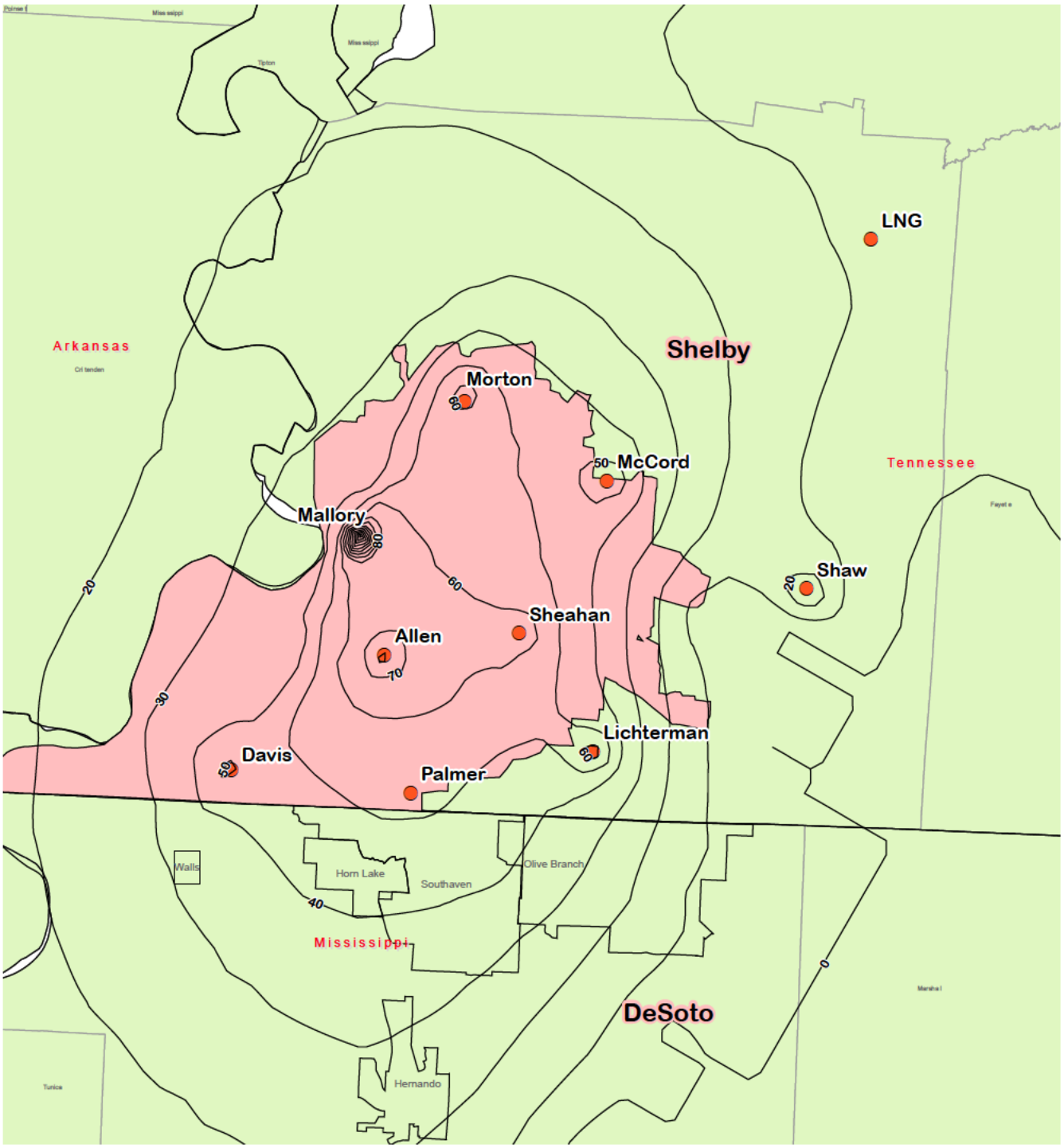

Source: Tenn., USGS

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Drawdown Contours

MLGW Well Fields

UPDATE REPORT ON DIVERSION AND WITHDRAWAL OF GROUNDWATER FROM NORTHERN MISSISSIPPI INTO THE STATE OF TENNESSEE

2016 DRAWDOWN CONTOUR MAP
DEVELOPED FROM GROUNDWATER MODEL

PREPARED BY:

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DATE:	June 2017
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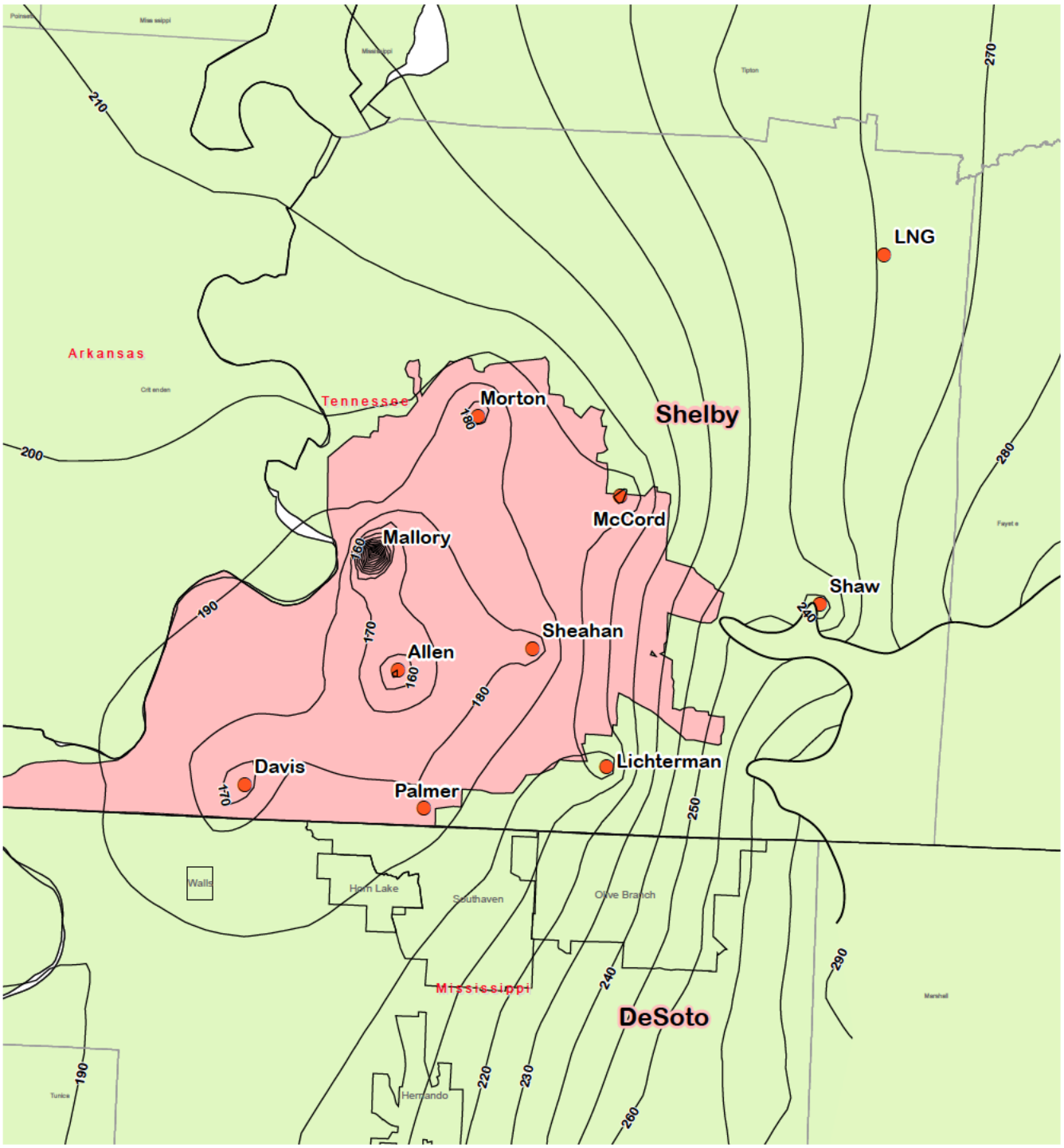

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POTENTIOMETRIC SURFACE CONTOURS

MLGW Well Fields

UPDATE REPORT ON DIVERSION AND WITHDRAWAL OF GROUNDWATER FROM NORTHERN MISSISSIPPI INTO THE STATE OF TENNESSEE

2013 POTENTIOMETRIC SURFACE MAP
DEVELOPED FROM GROUNDWATER MODEL

PREPARED BY:

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DATE:	June 2017
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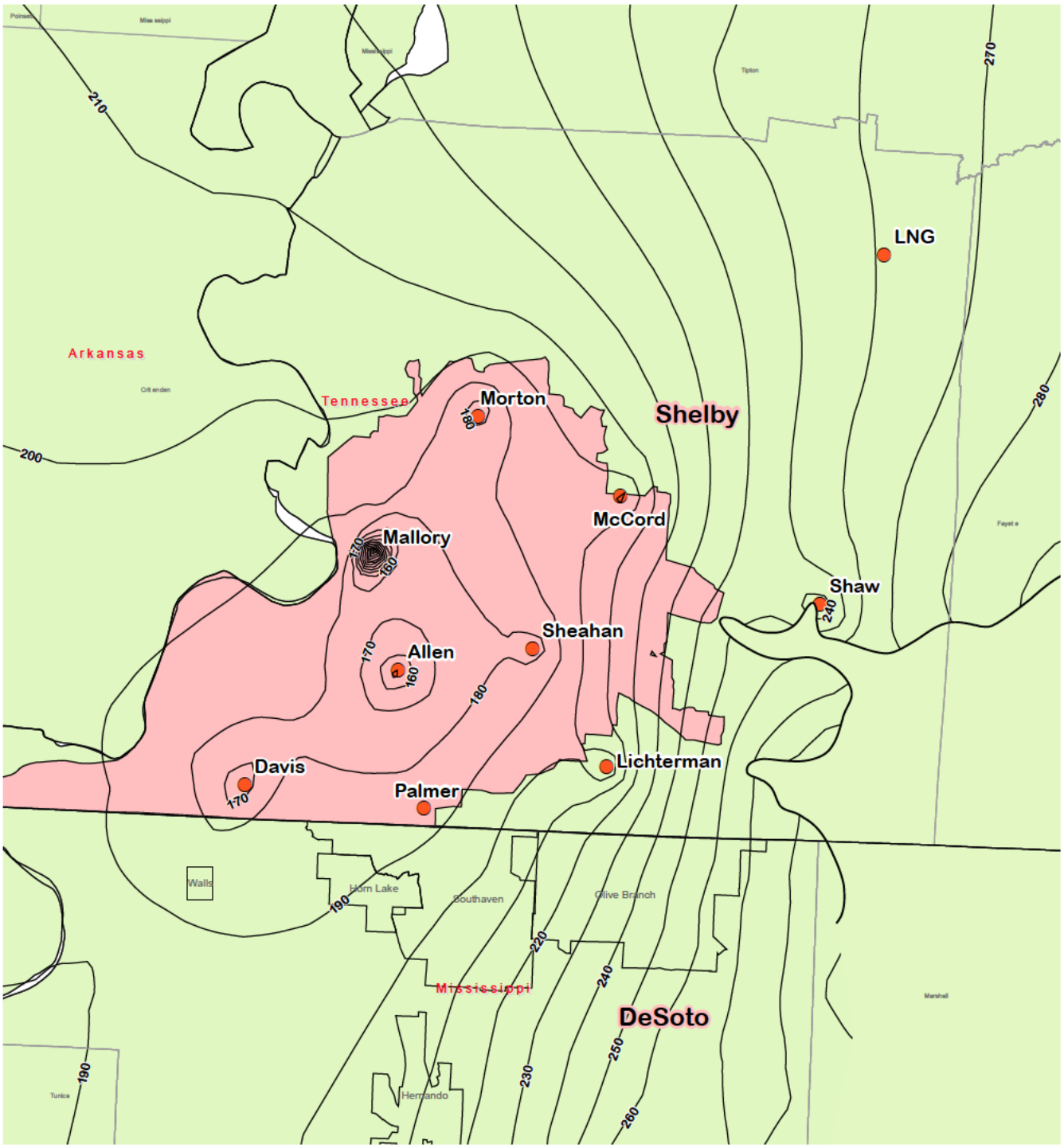

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POTENTIOMETRIC SURFACE CONTOURS

MLGW Well Fields

UPDATE REPORT ON DIVERSION AND WITHDRAWAL OF GROUNDWATER FROM NORTHERN MISSISSIPPI INTO THE STATE OF TENNESSEE

2014 POTENTIOMETRIC SURFACE MAP
DEVELOPED FROM GROUNDWATER MODEL

PREPARED BY:

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DATE:	June 2017
FILE NAME:	Figure19.MXD
FIGURE NO.:	19

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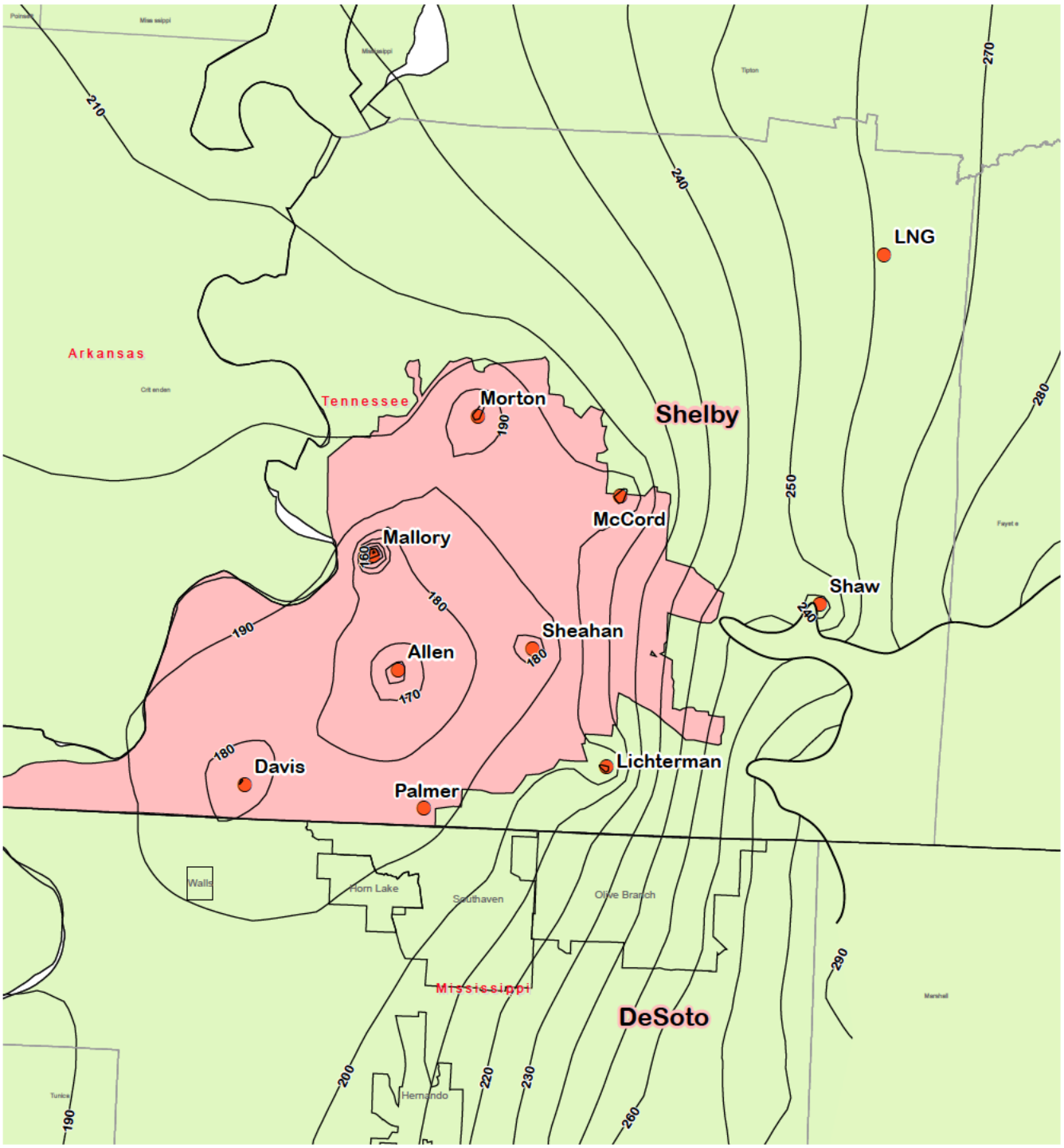

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POTENTIOMETRIC SURFACE CONTOURS

MLGW Well Fields

UPDATE REPORT ON DIVERSION AND WITHDRAWAL OF GROUNDWATER FROM NORTHERN MISSISSIPPI INTO THE STATE OF TENNESSEE

2015 POTENTIOMETRIC SURFACE MAP
DEVELOPED FROM GROUNDWATER MODEL

PREPARED BY:

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DRAWN BY:	TDH
CHECKED BY:	DAW
DATE:	June 2017
FILE NAME:	Figure20.MXD
FIGURE NO.:	20

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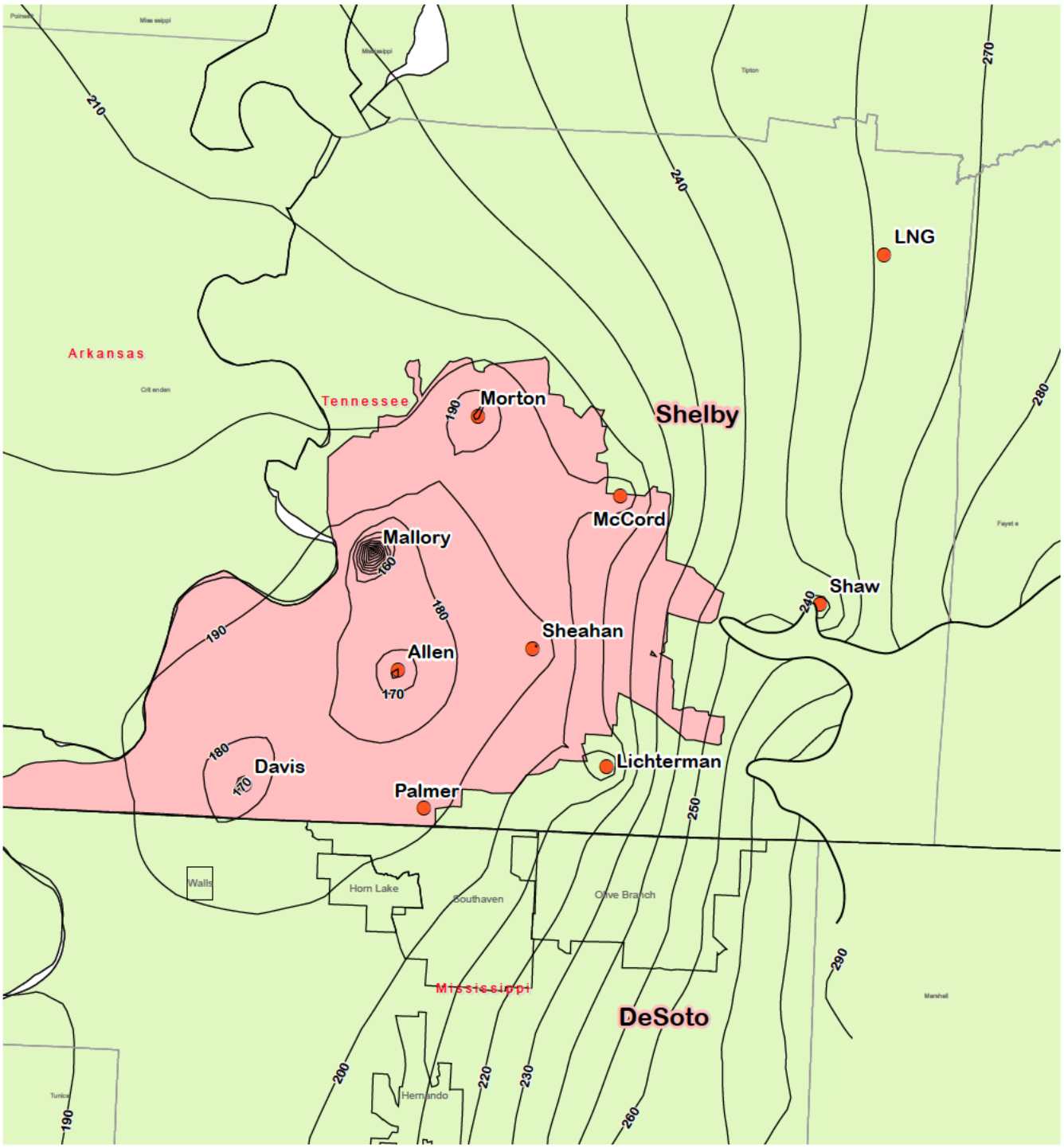

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POTENTIOMETRIC SURFACE CONTOURS

MLGW Well Fields

UPDATE REPORT ON DIVERSION AND WITHDRAWAL OF GROUNDWATER FROM NORTHERN MISSISSIPPI INTO THE STATE OF TENNESSEE

2016 POTENTIOMETRIC SURFACE MAP
DEVELOPED FROM GROUNDWATER MODEL

PREPARED BY:

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CHECKED BY:	DAW
DATE:	June 2017
FILE NAME:	Figure21.MXD
FIGURE NO.:	21

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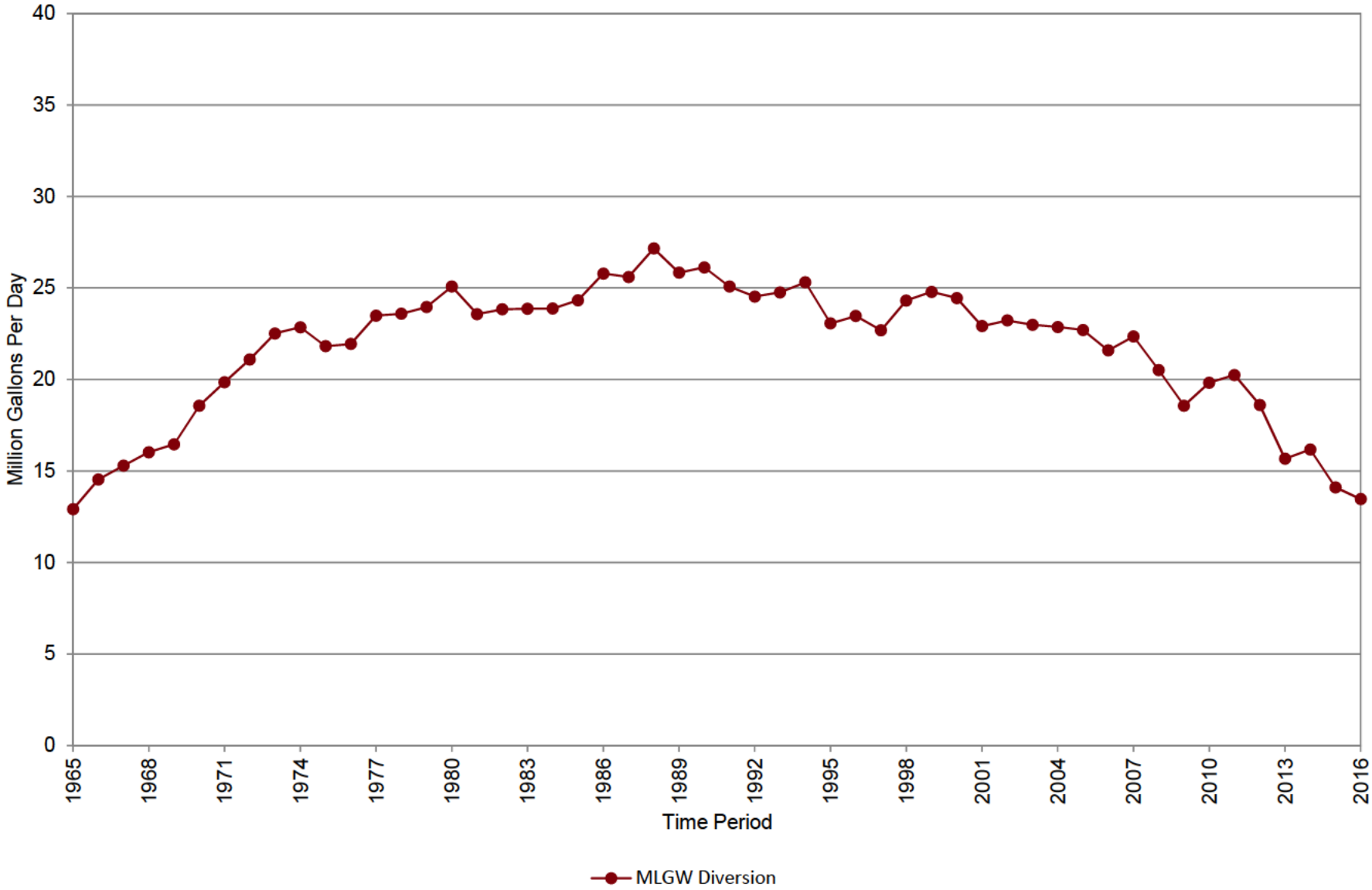
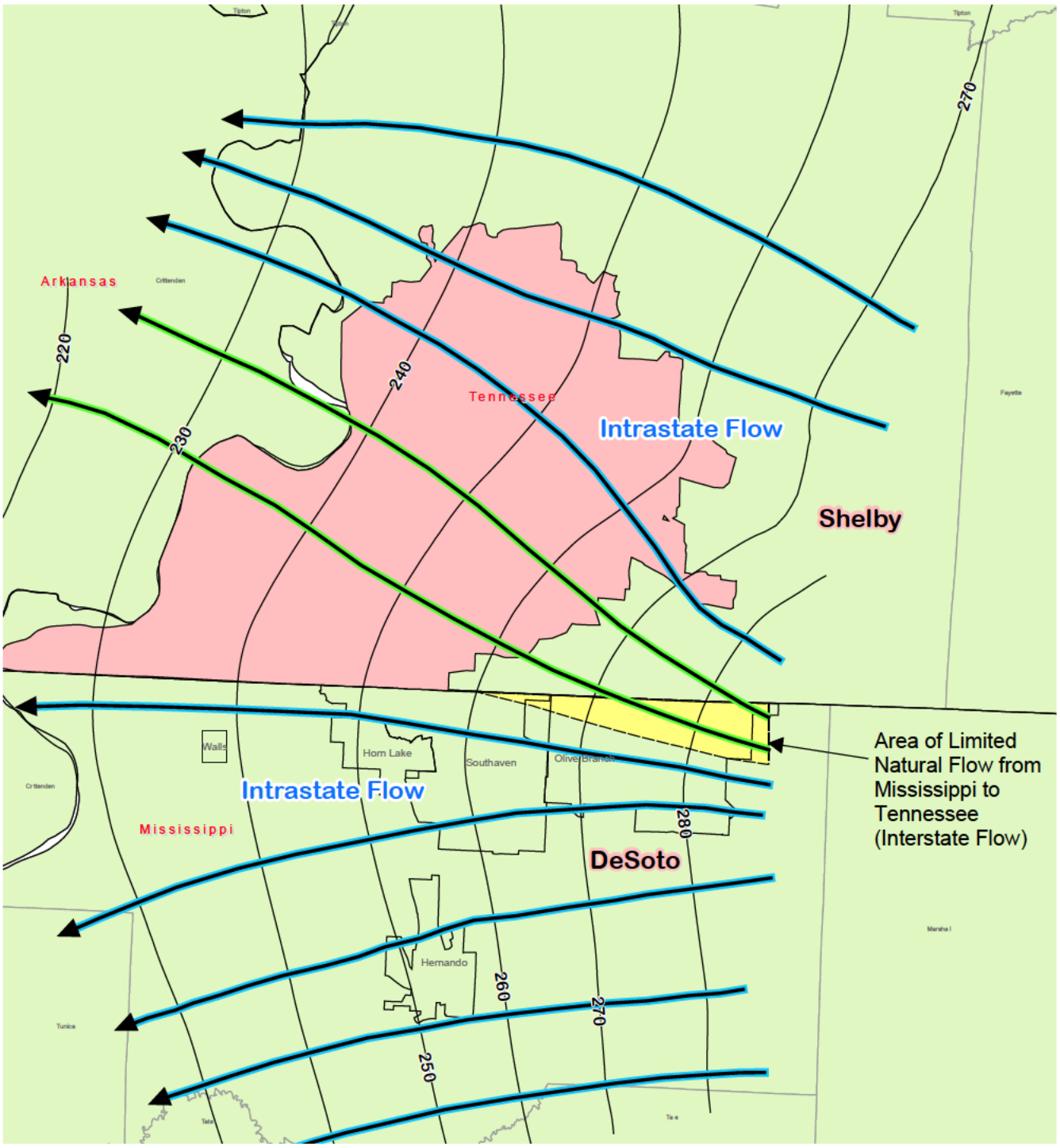
Figure 22
Volume of Groundwater Contributed to Shelby County, TN. From DeSoto & Marshall Counties Mississippi Due to MLGW Pumpage (1965-2016)





SOURCE: BRAHANA WRI 89-4131

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Miles

Flow Lines Showing Pre-Development Groundwater Flow Direction

Interstate Flow

Intrastate Flow

Potentiometric Surface Contour Lines

UPDATE REPORT ON DIVERSION AND WITHDRAWAL OF GROUNDWATER FROM NORTHERN MISSISSIPPI INTO THE STATE OF TENNESSEE

1886 ESTIMATED POTENTIOMETRIC SURFACE MAP FOR PREDEVELOPMENT CONDITIONS

PREPARED BY: LEGGETTE, BRASHEARS & GRAHAM, INC.

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DATE:	Feb. 2017
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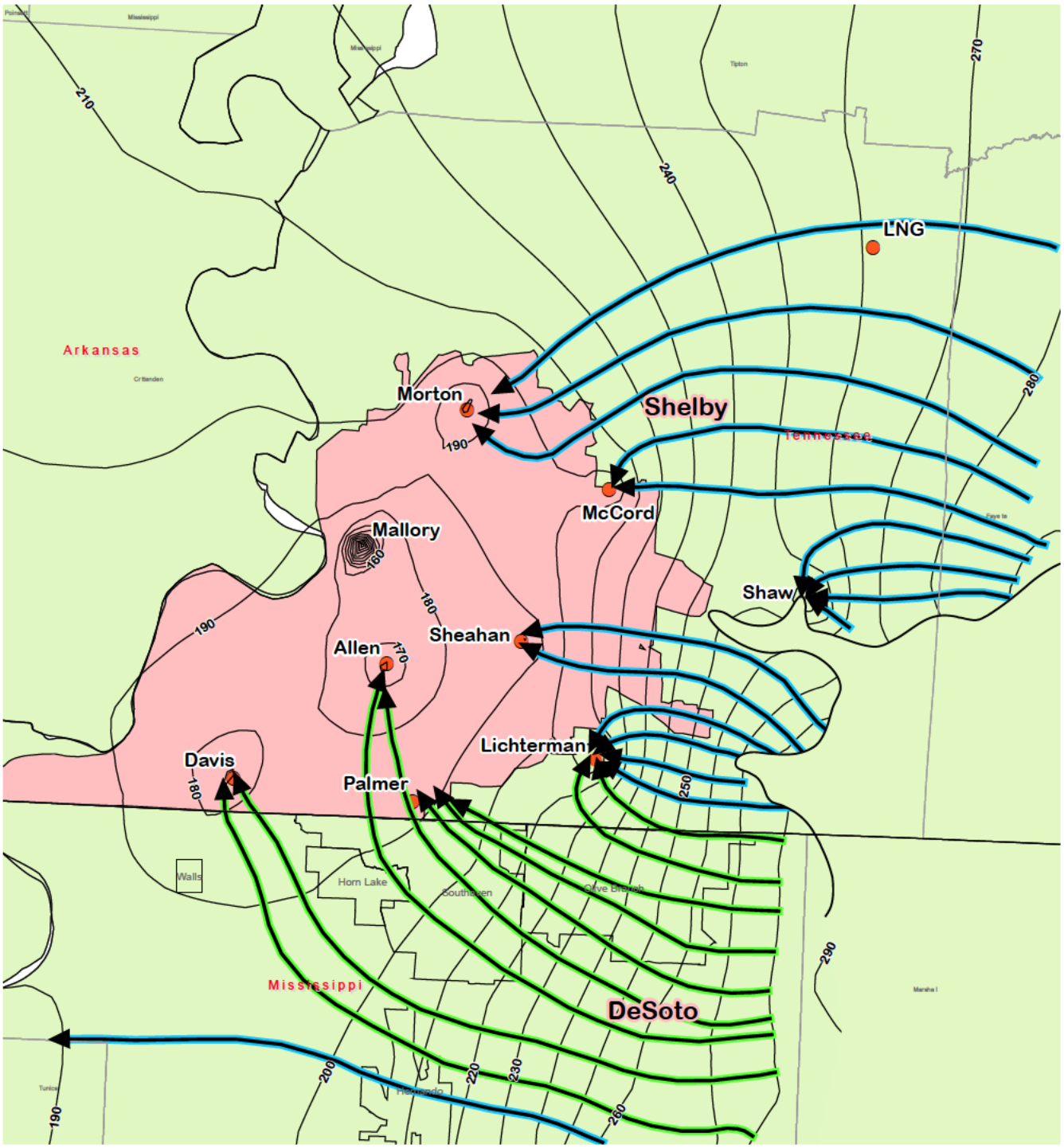

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Legend

- Interstate Flow
- Intrastate Flow
- Potentiometric Surface Contour Lines
- MLGW Well Fields
- Flow Lines Showing Groundwater Flow Direction

UPDATE REPORT ON DIVERSION AND WITHDRAWAL OF GROUNDWATER FROM NORTHERN MISSISSIPPI INTO THE STATE OF TENNESSEE

2016 POTENTIOMETRIC SURFACE MAP
DEVELOPED FROM GROUNDWATER MODEL

PREPARED BY:

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DRAWN BY:	TDH
CHECKED BY:	DAW
DATE:	June 2017
FILE NAME:	Figure24.MXD
FIGURE NO.:	24

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UPDATE REPORT ON DIVERSION AND WITHDRAWAL OF GROUNDWATER FROM NORTHERN MISSISSIPPI INTO THE STATE OF TENNESSEE
ADDENDUM # 1

Prepared For:

Jim Hood, Attorney General of the State of Mississippi

July 31, 2017

Prepared By:

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LIST OF FIGURES

INTRODUCTION

This report was prepared by David, A. Wiley, Professional Geologist and Sr. Vice President of Leggette, Brashears & Graham, Inc. (LBG) at the request of the Attorney General of the State of Mississippi. It amends the report dated June 30, 2017 that updated and confirmed previous work performed for the Attorney General to determine the effect of Memphis Light, Gas & Water's (MLGW's) consistent, significant expansion of the commercial water well pumping operations between 1965 and our previous report dated April 14, 2014 on Mississippi's natural groundwater flow and storage. This report addendum focuses solely on the review of and critique of the June 27, 2017 Expert Report on the Interstate Nature of the Memphis/Sparta Sand Aquifer prepared by Gradient Corporation Gradient) for City of Memphis, Tennessee and Memphis Light, Gas & Water Division (MLGW). Our review is presented in a concise manner addressing each section of the Gradient report in order as appropriate.

SUMMARY OF EVALUATION OF GRADIENT REPORT

Section 1 Introduction

1.2 Opinion Summary:

1. The Memphis Sand/Sparta Aquifer (MSSA) lies beneath several states and is a shared resource among all the states that overlie it, including Mississippi and Tennessee.

MLGW is not sharing water. They pump the amounts that they want without approval/permission from Mississippi for the amount diverted from Mississippi due to the cone of depression created.

4. In pre-development times (before pumping began), groundwater in the MSSA naturally flowed across multiple state lines, including the Mississippi-Tennessee border.

Only some water flows slowly from Mississippi to Tennessee.

6. Pumping from the MSSA in one state can impact the flow direction and potentiometric head in another state.

Agreed that pumping by MLGW impacts flow direction and potentiometric head in Mississippi.

8. Water flow patterns in the MSSA were not influenced by state lines under pre-development conditions and are not influenced by state lines under current conditions.

Agreed, however pumping by MLGW has altered flow patterns in Mississippi by diverting groundwater flow to Tennessee.

9. Under pre-development conditions, all groundwater that entered the MSSA in Mississippi would eventually leave Mississippi.

Under pre-development conditions Sparta aquifer water resides in Mississippi for approximately 4,000 years to 22,000 years (**Figure 1**) and moves at a rate of approximately 13 to 53 feet per year based on USGS model used by Gradient. From the

same model, in 2007, water velocity was increased due to MLGW pumpage to a rate of approximately 8 to 214 feet/year.

Section 2 Scientific Principles and Physical Setting

2.2 MSSA and Mississippi Embayment Overview:

Page 9, last paragraph – "Other interstate aquifers" is referred to by Gradient. The phrase "interstate aquifer" has no known technical reference in USGS literature or from other scientific professional organizations.

2.3 The Sparta Sand Aquifer in Mississippi and the upper Memphis Sand Aquifer in Tennessee are different names for the same aquifer:

Page 10, 1st sentence - There is no known historical and recent scientific literature that calls the MSSA an interstate aquifer. Also, the MSSA is not a shared resource. MLGW pumps the amounts that they want without approval from Mississippi.

Page 12, 5th bullet, Reed (1972) – Gradient refers to "interstate significance in such places as Memphis." This significance is the result of the cone of depression created by MLGW and the resulting groundwater flow diversions.

Page 12, 8th bullet, Arthur and Taylor (1990) – Arthur and Taylor do not refer to MSSA as being interstate.

Page 13, 2nd bullet, Arthur and Taylor (1998) – Gradient states that Arthur and Taylor describe the "historical shared nature of MSSA." Arthur and Taylor do not state that and just because one entity in one state pumps from an aquifer and another entity in another state pumps from the same aquifer does not mean they are not sharing. MLGW pumps the amount of water that they want with no permission from Mississippi for the amount being diverted.

2.4 The United States Geological Survey's MERAS Model

Page 14, 4th paragraph – Gradient states that particle tracking allows for tracking of water movement over a period of time but nowhere in their report do they address specific groundwater flow travel times.

Section 3 Statement of Opinion

3.1 The MSSA is physically located beneath several states, including Mississippi and Tennessee, and is a resource that is shared by and common to the states that overlie it.

Page 15, 1st paragraph – We concur that the aquifer is physically located beneath several states. There is no known technical reference for interstate aquifer by the USGS or other technical professional organizations.

Page 16, 1st paragraph – Gradient states there are no lateral barriers. Not true. Flow paths under natural pre-development conditions create a flow boundary. In most of the northwest Mississippi, ground water flows from east to west/southwest below the state line. Small portion of pre-development flow is northwest from Mississippi to Tennessee. Due to MLGW pumpage this natural east to west flow path in Mississippi has been altered to a northwesterly direction into Tennessee (see **Figures 2, 3, 4 and 5**). **Figures 2 and 3** are from the Gradient report, but are completed with additional flow lines in northern Mississippi. **Figures 4 and 5** are from the previous LBG report dated June 30, 2017.

3.2 In pre-development times (before pumping began), groundwater and surface water originating in Mississippi naturally flowed into and supplied the MSSA beneath Tennessee.

Page 16, 1st paragraph – Section 2.3 of the Gradient report does not discuss natural flow across state lines. Statements in paragraph 3.2 implies that a large volume of groundwater flowed from the Sparta sands in Desoto, Marshall and Benton Counties, Mississippi to Tennessee during pre-development times. In reality the MERAS model used by Gradient indicates that there was a net flow from Mississippi to Tennessee within the entire MSSA of less than 6 mgd; which is only 2.6 percent of the simulated areal

recharge to the state of Mississippi. Furthermore, the MERAS indicated that there is a net flow from Tennessee into Desoto County, Mississippi of 2.3 mgd during pre-development times (see **Figure 6**).

Gradient is implying that there is a connection between the potentiometric heads and the bottom of the MSSA where no connection should exist between the bottom of the confined aquifer and the potentiometric heads. Shape of potentiometric contours is dependent on formations above the confined aquifer, recharge and discharge areas.

3.2.1 Pre-development flow from Mississippi to Tennessee in the MSSA has been confirmed by analysis of report data

LBG is in agreement that some water flows from the northeastern portion of Mississippi into Tennessee, however, as indicated above this is a small percentage of the simulated pre-development areal recharge to the state. In Gradient's Figure 3.2.1a, only a small portion of flow from Mississippi to Tennessee near northeast Desoto County and Marshall Counties occurs near state line. The figure only addresses flows in the Memphis area and not regional flows. The Waldron Map, Figure 3.2.1b in the Gradient report is not based on actual water-level measurements. Most well locations in this map are in the outcrop area, which is not representative of confined aquifer conditions due to topography and/or river discharge. Waldron also estimated well locations. Waldron did not look at regional water-level conditions as Arthur and Taylor did. Waldron did not consider model pre-development conditions as Arthur and Taylor did. The Arthur Taylor (1990) map shows regional pre-development potentiometric surface map including the Tennessee and Mississippi area, which is Figure 3.3.3 in the Gradient report and our revised **Figure 3** in this addendum. This map is based on calibrated flow model. This map shows flow in an east to west/ southwest orientation in northern Mississippi. Also in the Gradient report, figures 3.3.1a and 3.3.1b show their modeled pre-development map using the USGS model. Gradient shows only one flow line on 3.3.1b ignoring the majority of flow in northwest Mississippi, which is east to west/southwest, similar to Arthur and Taylor. Most of that water flows within Mississippi. Both Arthur and Taylor and Gradient show a small flow component from Mississippi to Tennessee near the

outcrop. It should be noted that potentiometric contours shown in outcrops should be used carefully because those water levels are in unconfined conditions and not truly representative of the confined aquifer.

3.2.2 Pre-development flow from Mississippi to Tennessee in the MSSA has been confirmed by the USGS MERAS model particle tracking.

Page 17, 3.2.2.1 – Gradient's Fig 3.2.2 does not show flow paths that occur in only Mississippi from east to west/southwest, selective particle releasing was employed here. The flow amounts and residence times were not provided by Gradient, which was included by definition for using particle tracking earlier in their report. We used the USGS model presented by Gradient and calculated travel time, velocities and volumes. Results show the following travel times, velocities and volumes discharged are shown in Figures 1 and 6 in this addendum.

The flow path analysis completed by Gradient focuses primarily on the eastern portion of the Sparta sand outcrop (Benton and Marshall Counties) were the flow paths and direction are controlled primarily by surface water bodies. LBG completed a flow analysis along the western portion of the Sparta sand outcrop that shows that the groundwater would remain in the state of Mississippi (**Figure 1**). In addition, data derived for the USGS MERAS model shows that during the pre-development period approximately 84 percent of the simulated recharge to Mississippi would flow across the state for a period of time ranging from approximately 4,000 to 22,000 years.

Page 18, 3.2.2.2 - No Volumes, travel times, and velocities were provided with Gradient Figure 3.2.2.

Page 18, 3.2.2.3 – Gradient Fig 3.2.4a is misleading. Very little if any water that initiated in northeast Mississippi would flow around and discharge at the Mississippi river in Coahoma County, Mississippi. The USGS model used by Gradient shows that very little water follows the entire flow path in Gradient Figure 3.2.4a and on to the Mississippi River.

3.3 The interstate pre-development flow of groundwater in the MSSA from Mississippi to Tennessee is a component of and consistent with the larger, regional interstate groundwater flow patterns in the northern MSSA.

Page19, 3.3 – Gradient Figures 3.3.1a and 1b are selective, ignoring the majority of flow paths in northwest Mississippi. Initiating flow paths based on potentiometric surface contours must be done where the aquifer is continued or at edge of outcrop. Water levels in outcrop areas are under unconfined conditions, they discharge to rivers and not representative of the confined aquifer. Our **Figure 2** in this addendum revises the Gradient Figure 3.3.1b to show additional flow paths across northwestern Mississippi. The east to west/northwest flow paths are shown in **Figure 2**.

Gradient Figures 3.3.2a and 2b – These 2 figures show potentiometric contours and flow paths that under pre-development water flowed east to west/southwest in northwest Mississippi within 4 miles of the Mississippi/Tennessee state line. Gradient again used selective flow lines in Fig 3.3.3 (from Arthur and Taylor). We revised that Figure to add the northwest Mississippi flow lines shown on **Figure 3** of this addendum. Drawdown from MLGW extends more than 4 miles in Mississippi.

3.4 The interstate nature of the MSSA is demonstrated by the fact that pumping from the MSSA in one state can and does affect groundwater in the MSSA in other States.

Section 3.4 pages 20 - 22 – as shown in Gradient Figures 3.4.1 and 3.4.2a, a cone of depression has been created by MLGW pumpage that diverts Mississippi water from its natural east to west/southwest flow path as shown on **Figures 2, 3, 4 and 5** in this addendum. Many other USGS publications over the decades have shown and confirmed the cone of depression created by MLGW due to the large volumes of groundwater pumped from the aquifer.

LBG concurs that pumping in Tennessee impacts groundwater levels in Mississippi. LBG completed a flow budget analysis utilizing pre-development and 2007 output data from the USGS MERAS model. Pre-development showed that there is a net flow from

Tennessee into Desoto County of 2.3 mgd during pre-development conditions and a net flow out of Desoto County into Tennessee of 20.3 mgd under the 2007 pumping condition. Thus, withdrawal from Tennessee resulted in a net pumping related impact to the net flow out of Desoto County of 22.6 mgd as shown on **Figure 6** of this addendum. This value from the MERAS model is very comparable to the 2007 groundwater diversion (flux) LBG estimated at 22.3 mgd from using the Brahana model, to be taken from Mississippi due to MLGW Pumping. Additional modeling using the USGS MERAS shows that if Desoto County were to pump the same amount of water as MLGW, water levels would drop below the top of the aquifer, primarily in Mississippi, damaging the aquifer (see **Figure 7**). The red contours in **Figure 7** show areas where water levels drop below the top of the aquifer. This also infers that the MSSA is not a shared aquifer.

3.5 The MSSA has been and is a dynamic natural system. Groundwater flow in the MSSA was not influenced by state lines under pre-development conditions and is not influenced by state lines under current conditions.

Due to the cone of depression created by MLGW pumpage, recharge and discharge to and from Desoto County has change and reversed in some cases (see **Figure 6**). Reversal from discharge to recharge can effect water chemistry. From the USGS MERAS model used by Gradient, groundwater flow is calculated to be very slow. Under pre-development conditions, the model shows a flow velocity of approximately 14 to 53 feet/year across northwestern Mississippi. The residence time of water in northwest Mississippi is approximately 4,000 years to 22,000 years. Therefore, all water entering the aquifer during our lifetime or before the county was formed and before Moses time, stays in Mississippi.

3.6 Before and after pumping began, all groundwater entering the MSSA in Mississippi eventually leaves Mississippi.

See response to 3.5 above. This is misleading. As, stated previously, data derived from the USGS MERAS model shows that during the pre-development period approximately 84 percent of the simulated recharge to Mississippi would remain in the state. Gradient's

statement is only true if you count pumped groundwater and groundwater that discharges to surface water bodies in Mississippi as water leaving the state. Also, due to the cone of depression, the groundwater direction of flow in Mississippi is altered, flow velocities increase and the water balance altered with discharge components changed to recharge. Geology is a key factor helping to control groundwater flow conditions as shown on **Figure 4** of this addendum. **Figure 4** is a combination of Mississippi Embayment Geology with pre-development potentiometric surface levels for the MSSA as presented by Arthur and Taylor 1990. As discussed in the LBG June 30, 2017 Update Report, potentiometric surface levels of the MSSA are controlled by the eastern boundary of Mississippi Alluvial Plain aquifer in western Mississippi which overlies the Middle Claiborne aquifer and runs north-south in northwest Mississippi and receives discharge from the Middle Claiborne aquifer. This causes potentiometric surface levels to equilibrate in a north-south direction through northwest Mississippi forcing groundwater to flow east to west from the recharge area on the east side of Mississippi Embayment in northwestern Mississippi under pre-development conditions. As a result, structural geology in northwest Mississippi influences the shape of potentiometric surface contours and direction of groundwater flow, which is westward.

REFRENCES

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FIGURES

Sources: Esri, HERE, DeLorme, USGS, Intermap, increment P Corp., NRCAN, Esri Japan, METI, Esri China (Hong Kong), Esri (Thailand), TomTom, MapmyIndia, © OpenStreetMap contributors, and the

N

0 5 10 Miles

Particle Tracking Analysis			
Simulated Velocity to Particle Discharge Location			
Average (feet/Year)	**Median (ft/year)**	**Maximum (ft/year)**	**Minimum (ft/year)**
40.61	44.71	52.76	13.75
Average (feet/day)	**Median (ft/day)**	**Maximum (ft/day)**	**Minimum (ft/day)**
0.11	0.12	0.14	0.04

Simulated Travel Time		
	Days	**Years**
Minimum	1,416,080	3,877
Maximum	8,104,420	22,189
Average	2,754,800	7,542

Legend

- Sparta Sands Flow Paths
- Pre-Development Heads
- Memphis Aquifer Outcrop (unconfined) Approximate Limits
- Transition Zone
- Middle Claiborne Aquifer Extent

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CHECKED BY: DAW
DATE: Aug. 2017
FIGURE NO.: 1

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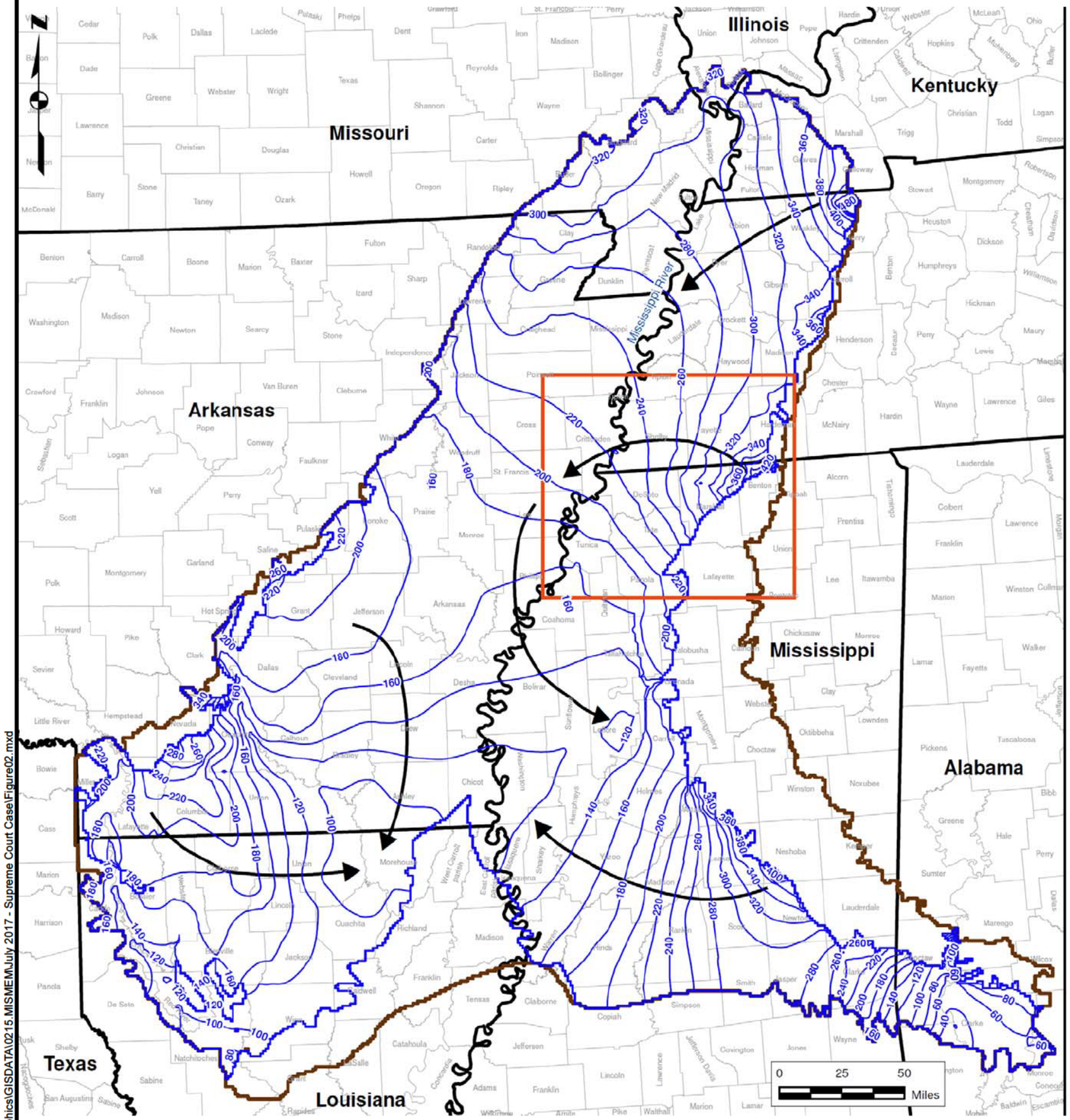
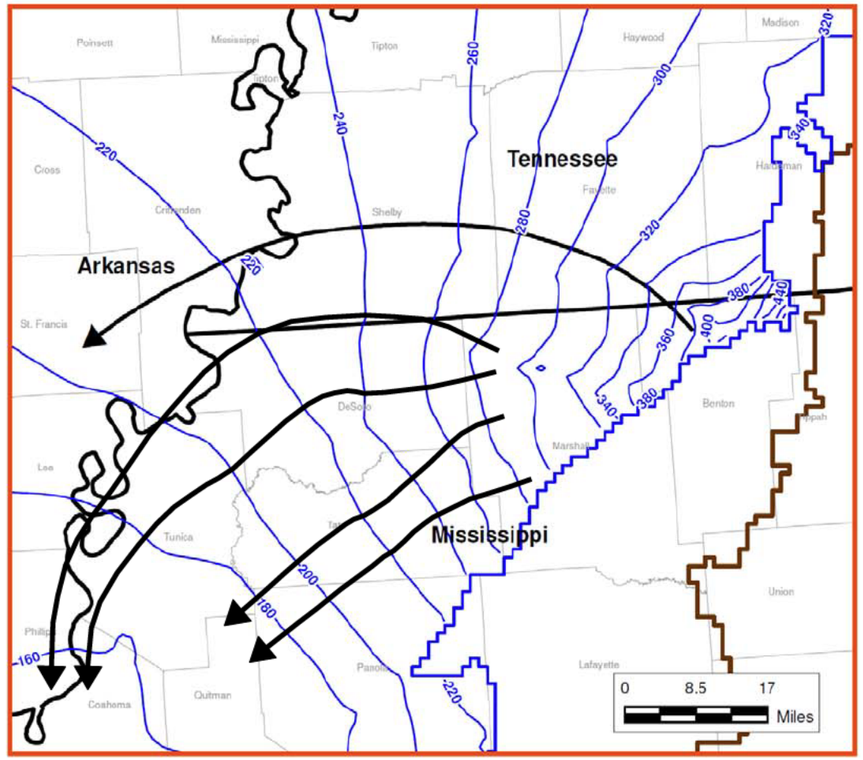
UPDATED REPORT ON DIVERSION AND WITHDRAWAL OF GROUNDWATER FROM NORTHERN MISSISSIPPI INTO THE STATE OF TENNESSEE

PRE-DEVELOPMENT FLOW PATHS IN NORTHWESTERN MISSISSIPPI

REVISED
DATE
FILE NAME: FIGURE01.MXD



Inset – Mississippi-Tennessee Border Area



LEGEND

- Pre-development MSSA Potentiometric Surface
- Generalized Flow Direction
- Edge of the Top of the MSSA
- Edge of the USGS MERAS Model Domain
- State Boundaries
- County Boundaries

NOTES:
1) Potentiometric surfaces were created by contouring the USGS MERAS model hydraulic head results for layer 5 under pre-development conditions.
2) Generalized flow direction added by Gradient.
3) All site features and locations are approximate.
4) The original figure was produced in color. Significant information will be lost if copied in black and white.

SOURCES:
1) US Census Bureau, 2016a,b.
2) MODFLOW files associated with Clark *et al.*, 2013.

Source: Gradient, 2017 USGS MERAS Model Pre-development Surface with Generalized Flow Directions-Figure 3.3.1b

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FIGURE NO.: 2

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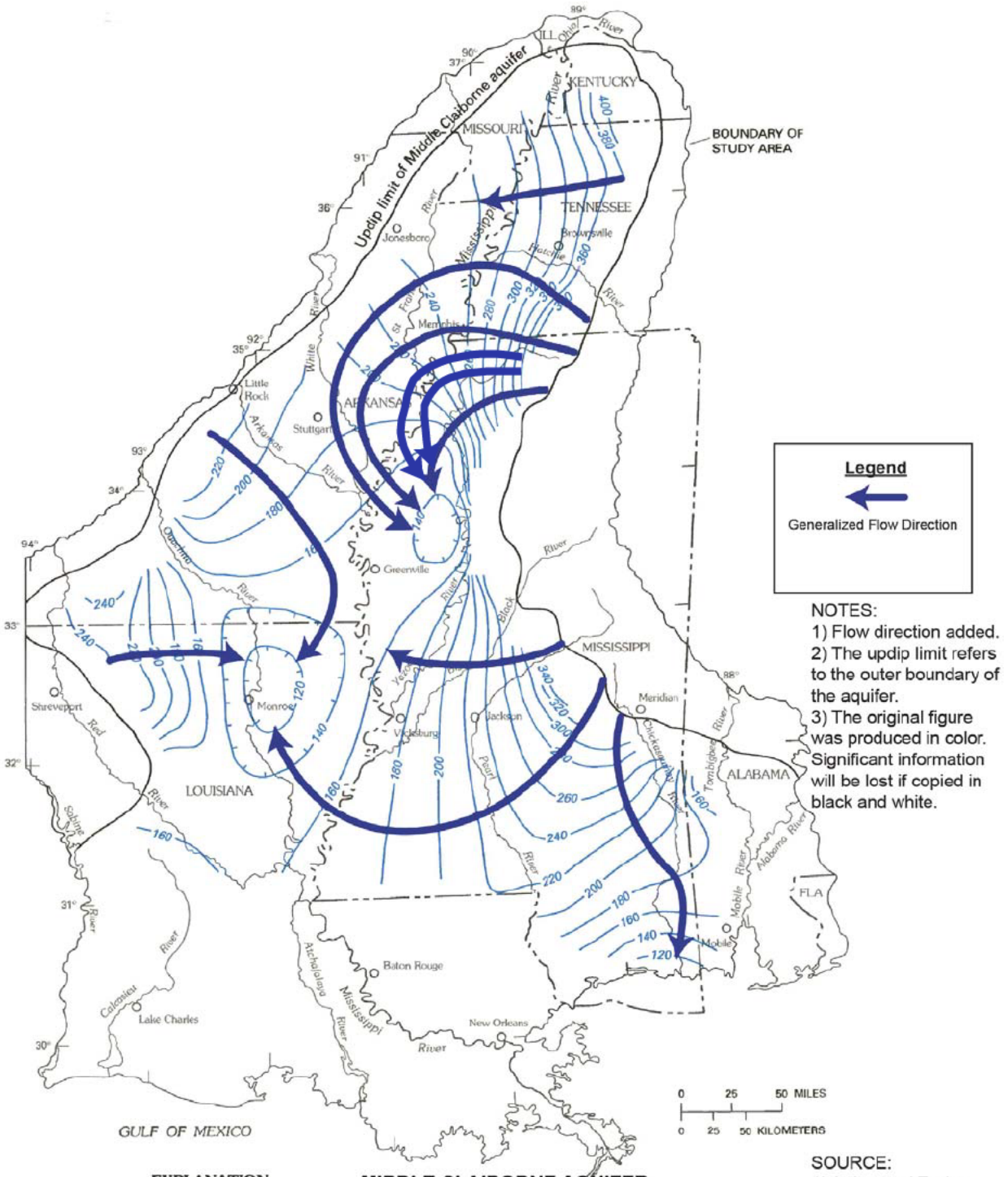
UPDATED REPORT ON DIVERSION AND WITHDRAWAL OF GROUNDWATER FROM NORTHERN MISSISSIPPI INTO THE STATE OF TENNESSEE

USGS MERAS MODEL PRE-DEVELOPMENT MSSA POTENTIOMETRIC SURFACE WITH GENERALIZED FLOW DIRECTIONS

DATE | REVISED | FILE NAME: FIGURE02.MXD



Source: Gradient, 2017; Model-Simulated Pre-development Potentiometric Head Contours for he Middle Claiborne Aquifer (Upper MSSA)-Figure 3.3.3

UPDATE REPORT ON DIVERSION AND WITHDRAWAL OF GROUNDWATER FROM NORTHERN MISSISSIPPI INTO THE STATE OF TENNESSEE

MODEL SIMULATED PRE-DEVELOPMENT POTENTIOMETRIC HEAD CONTOURS FOR THE MIDDLE CLAIBORNE AQUIFER

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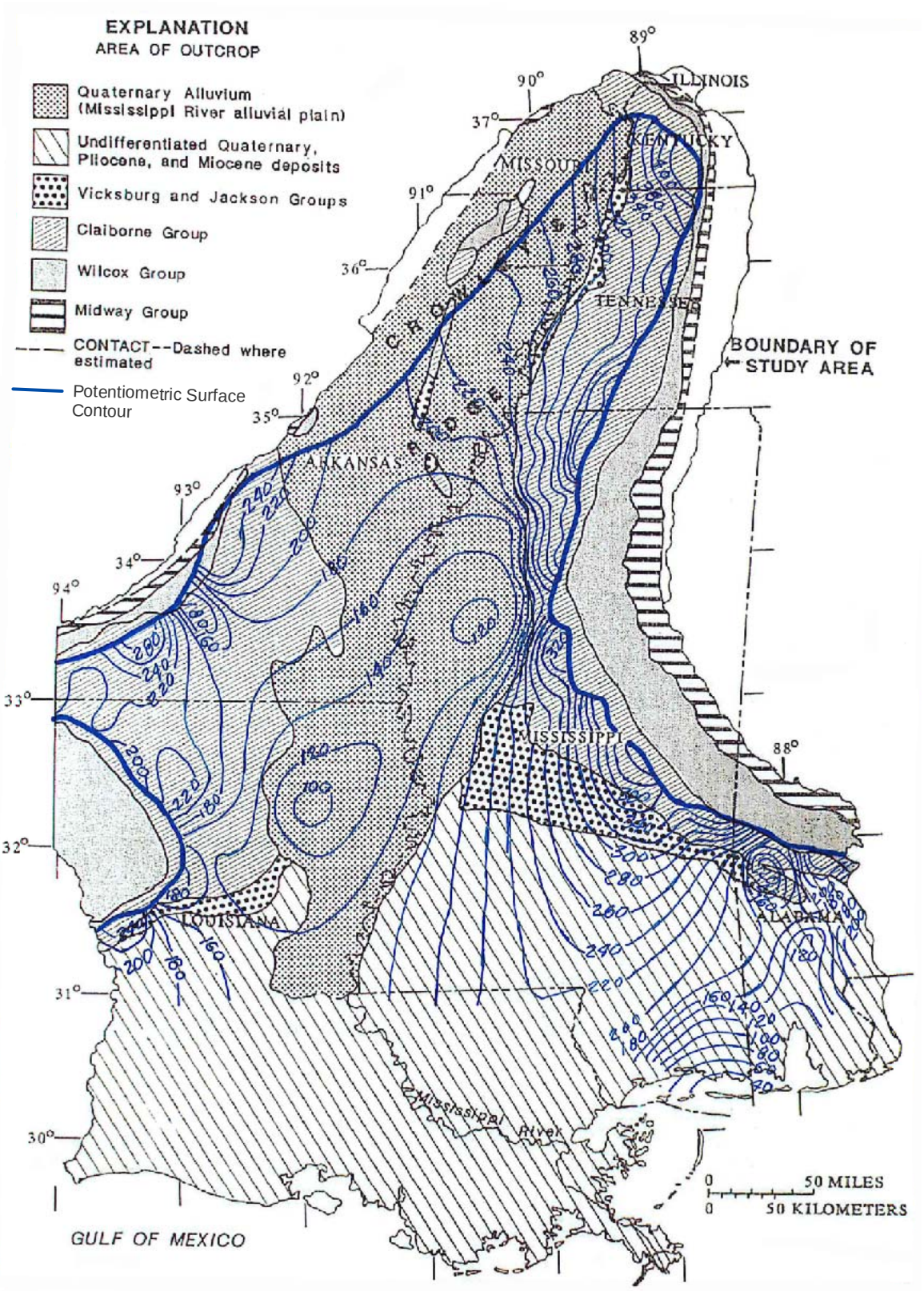

Source: Arthur & Taylor, 1990

UPDATE REPORT ON DIVERSION AND WITHDRAWAL OF GROUNDWATER FROM NORTHERN MISSISSIPPI INTO THE STATE OF TENNESSEE

GENERALIZED GEOLOGY OF ENBAYMENT AND PRE-DEVELOPMENT POTENTIOMETRIC SURFACE OF MIDDLE CLAIBORNE AQUIFER

PREPARED BY:

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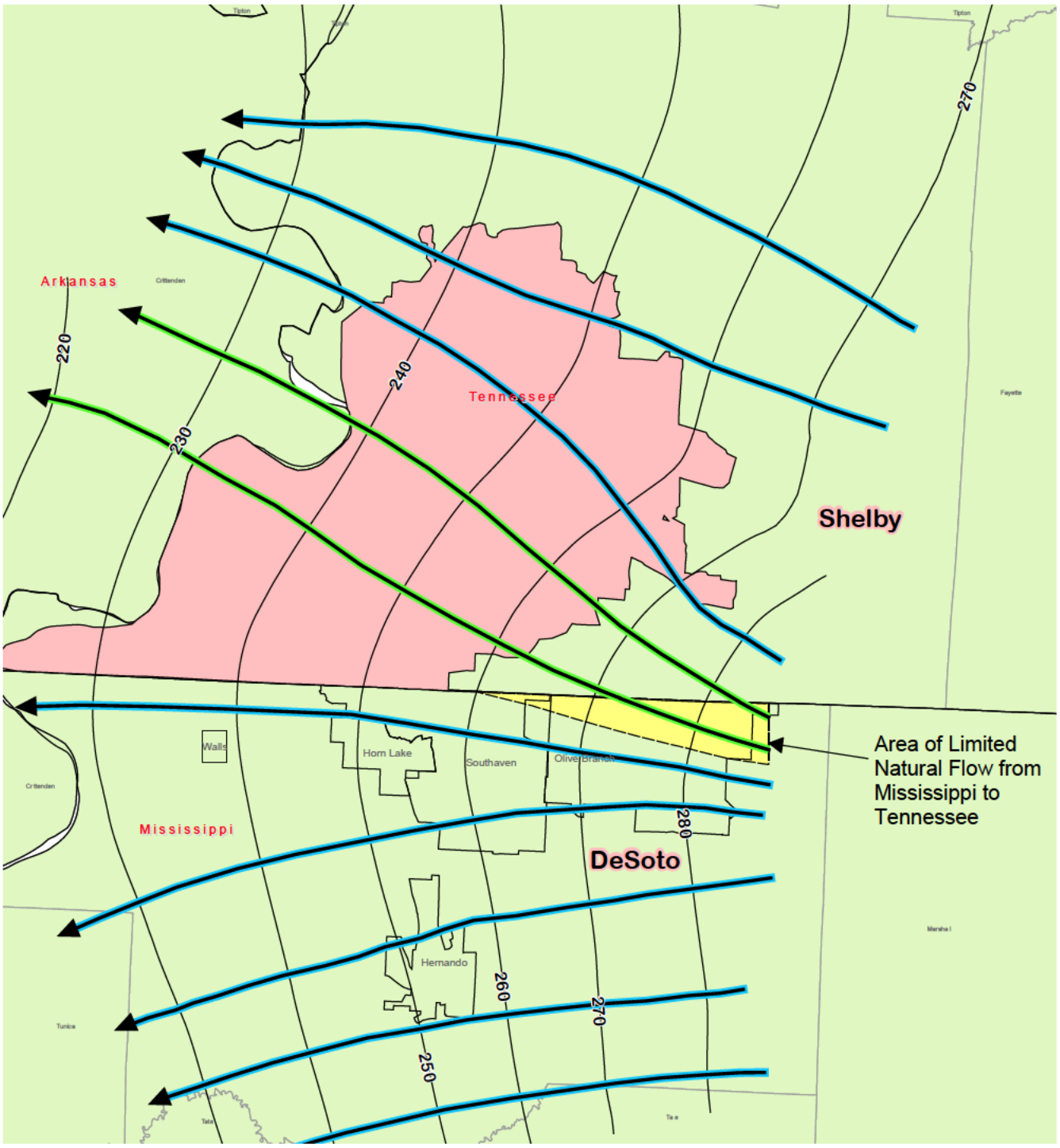

SOURCE: BRAHANA WRI 89-4131

N

0 3 6

Miles

Flow Lines Showing Pre-Development Groundwater Flow Direction

Flow Across State Line

Flow Within State

Potentiometric Surface Contour Lines

UPDATE REPORT ON DIVERSION AND WITHDRAWAL OF GROUNDWATER FROM NORTHERN MISSISSIPPI INTO THE STATE OF TENNESSEE

1886 ESTIMATED POTENTIOMETRIC SURFACE MAP FOR PREDEVELOPMENT CONDITIONS

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FILE NAME:	Figure05.MXD
FIGURE NO.:	5

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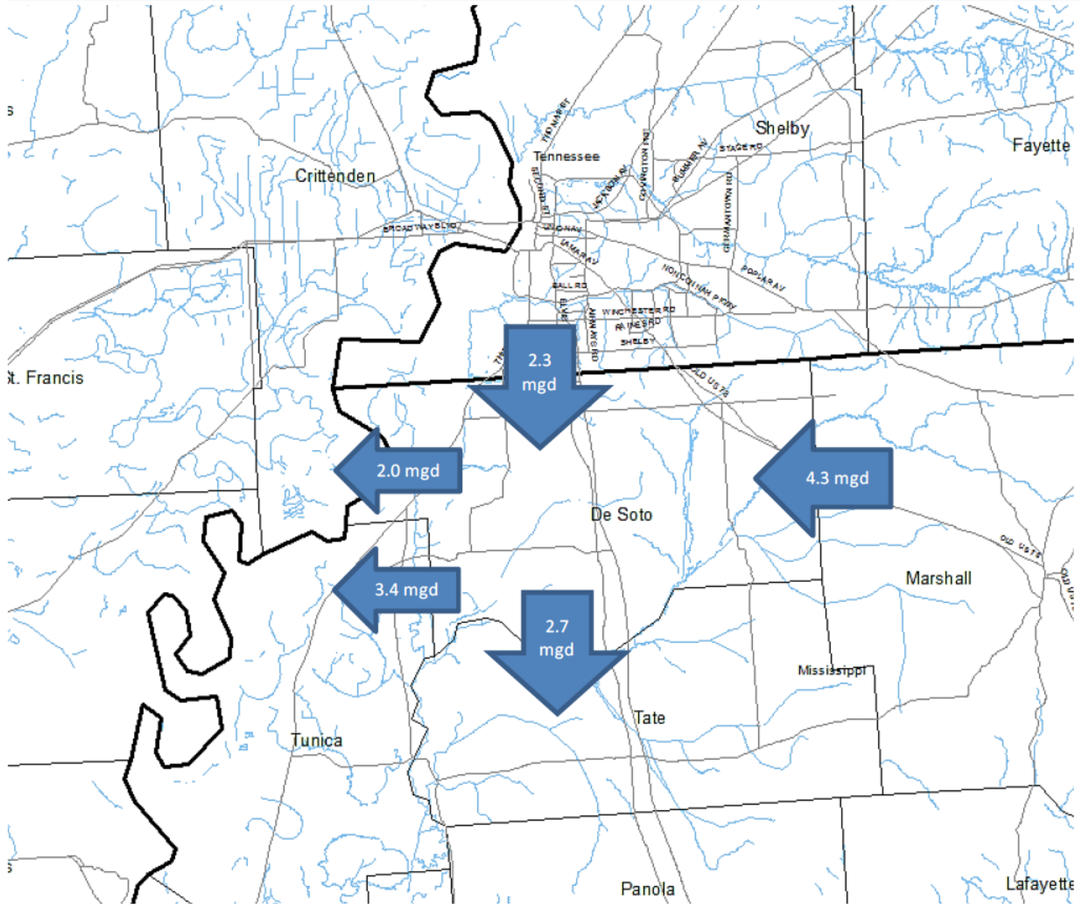
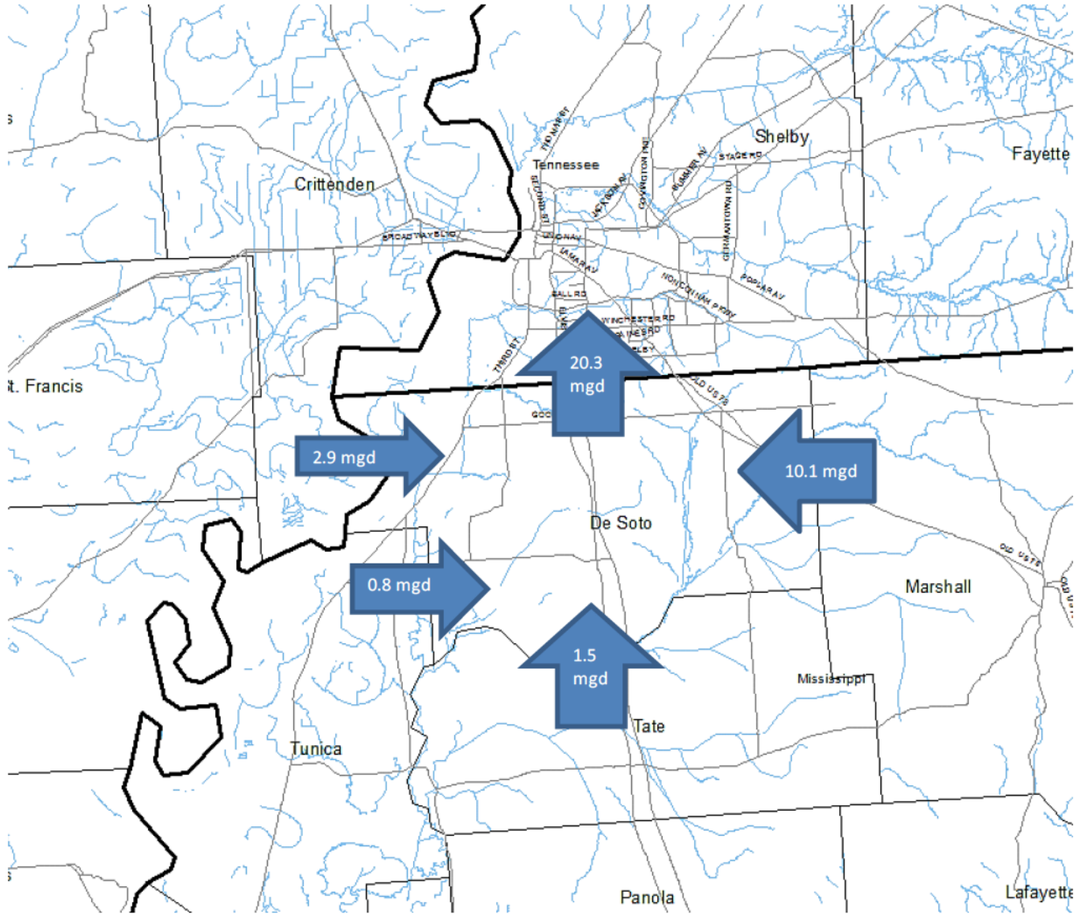
Pre - Development Memphis Sand Sparta Aquifer
Model Layers 5 Through 10 (Desoto County)



2007 Memphis Sand Sparta Aquifer
Model Layers 5 Through 10 (Desoto County)



Simulated Flow in Memphis Sand Sparta Aquifer

Simulation Period	Flux (million gallons per day)
Pre-Development Flow from Tennessee To Mississippi	2.3
2007 Flow from Mississippi To Tennessee	20.3
Net Pumping Related Impact (Diversion)	22.6

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UPDATED REPORT ON DIVERSION AND WITHDRAWAL OF GROUNDWATER FROM NORTHERN MISSISSIPPI INTO THE STATE OF TENNESSEE

PRE-DEVELOPMENT AND 2007 WATER BUDGET IN DESOTO COUNTY MISSISSIPPI FROM USGS MERAS MODEL

REVISED
DATE
FILE NAME: FIGURE06.MXD

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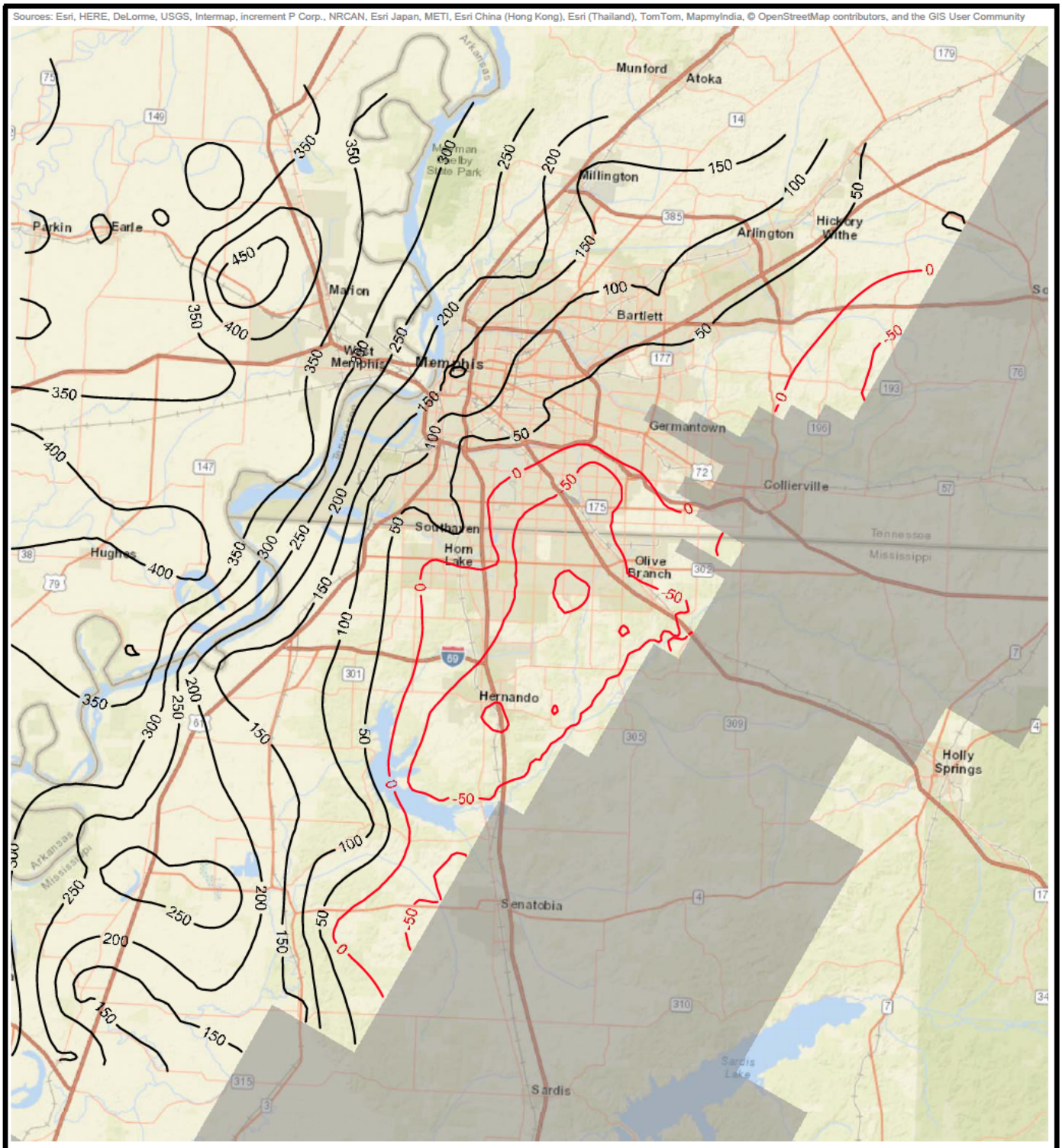

N

0 5 10 Miles

Legend

Water Level in Feet Above or Below the Top of Memphis Sand Sparta Aquifer

Black - Above

Red - Below

Constant Head

UPDATE REPORT ON DIVERSION AND WITHDRAWAL OF GROUNDWATER FROM NORTHERN MISSISSIPPI INTO THE STATE OF TENNESSEE

HEADS ABOVE AND BELOW THE TOP OF MSSA AQUIFER FROM EQUAL AMOUNTS OF PUMPAGE OCCURING IN MISSISSIPPI AND TENNESSEE (BASED ON 2016 MLGW AND DESOTO COUNTY ESTIMATES)

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DATE:	Aug. 2017
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FIGURE NO.:	7

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Larry Moffett

From: Larry Moffett
Sent: Tuesday, November 7, 2017 4:43 PM
To: 'Bearman, David'; Roberts, Kristine
Cc: Bearman, Leo; Branson, Joshua D. (jbranson@kellogghansen.com); Hill, T. Dietrich (Deke) (dhill@kellogghansen.com); Mike Ellingburg
Subject: RE: Mississippi v. Tennessee, Memphis and MLGW - Documents Requested During Depositions
Attachments: MS SCT 016199-West TN Water System 2007 Pumpage Data.xlsx; MS SCT 016200-West TN Water System 2008 Pumpage Data.xlsx; MS SCT 016201-West TN Water System 2009 Pumpage Data.xlsx; MS SCT 016202-West TN Water System 2010 Pumpage Data.xlsx; MS SCT 016203-West TN Water System 2011 Pumpage Data.xlsx; MS SCT 016204-West TN Water System 2012 Pumpage Data.xlsx

Follow Up Flag: Follow up
Flag Status: Flagged

Here are the spreadsheets referenced in my email below as MS SCT 015538-43, but which have now been renumbered as MS SCT 016199-204. Sorry for the confusion! Regards, Larry

From: Bearman, David [mailto:dbearman@bakerdonelson.com]
Sent: Tuesday, November 07, 2017 4:05 PM
To: Larry Moffett <LMoffett@danielcoker.com>; Roberts, Kristine <klroberts@bakerdonelson.com>
Cc: Bearman, Leo <lbearman@bakerdonelson.com>; Branson, Joshua D. (jbranson@kellogghansen.com) <jbranson@kellogghansen.com>; Hill, T. Dietrich (Deke) (dhill@kellogghansen.com) <dhill@kellogghansen.com>; Mike Ellingburg <MEllingburg@danielcoker.com>; Bearman, David <dbearman@bakerdonelson.com>
Subject: RE: Mississippi v. Tennessee, Memphis and MLGW - Documents Requested During Depositions

Larry - can you please check the Bates numbers of the docs you just produced. It appears Mississippi has already produced documents through MS SCT 016198. Do you want to renumber and resend?
David

> **From:** Larry Moffett [mailto:LMoffett@danielcoker.com]
> **Sent:** Tuesday, November 07, 2017 3:09 PM
> **To:** Roberts, Kristine
> **Cc:** Bearman, David; Bearman, Leo; Branson, Joshua D. (jbranson@kellogghansen.com); Hill, T. Dietrich (Deke) (dhill@kellogghansen.com); Mike Ellingburg
> **Subject:** RE: Mississippi v. Tennessee, Memphis and MLGW - Documents Requested During Depositions
>
> Kristine, I believe we have produced everything on which Dave relied for the DeSoto County pumping. On another matter relating to Dave, there were some questions in his deposition about discrepancies between the MLGW pumping data in his 2014 report and the MLGW pumping data in his 2017 report. To clarify this, please be advised that for the years 2007-2012 in his 2014 report, Dave used MLGW pumping data from the attached West TN spreadsheets, which he obtained from TDEC in 2013 (and which we are hereby producing as Bate Nos. MS SCT 015538-43); but for the years 2007-2012 in his 2017 report, he used MLGW SCT 000097 (attached) produced by MLGW in this proceeding (the second tab of 000097 contains data for 2007-2011 and the first tab contains data for 2012). Regards, Larry

From: Roberts, Kristine [mailto:klroberts@bakerdonelson.com]
Sent: Monday, October 16, 2017 2:38 PM
To: Larry Moffett <LMoffett@danielcoker.com>
Cc: Bearman, David <dbearman@bakerdonelson.com>; Bearman, Leo <lbearman@bakerdonelson.com>; Branson, Joshua D. (jbranson@kellogghansen.com) <jbranson@kellogghansen.com>; Hill, T. Dietrich (Deke) (dhill@kellogghansen.com) <dhill@kellogghansen.com>; Mike Ellingburg <MEllingburg@danielcoker.com>
Subject: RE: Mississippi v. Tennessee, Memphis and MLGW - Documents Requested During Depositions

Thanks very much, Larry. Just to confirm, have you provided all of the information that David Wiley received from MDEQ or otherwise reviewed regarding DeSoto County pumping from the Memphis Sand Sparta Aquifer? I want to make sure we are not missing anything on which Wiley relied for DeSoto County pumping.

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From: Larry Moffett [mailto:LMoffett@danielcoker.com]
Sent: Friday, October 13, 2017 1:58 PM
To: Roberts, Kristine
Cc: Bearman, David; Bearman, Leo; Branson, Joshua D. (jbranson@kellogghansen.com); Hill, T. Dietrich (Deke) (dhill@kellogghansen.com); Mike Ellingburg
Subject: RE: Mississippi v. Tennessee, Memphis and MLGW - Documents Requested During Depositions

Kristine, regarding David Wiley's deposition, you have requested "spreadsheets containing data on Desoto County pumping from the Memphis Sand Sparta Aquifer provided by MDEQ." Mr. Wiley advises that he was referring to two of the attached documents. The first document (water use data for 2013-15) was produced as MS SCT 000007-000008. The second document covers various periods of time prior to 2013. We thought this second document had been produced previously, but due to an oversight, it was not. We have marked the document as Bates No. MS SCT 015526. We apologize for this oversight.

You have also requested the "source of potentiometric maps and drawdown maps that incorrectly identify the source as 'TENN., USGS'." Mr. Wiley advises that the source for Figure No. 11 in his June 2017 report is the USGS MATRAS document that is attached hereto and bears Bates Nos. MS SCT 015527-015537. We inadvertently failed to produce this document previously. Again, we apologize. Mr.

Wiley advises that Figures 13-21 and 24 in his June 2017 report were generated by Leggette Brashears & Graham running the Brahana & Broshears Model WRI-89-4131 (previously produced as Bates Nos. GWI 00065 and as MS SCT 00298-00361).

Please let us know if you have any questions. We expect to provide you with a response to your inquiry about Dr. Spruill on Monday. Regards, Larry

From: Roberts, Kristine [mailto:klroberts@bakerdonelson.com]
Sent: Tuesday, October 10, 2017 4:45 PM
To: Mike Ellingburg <MEllingburg@danielcoker.com>; Larry Moffett <LMoffett@danielcoker.com>
Cc: Bearman, David <dbearman@bakerdonelson.com>; Bearman, Leo <lbearman@bakerdonelson.com>; Branson, Joshua D. (jbranson@kellogghansen.com) <jbranson@kellogghansen.com>; Hill, T. Dietrich (Deke) (dhill@kellogghansen.com) <dhill@kellogghansen.com>
Subject: RE: Mississippi v. Tennessee, Memphis and MLGW - Documents Requested During Depositions

Mike and Larry,

I am following up about the documents the defendants requested during the depositions of Mississippi's experts (see my email below). Can you please let me know when we can expect to receive them?

Thanks,
Kristine

Kristine L. Roberts
Chair, Financial Services Litigation Group
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www.bakerdonelson.com

From: Roberts, Kristine
Sent: Friday, September 29, 2017 1:27 PM
To: Mike Ellingburg; 'Larry Moffett'
Cc: dbearman@bakerdonelson.com; Bearman, Leo (lbearman@bakerdonelson.com); Branson, Joshua D. (jbranson@kellogghansen.com); Hill, T. Dietrich (Deke) (dhill@kellogghansen.com)
Subject: Mississippi v. Tennessee, Memphis and MLGW - Documents Requested During Depositions

Mike and Larry,

During the depositions of David Wiley and Richard Spruill, the witnesses identified various documents and information that Mississippi has not yet produced. You requested that we compile and send you a list of those items. Please provide the following documents and information:

Wiley

- Spreadsheets containing data on DeSoto County pumping from the Memphis Sand Sparta Aquifer provided by MDEQ
- Source of potentiometric maps and drawdown maps that incorrectly identify the source as "Tenn., USGS"

Spruill

- Expert Report Addendum #1 - Figure 3 - Well construction records for wells used by Criner & Parks in preparing their equipotential map that Spruill reviewed
- Expert Report Addendum #1 - Page 18 - Item #11 - Spruill's sketch of how Waldron's contours would change based on the inclusion of Well #3
- Expert Report Addendum #1 - Page 20 - Item #14 - Spruill's sketch of what the contour lines on Waldron's map would look like if Wells #12 and #14 were removed
- Map created by Spruill that compares predevelopment potentiometric contours and/or head levels with current potentiometric contours and/or head levels
- Any test data and/or letter reports for wells in DeSoto County (including the Airways #2 Well in Southaven) that Spruill received from Mississippi's counsel
- Particle tracking maps from Wiley showing vertical movement
- The MDEQ regulations or "tables" to which Spruill referred
- Graph showing MLGW pumping to which Spruill referred

We have not yet received the transcripts from the depositions, and we reserve the right to request additional items after we review the transcripts.

Regards,
Kristine

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MS SCT 016199-West TN Water System 2007 Pumpage Data

PWS_ID	MA_NAME	L_SI	SOURCE	YEAR	JANAVER	JANMAX	FEBAVER	FEBMAX	MARAVE	MARMAX	APRAVER	APRMAX	MAYAVE	MAYMA	UNAVE	UNMA	ULAVER	ULMAX	UGAVE	AUGMAX	SEPAVER	SEPMAX	OCTAVE	OCTMAX	NOVAVE	NOVMA	DECAVER	DECMAX
TN0000126	COLLIERVILLE WATER DEPT		PLANT #1	2007	4.387	4.928	4.575	5.823	5.806	8.294	5.912	8.417	9.286	12.351	10.67	12.98	9.399	11.95	14.08	16.791	8.961	13.46	7.331	10.468	5.409	6.593	4.685	5.747
TN0000126	COLLIERVILLE WATER DEPT		PLANT #2	2007	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TN0000126	COLLIERVILLE WATER DEPT		PLANT #3	2007	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TN0000126	COLLIERVILLE WATER DEPT		PLANT #4	2007	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TN0000126	COLLIERVILLE WATER DEPT		PLANT #5	2007	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TN0000262	GERMANTOWN WATER DEPT		SOUTHERN AV W P	2007	4.761	5.592	4.927	5.66	5.562	8.429	6.759	9.497	7.994	10.262	8.731	10.36	7.431	10.89	11.19	11.984	6.877	11.34	6.876	9.026	6.079	7.909	5.063	5.676
TN0000262	GERMANTOWN WATER DEPT		JOHNSON RD F P	2007	0.514	0.973	0.506	1.284	0.62	0.999	0.717	1.366	3.665	6.445	4.845	6.401	4.582	6.399	5.752	7.253	4.896	6.988	4.648	5.917	0.868	1.512	0.74	1.158
TN0000262	GERMANTOWN WATER DEPT	02	MLGW	2007	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TN0000450	MEMPHIS LIGHT, GAS, & WATER		ARLINGTON (2)	2007	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TN0000450	MEMPHIS LIGHT, GAS, & WATER		MORTON ST(17)	2007	0.1784	21.59	16.92	18.75	16.85	19.11	17.86	20.19	19.33	22.54	19.25	20.99	19.12	20.99	22.01	23.7	19.3	22.32	17.77	19.57	17.81	19.26	16.96	18.25
TN0000450	MEMPHIS LIGHT, GAS, & WATER		SHEAHAN ST(22)	2007	13.07	14.74	13.1	14.34	13.28	18.85	11.97	17.85	18.16	24	24.05	29.12	21.69	26.77	26.43	31.67	18.74	26.87	14.03	21.14	8.92	11.78	7.89	9.91
TN0000450	MEMPHIS LIGHT, GAS, & WATER		ALLEN ST(26)	2007	17.29	19.49	17.52	19.52	17.36	20.57	17.84	20.13	20.26	22.76	22.67	25.31	21.82	24.85	24.06	27.49	21.37	24.84	19.53	24.35	17.76	20.33	16.74	20.15
TN0000450	MEMPHIS LIGHT, GAS, & WATER		McCORD ST(24)	2007	13.78	14.67	13.1	15.43	13.75	17.34	17.16	19.1	18.95	21.53	19.47	23.25	18.24	21.15	20.71	25.32	17.72	20.73	15.93	18.6	15.37	17.89	14.16	16.05
TN0000450	MEMPHIS LIGHT, GAS, & WATER		LICHTERMAN(23)	2007	16.51	18.14	16.87	20.04	17.2	20.57	18.92	22.26	21.01	25.12	22.8	26.16	21.41	25.44	26.95	0.3418	22.28	25.8	20.8	24.77	17.93	22.22	15.55	17.3
TN0000450	MEMPHIS LIGHT, GAS, & WATER		DAVIS ST(19)	2007	18.35	20.84	19.39	21.53	20.6	23.21	20.3	23.39	23.12	25.98	23.65	27	23.19	27.07	25.23	28.3	24.1	28.2	21.43	24.3	20.08	22.74	17.93	18.25
TN0000450	MEMPHIS LIGHT, GAS, & WATER		LNG ST(3)	2007	0	0	0	0	0	0	0.47	0.68	0.51	0.69	0.56	0.7	0.47	0.77	0.7	0.96	0.45	0.82	0.37	0.52	0.35	0.46	0.44	0.57
TN0000450	MEMPHIS LIGHT, GAS, & WATER		MALLORY ST(23)	2007	13.07	15.17	13.88	15.84	13.98	16.9	14.5	16.73	17.2	21.34	20.93	25.13	19.6	25.53	23.21	27.48	18.5	25.55	15.89	20.72	13.06	14.87	12.21	13.99
TN0000450	MEMPHIS LIGHT, GAS, & WATER		SHAW ST(17)	2007	17.43	20.3	18.09	19.96	18.79	21.71	20.07	25.09	24.74	30.81	28.56	33.14	26.56	33.24	33.07	37.05	24.64	33.55	23.47	28.11	19.26	22.03	19.87	21.88
TN0000450	MEMPHIS LIGHT, GAS, & WATER		PALMER ST(4)	2007	4.15	4.35	4.27	4.55	4.23	4.74	4.17	4.42	4.25	4.53	4.26	4.74	4.12	4.5	4.2	4.7	3.96	4.65	4.08	4.62	4.12	4.53	4.27	4.74
TN0000463	MILLINGTON WATER DEPT		CLEARWELL	2007	0.525	0.69	0.531	0.649	0.533	0.708	0.531	0.641	0.619	0.782	0.667	0.812	0.607	0.719	0.702	0.959	0.655	1.141	0.599	1.244	0.531	0.627	0.535	0.706
TN0000463	MILLINGTON WATER DEPT	02	MLGW	2007	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TN0000468	NSA - MIDSOUTH		CLEARWELL	2007	0.501	0.718	0.517	0.788	0.408	0.572	0.409	0.554	0.551	0.903	0.624	0.781	0.596	1.067	0.682	1.4	0.581	0.776	0.441	0.624	0.394	0.636	0.34	0.554
TN0000765	BARTLETT WATER SYSTEM		O. T. YATES	2007	4.947	6.027	5.178	7.515	5.282	7.193	5.516	7.739	7.85	12.591	10.16	13.12	8.386	10.92	12.47	15.575	8.029	12.69	6.622	8.19	5.393	6.577	5.228	5.648
TN0000765	BARTLETT WATER SYSTEM		A. G. WARNER	2007	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TN0000765	BARTLETT WATER SYSTEM		BARTLETT #4	2007	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

PWS_ID	MA_NAME	L_SI	SOURCE	YEAR	JANAVER	JANMAX	FEBAVER	FEBMAX	MARAVE	MARMAX	APRAVER	APRMAX	MAYAVE	MAYMA	UNAVE	UNMA	ULAVER	ULMAX	UGAVE	AUGMAX	SEPAVER	SEPMAX	OCTAVE	OCTMAX	NOVAVE	NOVMA	DECAVER	DECMAX
TN0000126	COLLIERVILLE WATER DEPT		PLANT #1	2008	4.732	5.777	4.25	4.902	4.327	5.183	4.842	5.74	6.171	8.352	9.558	12.12	11.316	13.48	8.819	11.997	7.025	9.32	6.126	8.814	4.68	5.929	4.239	4.946
TN0000126	COLLIERVILLE WATER DEPT		PLANT #2	2008	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TN0000126	COLLIERVILLE WATER DEPT		PLANT #3	2008	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TN0000126	COLLIERVILLE WATER DEPT		PLANT #4	2008	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TN0000126	COLLIERVILLE WATER DEPT		PLANT #5	2008	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TN0000262	GERMANTOWN WATER DEPT		SOUTHERN AV W P	2008	4.771	6.887	4.831	5.916	4.658	5.431	4.621	5.857	5.262	7.085	8.279	11.23	9.274	11.23	7.381	10.526	6.794	8.888	5.448	8.389	4.749	7.253	4.83	5.715
TN0000262	GERMANTOWN WATER DEPT		JOHNSON RD F P	2008	0.879	1.238	0.908	2.351	0.876	1.208	1.483	3.171	2.339	4.089	3.336	5.202	4.721	6.756	3.761	5.228	3.111	3.887	2.624	4.34	1.526	2.561	0.76	0.844
TN0000262	GERMANTOWN WATER DEPT	02	MLGW	2008	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TN0000450	MEMPHIS LIGHT, GAS, & WATER		ARLINGTON (2)	2008	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TN0000450	MEMPHIS LIGHT, GAS, & WATER		MORTON ST(17)	2008	18.19	20.54	18.84	19.7	16.04	18.95	15.97	17.54	16.64	18.29	18.02	19.37	18.91	21.9	17.51	22.7	17.22	18.4	16.51	18.4	15.81	17.07	16.43	17.43
TN0000450	MEMPHIS LIGHT, GAS, & WATER		SHEAHAN ST(22)	2008	8.67	12.15	8.88	17.92	8.31	14.37	8.58	12.37	12.37	18.05	20.42	25.07	23.64	27.91	20.84	26.64	17.77	25.4	13.39	20.7	10.41	12.52	11.41	14.4
TN0000450	MEMPHIS LIGHT, GAS, & WATER		ALLEN ST(26)	2008	18.1	20.87	17.09	19.13	15.79	18.17	17.58	19.98	19.88	23.1	22.95	0.256	23.9	26.73	22.46	27.51	21.92	25.22	20.36	23.78	17.2	21.3	18.61	25.15
TN0000450	MEMPHIS LIGHT, GAS, & WATER		McCORD ST(24)	2008	14.52	16.12	14.46	16.41	14.13	15.49	14.37	15.83	14.98	17.42	16.77	19.25	18.56	23.1	17.77	21.9	17.59	20.42	15.99	17.73	15.32	17.18	15.16	16.96
TN0000450	MEMPHIS LIGHT, GAS, & WATER		LICHTERMAN(23)	2008	16.12	18.38	16.03	20	14.94	18.31	15.91	18.92	18.06	21.58	20.25	24.65	22.5	26.8	21.09	27.04	19.36	22.57	18.53	22.63	16.67	19.32	15.18	18.06
TN0000450	MEMPHIS LIGHT, GAS, & WATER		DAVIS ST(19)	2008	18.81	21.6	19.07	21.53	19.2	22.17	20.35	28.56	19.18	24.53	21	22.75	21.63	23.45	20.26	22.54	19.68	21.69	19.34	21.89	17.26	20.29	15.97	19
TN0000450	MEMPHIS LIGHT, GAS, & WATER		LNG ST(3)	2008	0.4	0.63	0.4	0.64	0.42	0.62	0.43	0.56	0.47	0.57	0.62	0.85	0.73	0.87	0.67	0.93	0.45	0.71	0.39	0.51	0.33	0.5	0.35	0.51
TN0000450	MEMPHIS LIGHT, GAS, & WATER		MALLORY ST(23)	2008	12.19	14.05	0.1136	13.38	10.77	12.35	12.21	14.02	14.03	16.7	17.77	20.68	19.29	21.45	19.33	22.26	17.18	20.43	14.01	18.2	13.6	18.5	0.1313	0.1526
TN0000450	MEMPHIS LIGHT, GAS, & WATER		SHAW ST(17)	2008	20.95	23.27	20.34	23.6	20.72	22.79	20.67	22.8	22.5	27.09	27.86	32.49	31.3	36.35	27.15	35.44	20.8	29.52	20.61	29.82	20.64	22.51	19.79	21.2
TN0000450	MEMPHIS LIGHT, GAS, & WATER		PALMER ST(4)	2008	4.14	4.49	4.09	4.41	3.61	4.22	3.38	4.21	4.09	4.26	4.06	4.35	4.03	4.36	4.19	4.82	4.06	4.22	4.07	4.25	4.21	4.53	4.1	4.6
TN0000463	MILLINGTON WATER DEPT		CLEARWELL	2008	0.509	0.976	0.48	0.628	0.465	0.587	0.506	0.852	0.513	0.855	0.587	0.717	0.661	0.817	0.62	0.963	0.558	0.667	0.542	1.103	0.488	0.579	0.457	0.586
TN0000463	MILLINGTON WATER DEPT	02	MLGW	2008	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TN0000468	NSA - MIDSOUTH		CLEARWELL	2008	0.38	0.536	0.494	0.663	0.521	1.2966	0.524	0.703	0.626	0.998	0.722	1.131	0.731	1.365	0.558	0.816	0.469	0.756	0.426	0.694	0.389	0.725	0.349	0.57
TN0000765	BARTLETT WATER SYSTEM		O. T. YATES	2008	5.226	5.908	5.078	6.133	5.188	6.085	5.186	5.89	6.195	8.386	8.178	10.51	10.489	12.21	8.136	14.285	6.781	8.436	5.996	8.092	5.139	8.419	4.962	6.111
TN0000765	BARTLETT WATER SYSTEM		A. G. WARNER	2008	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TN0000765	BARTLETT WATER SYSTEM		BARTLETT #4	2008	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

PWS_ID	MA_NAME	L_SI	SOURCE	YEAR	JANAVER	JANMAX	FEBAVER	FEBMAX	MARAVE	MARMAX	APRAVER	APRMAX	MAYAVE	MAYMA	UNAVE	UNMA	JULAVER	ULMAX	UGAVE	AUGMAX	SEPAVER	SEPMAX	OCTAVE	OCTMAX	OVAVE	NOVMA	DECAVER	DECMAX
TN0000126	COLLIERVILLE WATER DEPT		PLANT #1	2009	4.257	4.569	4.236	4.882	4.312	4.958	4.876	6.843	5.77	7.968	8.706	12.34	8.609	12.71	8.068	10.327	6.878	9.438	5.003	6.072	4.592	5.399	0.4245	4.678
TN0000126	COLLIERVILLE WATER DEPT		PLANT #2	2009	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TN0000126	COLLIERVILLE WATER DEPT		PLANT #3	2009	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TN0000126	COLLIERVILLE WATER DEPT		PLANT #4	2009	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TN0000126	COLLIERVILLE WATER DEPT		PLANT #5	2009	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TN0000262	GERMANTOWN WATER DEPT		SOUTHERN AV W P	2009	4.743	5.542	4.737	5.347	4.518	5.498	5.461	7.661	6.534	9.043	10.13	10.76	7.498	10.75	7.642	9.701	6.792	8.321	4.127	8.141	2.482	3.114	3.48	6.315
TN0000262	GERMANTOWN WATER DEPT		JOHNSON RD F P	2009	0.707	0.899	0.849	1.731	0.795	1.216	0.679	1.165	1.763	2.923	3.372	8.297	5.156	8.023	4.732	6.245	2.576	6.685	3.03	3.954	3.048	3.312	1.926	4.683
TN0000262	GERMANTOWN WATER DEPT	02	MLGW	2009	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TN0000450	MEMPHIS LIGHT, GAS, & WATER		ARLINGTON (2)	2009	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TN0000450	MEMPHIS LIGHT, GAS, & WATER		MORTON ST(17)	2009	16.34	18.95	16.08	16.88	15.81	17.03	15.97	16.98	16.56	18.74	18.46	20.25	18.82	21.85	18.1	20.42	18.33	250.3	18.04	19.32	17.91	18.96	18.44	19.66
TN0000450	MEMPHIS LIGHT, GAS, & WATER		SHEAHAN ST(22)	2009	12.04	14.62	10.44	11.75	11.42	14.85	11.15	14.3	12.21	15.48	18.71	28.2	18.37	28.8	16.7	20.91	13.05	17.72	10.58	12.69	9.76	11.47	10.31	11.7
TN0000450	MEMPHIS LIGHT, GAS, & WATER		ALLEN ST(26)	2009	18.98	22.07	17.59	19.84	16.85	19.62	17.23	20.43	19.11	22.72	22.85	27.49	22.63	26.57	22.61	26.39	20.73	24.35	17.7	21.82	16.52	19.55	16.07	18.7
TN0000450	MEMPHIS LIGHT, GAS, & WATER		McCORD ST(24)	2009	15.11	16.43	14.77	16.2	15.19	17.11	16.01	17.92	16.76	19.22	19.18	23.98	18.56	22.66	18.62	21.78	17.63	19.59	16.52	18.22	16.41	18.91	15.8	17.25
TN0000450	MEMPHIS LIGHT, GAS, & WATER		LICHTERMAN(23)	2009	15.94	18.1	15.64	19.18	15.52	18.35	15.76	17.93	17.35	20.71	19.29	25.61	20.28	25.39	19.19	22.55	20.12	23.5	17.04	22.5	14.74	16.96	15.43	17.17
TN0000450	MEMPHIS LIGHT, GAS, & WATER		DAVIS ST(19)	2009	14.5	18.91	16.39	17.63	16.39	17.68	17.53	19.3	18.04	19.93	19.7	21.48	19.39	21.9	19.29	20.9	18.03	19.73	17.15	18.57	17.07	18.48	16.73	18.42
TN0000450	MEMPHIS LIGHT, GAS, & WATER		LNG ST(3)	2009	0.39	0.54	0.41	0.61	0.37	0.56	0.39	0.57	0.37	0.57	0.45	0.75	0.49	0.72	0.49	0.86	0.48	0.79	0.41	0.6	0.36	0.5	0.36	0.57
TN0000450	MEMPHIS LIGHT, GAS, & WATER		MALLORY ST(23)	2009	13.28	17	11.76	13.66	12.01	13.79	12.74	14.93	13.29	16.84	16.36	20.9	16.01	20.73	16.47	20.89	15	20.92	12.33	15.55	12.1	14.44	11.78	14.28
TN0000450	MEMPHIS LIGHT, GAS, & WATER		SHAW ST(17)	2009	20.3	22.03	19.16	20.95	19.48	21.23	19.95	21.63	20.73	24.34	24.93	29.52	23.66	30.01	25.27	28.11	23.4	29.96	20.48	23.49	19.76	21.64	19.07	20.31
TN0000450	MEMPHIS LIGHT, GAS, & WATER		PALMER ST(4)	2009	4.5	4.91	4.17	4.48	4.09	4.4	4.14	4.72	4.15	4.58	4.26	4.87	4.14	4.39	4.15	4.2	4.15	4.48	4.19	4.73	4.09	4.45	4.05	4.29
TN0000463	MILLINGTON WATER DEPT		CLEARWELL	2009	0.492	1.159	0.899	0.807	0.907	0.614	0.948	0.941	1.012	0.995	1.116	1.364	1.091	0.675	1.068	1.224	1.031	1.187	0.997	1.563	0.958	1.081	0.96	1.142
TN0000463	MILLINGTON WATER DEPT	02	MLGW	2009	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TN0000468	NSA - MIDSOUTH		CLEARWELL	2009	0.392	0.618	0.358	0.714	0.463	0.954	0.523	0.951	0.562	0.972	0.551	1.196	0.65	1.44	0.64	1.302	0.447	0.777	0.38	0.696	0.35	0.717	0.32	0.626
TN0000765	BARTLETT WATER SYSTEM		O. T. YATES	2009	5.199	8.382	4.462	5.912	4.722	7.552	4.576	5.551	5.431	7.705	7.444	11.62	8.059	12.07	6.976	8.56	5.873	8.035	4.922	6.36	4.462	5.614	5.089	7.165
TN0000765	BARTLETT WATER SYSTEM		A. G. WARNER	2009	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TN0000765	BARTLETT WATER SYSTEM		BARTLETT #4	2009	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

MS SCT 016202-West TN Water System 2010 Pumpage Data

PWS_ID	MA_NAME	L_SI	SOURCE	Year	JANAVER	JANMAX	FEBAVER	FEBMAX	MARAVE	MARMAX	APRAVER	APRMAX	MAYAVE	MAYMA	UNAVE	UNMA	ULAVER	ULMAX	UGAVE	AUGMAX	SEPAVER	SEPMAX	OCTAVE	OCTMAX	NOVAVE	NOVMA	DECAVER	DECMAX
TN0000126	COLLIERVILLE WATER DEPT		PLANT #1	2010	4.652	6.577	4.365	4.995	4.358	4.86	5.61	7.278	6.304	8.226	0.855	11.22	9.624	11.84	10.04	11.644	10.7	11.9	8.605	10.196	5.178	7.137	4.414	4.922
TN0000126	COLLIERVILLE WATER DEPT		PLANT #2	2010	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TN0000126	COLLIERVILLE WATER DEPT		PLANT #3	2010	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TN0000126	COLLIERVILLE WATER DEPT		PLANT #4	2010	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TN0000126	COLLIERVILLE WATER DEPT		PLANT #5	2010	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TN0000262	GERMANTOWN WATER DEPT		SOUTHERN AV W P	2010	2.792	4.344	3.69	4.614	2.121	3.924	0	0	3.805	6.06	0	0	4.394	7.622	6.738	4.663	0	0	4.259	6.227	2.073	3.178	2.259	4.363
TN0000262	GERMANTOWN WATER DEPT		JOHNSON RD F P	2010	2.859	3.45	1.399	2.992	2.954	3.12	0	0	4.107	7.797	0	0	7.153	8.859	7.093	7.921	0	0	6.775	7.589	4.928	6.298	3.244	4.211
TN0000262	GERMANTOWN WATER DEPT	02	MLGW	2010	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TN0000450	MEMPHIS LIGHT, GAS, & WATER		ARLINGTON (2)	2010	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TN0000450	MEMPHIS LIGHT, GAS, & WATER		MORTON ST(17)	2010	18.67	22.21	17.46	18.61	17.25	18.56	17.28	19.13	17.84	19.26	18.97	21.03	19.19	21.82	19.1	21.07	18.67	21.28	18.11	19.7	16.85	18.1	17.62	19.09
TN0000450	MEMPHIS LIGHT, GAS, & WATER		SHEAHAN ST(22)	2010	11.72	16.41	10.57	12.06	9.45	10.73	11.53	14.03	12.72	15.22	19.86	27.22	21.61	26.19	21.83	26.1	19.15	22.48	15.99	19.32	10.87	13.28	10.78	13.08
TN0000450	MEMPHIS LIGHT, GAS, & WATER		ALLEN ST(26)	2010	20.06	27.31	19.13	22.11	17.19	19.98	17.2	21.78	18.27	22.3	21.36	24.56	23.53	26.6	22.86	25.45	21.56	24.16	19.05	22.16	15.76	19.83	17	20.84
TN0000450	MEMPHIS LIGHT, GAS, & WATER		McCORD ST(24)	2010	17.3	20.9	16.6	17.97	15.66	17.55	16.23	18.49	15.88	17.52	18.55	21.85	19.99	22.62	19.97	21.77	21.58	24.1	19.89	21.74	17.44	19.49	17.52	20.21
TN0000450	MEMPHIS LIGHT, GAS, & WATER		LICHTERMAN(23)	2010	17.65	24.22	15.2	17.05	14.91	16.87	16.55	20.67	18.97	29.28	22.69	25.65	22.21	24.99	24.17	27.94	23.22	25.88	21.98	26.36	16.44	20.61	16.48	19.56
TN0000450	MEMPHIS LIGHT, GAS, & WATER		DAVIS ST(19)	2010	17.95	22.79	17.12	19.04	16.95	19.31	17.91	19.75	18.7	21.07	20.92	22.67	20.19	22.35	21.22	22.26	20.63	22.85	21.01	22.64	19.09	20.61	18.19	20.32
TN0000450	MEMPHIS LIGHT, GAS, & WATER		LNG ST(3)	2010	0.35	0.59	0.37	0.69	0.43	3.55	0.39	0.55	0.41	0.68	0.49	0.7	0.54	0.7	0.89	0.98	0.48	0.74	0.54	3.77	1.41	33	0.36	0.53
TN0000450	MEMPHIS LIGHT, GAS, & WATER		MALLORY ST(23)	2010	14.08	20.13	12.7	14.4	11.85	13.56	14.1	17.44	15.87	20.43	21.02	24.58	20.46	24.16	18.95	24.04	17.91	21.79	15.22	18.8	12.8	17.76	12.49	14.42
TN0000450	MEMPHIS LIGHT, GAS, & WATER		SHAW ST(17)	2010	20.3	23.52	20.15	24.74	20.3	23.03	21.41	23.84	22.95	25.53	26.66	29.51	26.79	31.86	25.3	27.89	23.83	26.61	22.39	24.79	20.49	22.97	20.84	23.03
TN0000450	MEMPHIS LIGHT, GAS, & WATER		PALMER ST(4)	2010	4.39	4.88	4.23	4.85	3.83	4.41	3.52	4.25	3.28	4.21	3.7	4.28	4.27	4.65	3.6	4.64	3.7	3.74	4.19	4.71	4.41	4.73	4.23	4.74
TN0000463	MILLINGTON WATER DEPT		CLEARWELL	2010	0.983	1.4	0.928	1.494	0.883	0.618	1.009	1.473	1.03	1.169	1.072	0.692	1.118	1.831	1.15	1.343	1.098	0.696	1.02	1.223	0.896	1.186	0.896	1.107
TN0000463	MILLINGTON WATER DEPT	02	MLGW	2010	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TN0000468	NSA - MIDSOUTH		CLEARWELL	2010	0.38	0.739	0.25	0.468	0.224	0.488	0.225	0.402	0.239	0.413	0.279	0.453	0.315	0.632	0.377	0.701	0.3	0.477	0.274	0.645	0.364	0.753	0.341	0.764
TN0000765	BARTLETT WATER SYSTEM		O. T. YATES	2010	5.328	7.066	4.466	6.06	4.728	5.816	5.151	7.255	5.776	7.737	7.129	10.11	8.336	11.96	7.962	9.773	7.789	11.44	6.805	8.529	5.238	6.59	5.04	6.231
TN0000765	BARTLETT WATER SYSTEM		A. G. WARNER	2010	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TN0000765	BARTLETT WATER SYSTEM		BARTLETT #4	2010	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

PWS_ID	MA_NAME	L_SI	SOURCE	YEAR	JANAVER	JANMAX	FEBAVER	FEBMAX	MARAVER	MARMAX	APRAVER	APRMAX	MAYAVER	MAYMAX	JUNAVER	JUNMAX	JULAVER	JULMAX	AUGAVER	AUGMAX	SEPAVER	SEPMAX	OCTAVER	OCTMAX	NOVAVER	NOVMAX	DECAVER	DECMAX
TN0000126	COLLIERVILLE WATER DEPT		PLANT #1	2011	4.727	3.758	4.258	4 8	4.449	5.432	4.941	5.819	5 902	8.159	9.834	12.16	10.135	11.716	9 589	12.7	8.497	11.739	6 881	8.997	4 882	5.992	4 313	4.777
TN0000126	COLLIERVILLE WATER DEPT		PLANT #2	2011	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TN0000126	COLLIERVILLE WATER DEPT		PLANT #3	2011	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TN0000126	COLLIERVILLE WATER DEPT		PLANT #4	2011	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TN0000126	COLLIERVILLE WATER DEPT		PLANT #5	2011	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TN0000262	GERMANTOWN WATER DEPT		SOUTHERN AV W P	2011	2.756	4.402	2.371	3.64	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3 273	4.634	0	0	0	0
TN0000262	GERMANTOWN WATER DEPT		JOHNSON RD F P	2011	2.541	3.172	2 96	3.491	0	0	3.378	7.083	0	0	0	0	0	0	0	0	0	0	5.419	8.059	0	0	0	0
TN0000262	GERMANTOWN WATER DEPT	02	MLGW	2011	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TN0000450	MEMPHIS LIGHT, GAS, & WATER		ARLINGTON (2)	2011	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TN0000450	MEMPHIS LIGHT, GAS, & WATER		MORTON ST(17)	2011	17.01	18.56	16.46	18.08	15.9	17.15	16.41	18.03	0	0	17.39	19.23	18.35	20.02	18.55	20 29	18.28	20 52	17.95	20.04	16.59	18.27	16.54	19.21
TN0000450	MEMPHIS LIGHT, GAS, & WATER		SHEAHAN ST(22)	2011	10.36	11.88	10 04	11.76	10.28	11.7	11.06	13.18	0	0	18.85	26.45	19.27	22.8	18.19	23 57	16.06	20 96	12.45	15.93	10.32	12.79	9.57	13.1
TN0000450	MEMPHIS LIGHT, GAS, & WATER		ALLEN ST(26)	2011	17.88	21.81	17.14	20.42	16.3	20.98	7.68	20.64	0	0	23.9	26.24	22.85	25.5	21.02	26.65	19.87	23.17	17.74	21.02	14.31	17.24	13.77	16.53
TN0000450	MEMPHIS LIGHT, GAS, & WATER		McCORD ST(24)	2011	16.1	18.21	15.2	17.29	15.25	16.99	16.17	18.83	0	0	21.25	25.03	21.86	24.03	21.11	23 91	20	23.64	18.78	21.55	16.88	19.24	15.86	18.47
TN0000450	MEMPHIS LIGHT, GAS, & WATER		LICHTERMAN(23)	2011	16.9	19.58	15 52	18.6	16.75	19 8	18.25	21.16	0	0	23.94	28.1	22.57	27.8	22.52	27 21	19.5	25 58	19.1	22.42	15.92	19.04	14.85	17.14
TN0000450	MEMPHIS LIGHT, GAS, & WATER		DAVIS ST(19)	2011	17.81	19.67	17 97	20.01	17.69	19.59	18.52	21.02	0	0	21.68	24.06	21.37	23.57	20.86	23.19	20.1	23.13	18.2	21.25	18.41	19.92	17.54	20.02
TN0000450	MEMPHIS LIGHT, GAS, & WATER		LNG ST(3)	2011	0.4	0.6	0.43	0.62	0.32	0.7	0.46	2.12	0	0	0 55	0.84	0.54	0.74	0.53	0 84	0.57	0.79	0.4	0.75	0.38	0.55	0.39	0.74
TN0000450	MEMPHIS LIGHT, GAS, & WATER		MALLORY ST(23)	2011	12.57	14.64	12 89	16.05	12.8	15.14	14.13	17.37	0	0	19.11	23.59	19.96	22.95	18.09	23.45	15.36	20 84	13.93	15.92	12.2	13.97	11.84	13.25
TN0000450	MEMPHIS LIGHT, GAS, & WATER		SHAW ST(17)	2011	20.66	22.65	20 96	23.03	20.89	22.06	20.67	23.25	0	0	25.55	27.96	25.7	27.76	25.03	28 52	22.85	26 95	22.01	25.39	20.01	23.65	19.78	21.51
TN0000450	MEMPHIS LIGHT, GAS, & WATER		PALMER ST(4)	2011	3.18	4.28	4 05	4.56	3.81	4.36	0	0	0	0	0	0	4.26	5.12	4.73	5 09	4.76	5 02	4.69	5.04	4.59	5.25	4.27	5.02
TN0000463	MILLINGTON WATER DEPT		CLEARWELL	2011	0.906	1.013	0.903	1.1	0 877	1.101	0.901	1.471	0 949	1.174	1.188	1.643	1 288	1 883	1.119	1.354	1 034	1.581	1 005	1.638	0 966	1.175	0 841	1.028
TN0000463	MILLINGTON WATER DEPT	02	MLGW	2011	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TN0000468	NSA - MIDSOUTH		CLEARWELL	2011	0.385	1.146	0.349	0.723	0 377	0.766	0.385	0.729	0 399	0.892	0.579	1.038	0.605	1 085	0.609	1.143	0.488	0.923	0 379	0.8	0 328	0.77	0 357	0.794
TN0000765	BARTLETT WATER SYSTEM		O. T. YATES	2011	4.773	5.742	4.739	5.564	5 312	7.428	4.583	7.361	5.471	8.851	7.649	9.946	8 895	10 559	8 508	11.588	5.04	6.231	6.171	9.049	4.703	6.733	4 338	5.306
TN0000765	BARTLETT WATER SYSTEM		A. G. WARNER	2011	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TN0000765	BARTLETT WATER SYSTEM		BARTLETT #4	2011	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

PWS_ID	MA_NAME	L_SI	SOURCE	YEAR	JANAVER	JANMAX	FEBAVER	FEBMAX	MARAVER	MARMAX	APRAVER	APRMAX	MAYAVER	MAYMAX	JUNAVER	JUNMAX	JULAVER	JULMAX	AUGAVE	AUGMAX	SEPAVER	SEPMAX	OCTAVER	OCTMAX	NOVAVER	NOVMAX	DECAVER	DECMAX
TN0000126	COLLIERVILLE WATER DEPT		PLANT #1	2012	4.263	5.05	4.197	4.6	4.312	5.568	5.965	8.804	5.535	11.772	9.571	15.472	11.123	14.543	9.496	12.226	6.996	7.896	5.438	6.181	4.356	5.258	4.009	4.417
TN0000126	COLLIERVILLE WATER DEPT		PLANT #2	2012	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TN0000126	COLLIERVILLE WATER DEPT		PLANT #3	2012	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TN0000126	COLLIERVILLE WATER DEPT		PLANT #4	2012	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TN0000126	COLLIERVILLE WATER DEPT		PLANT #5	2012	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TN0000262	GERMANTOWN WATER DEPT		SOUTHERN AV W P	2012	1.714	2.328	1.62	2.557	2.328	3.456	0	0	4.72	6.993	6.335	9.247	6.232	9.376	5.983	7.497	0	0	3.799	6.851	2.868	3.65	0	0
TN0000262	GERMANTOWN WATER DEPT		JOHNSON RD F P	2012	2.949	4.894	3.143	4.443	2.998	3.983	0	0	5.575	7.131	5.38	9.433	6.022	8.073	5.633	6.614	0	0	3.202	4.099	3.268	3.826	0	0
TN0000262	GERMANTOWN WATER DEPT	02	MLGW	2012	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TN0000450	MEMPHIS LIGHT, GAS, & WATER		ARLINGTON (2)	2012	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TN0000450	MEMPHIS LIGHT, GAS, & WATER		MORTON ST(17)	2012	16.24	18.16	15.91	17.84	15.81	17.24	17.21	18.71	18.68	21.11	18.55	21.1	19.32	21.89	18.69	20.79	17.4	20.5	16.85	18.48	16.68	18.22	16.78	18.09
TN0000450	MEMPHIS LIGHT, GAS, & WATER		SHEAHAN ST(22)	2012	9.88	10.9	10.04	13.13	9.72	12.18	12.15	17.17	15.41	19.26	15.71	23.12	18.64	24.94	17.1	22.03	13.23	15.27	12.16	13.87	11.13	12.79	11.49	13.39
TN0000450	MEMPHIS LIGHT, GAS, & WATER		ALLEN ST(26)	2012	14.14	17.96	11.97	15.86	15.01	19.07	16.9	19.89	20.36	26.45	22.56	26.7	23.84	26.81	18.85	24	17.3	21.58	16.67	20.39	14.41	17.3	13.95	17.61
TN0000450	MEMPHIS LIGHT, GAS, & WATER		McCORD ST(24)	2012	15.89	18.53	15.87	20.51	15.66	17.95	16.19	18.47	19.57	22.04	18.7	23.26	19.82	23.38	18.43	20.95	16.74	19.52	14.76	16.69	14.45	16.43	14.25	16.06
TN0000450	MEMPHIS LIGHT, GAS, & WATER		LICHTERMAN(23)	2012	14.77	16.97	14.71	17.5	14.41	18.09	17.26	20.8	21.11	27.6	23.68	29.58	23.16	27.79	24.52	28.31	22.56	25.12	18.68	35.83	15.69	19.79	13.68	16.87
TN0000450	MEMPHIS LIGHT, GAS, & WATER		DAVIS ST(19)	2012	17.36	20.12	17.64	20.47	17.77	19.37	18.18	20.37	19.87	21.84	20.87	24.36	21.2	23.02	21.63	23.17	20.48	22.45	18.74	21.69	17.78	19.19	16.94	18.67
TN0000450	MEMPHIS LIGHT, GAS, & WATER		LNG ST(3)	2012	0.36	0.52	0.44	0.59	0.46	0.67	0.39	0.54	0.37	0.58	0.57	0.9	0.66	0.93	0.62	0.86	0.47	0.7	0.36	0.58	0.43	0.67	0.41	0.66
TN0000450	MEMPHIS LIGHT, GAS, & WATER		MALLORY ST(23)	2012	12.21	19.2	12.38	15.53	12.19	13.77	13.52	15.8	16.29	20.6	17.62	23.3	19.17	24.76	19.39	24.54	16.12	20.37	13.04	15.66	12.44	14.55	12.7	14.66
TN0000450	MEMPHIS LIGHT, GAS, & WATER		SHAW ST(17)	2012	19.67	21.32	19.41	20.86	19.83	21.76	21.26	25.59	23.32	26.98	25.45	32.21	26.83	32.06	25.64	30.05	23.39	27.74	21.69	34.04	19.73	21.8	19.23	23.59
TN0000450	MEMPHIS LIGHT, GAS, & WATER		PALMER ST(4)	2012	4.81	9.89	4.58	4.95	4.65	4.95	4.66	4.9	4.69	4.97	4.58	4.78	4.53	4.68	4.33	6.02	3.69	4.14	3.82	4.01	3.55	3.83	3.41	3.58
TN0000463	MILLINGTON WATER DEPT		CLEARWELL	2012	0.839	1.048	0.862	1.089	0.958	1.598	1.033	1.337	0.982	1.106	1.027	1.329	1.139	1.347	1.082	1.352	0.969	1.115	0.884	0.943	0.836	0.991	0.838	1.042
TN0000463	MILLINGTON WATER DEPT	02	MLGW	2012	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TN0000468	NSA - MIDSOUTH		CLEARWELL	2012	0.381	0.784	0.381	0.813	0.414	0.904	0.374	0.766	0.485	0.8924	0.536	0.927	0.573	1.018	0.596	1.096	0.415	0.832	0.335	0.729	0.198	0.467	0.273	0.689
TN0000765	BARTLETT WATER SYSTEM		O. T. YATES	2012	4.264	5.1091	4.354	5.671	4.717	7.042	5.704	8.488	7.666	9.919	8.338	13.404	9.32	14.3	7.44	10.56	5.9	6.94	4.75	6.65	4.033	5.022	4.173	5.41
TN0000765	BARTLETT WATER SYSTEM		A. G. WARNER	2012	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TN0000765	BARTLETT WATER SYSTEM		BARTLETT #4	2012	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

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.

AFFIDAVIT OF DAVID A. WILEY

STATE OF FLORIDA

COUNTY OF Pinellas

I, David A. Wiley, being first duly sworn, do hereby swear and affirm under oath the following:

1. My name is David A. Wiley. I am over twenty-one (21) years of age and am competent to make this Affidavit. This Affidavit is based on my personal knowledge.

2. I am a hydrogeologist and was retained as an expert witness for the State of Mississippi in the prior *Hood v. City of Memphis* lawsuit and also have been retained in the current proceeding pending before the United States Supreme Court. My work

has included the submission of a May 2007 report in the *Hood* litigation ("2007 Report); an April 2014 report, which I understand was submitted by Mississippi in support of its motion for leave to file its complaint against Memphis, Memphis Light, Gas & Water, and the State of Tennessee ("2014 Report"); and a June 2017 report in this proceeding ("2017 Report").

3. This Affidavit has been prepared for the purpose of addressing certain issues raised by the defendants in their November 1, 2018, motion to exclude my testimony.

4. On pages 7-8 of their motion, the defendants note there are differences between the pumping volumes for DeSoto County, Mississippi, that were included in Table 2 of my 2007 Report and those that were included in Table 2 of my 2017 Report. I have reviewed my files and, based on my investigation prepared the spreadsheet attached hereto as Exhibit "A." I have confirmed that Table 2 of my 2017 Report correctly reflects the DeSoto County pumpage volumes (expressed in rounded millions of gallons per day) that were used in my groundwater modeling work. These same volumes had been used for my 2007 groundwater modeling, but a clerical error was made when entering those volumes on Table 2 of my 2007 Report. In other words, the error in Table 2 of my 2007 Report has been corrected in Table 2 of my 2017 Report.

5. Table 1 of my 2017 Report reflects pumping volumes for MLGW. The defendants note that the MLGW pumping volumes in Table 1 of my 2017 report for each of the years 2007-2012 are different from the volumes for those same years shown in Table 1 of my 2014 Report. The differences are attributable to a difference in the source documents I used for the two reports. For my 2007 Report, I had utilized pumping data that had been produced by MLGW in the *Hood* proceeding and covered a period of time through 2006. When preparing my 2014 Report, I did not have MLGW pumpage data for the years 2007-2012, so I obtained information from the Tennessee Department of Environment and Conservation ("TDEC") about

MLGW's 2007-2012 pumpage and used that TDEC data to prepare my 2014 Report, including Table 1. A copy of the TDEC data I used for my 2014 Report is attached hereto as Exhibit "B." When discovery was taken in this proceeding, MLGW produced additional pumpage data, including for the years 2007-2012. In preparing my 2017 Report, including Table 1, I used the pumpage data MLGW produced for 2007-2012 (copy attached as Exhibit "C") instead of the TDEC data I had used for my 2014 Report.

6. On pages 9-10 of their motion, the defendants note that there are differences between the MLGW pumping volumes shown on Table 1 of my reports and the MLGW pumping volumes shown on Table 2 of my reports. The differences are due to unit conversion rounding as explained below.

7. Table 1 of my 2014 and 2017 reports reflects MLGW's pumping volumes for each of the years shown (expressed in gallons per day). Table 2 of the reports reflects the pumping volumes for MLGW and for DeSoto County (expressed in rounded millions of gallons per day) that were used in my groundwater modeling.

8. The volumes in Tables 1 and 2 for the years 1965-2006 were based on the work I had done when preparing my 2007 Report. In order to utilize the groundwater model, the pumpage volumes must be entered into the model in units of cubic feet per second ("cfs"), not as gallons per day ("gpd"). (1 gpd = .00000154723 cfs.) When we were doing groundwater modeling for my 2007 Report for the years 1965-2005, we converted the reported MLGW and DeSoto County pumping volumes from gpd to cfs using a rounded conversion factor of .00000155, and ran our model using the resulting cfs rates. Such rounding is a standard, acceptable practice in the hydrologic profession, and did not materially affect the results of our modeling. Similar unit conversions and rounding were done for the years 2007-2012 when preparing my 2014 Report The cfs modeling rates were converted back to gallons per day (1 cfs equals 646,315.20 gpd), and the results were reported on Table 2 in

rounded million gallons per day. The spreadsheet attached hereto as Exhibit "D" pertains to 1995 and is representative of what I have just described. For the year 2006, the volume of 149.8 mgd on Table 2 is less than the volume shown on Table 1 due to the fact that the MLGW groundwater modeling pumpage volume in Table 2 was based on the TDEC spreadsheet attached hereto as Exhibit "E" (without any rounding of the conversion factor), while the Table 1 pumpage volume for 2006 was based on MLGW-produced data.

9. For the years 2007-2016 in my 2017 Report, the cfs rates in our model were derived without any rounding of the "gpd to cfs" conversion factor. In other words, for the years 2007-2016 in my 2017 Report, the gpd pumping volumes were converted to cfs by multiplying the gpd times .00000154723, instead of multiplying them times the rounded conversion factor (.00000155) that was utilized for the 1965-2006 numbers. This explains why there is no difference at all between the Table 1 and Table 2 volumes for the years 2007-2016 in my 2017 Report.

I declare under penalty of perjury that the foregoing is true and correct.

Executed, this the 20th day of November, 2018.

David A. Wiley

SWORN TO AND SUBSCRIBED BEFORE ME, THIS THE 20th DAY OF November, 2018.

NOTARY PUBLIC

My Commission Expires:

1-21-19

HENRY E ALTAMIRANO NOTARY PUBLIC STATE OF FLORIDA My Comm. Expires January 21, 2019 No. FF 191837

DESOTO COUNTY PUMPING VALUES

year	2017 Model Input Pumping Values (mgd)	2017 Report Table 2 Pumping Values (mgd)	2007 Model Input Pumping Values (mgd)	2007 Report Table 2 Pumping Values (mgd) (error in preparation of table)
1965	0.90	0.90	0.90	1.23
1966	0.90	0.90	0.90	1.23
1967	0.90	0.90	0.90	1.23
1968	0.90	0.90	0.90	1.23
1969	0.90	0.90	0.90	1.23
1970	1.23	1.23	1.23	4.18
1971	1.23	1.23	1.23	4.18
1972	1.23	1.23	1.23	4.18
1973	1.23	1.23	1.23	4.18
1974	1.23	1.23	1.23	4.18
1975	4.18	4.18	4.18	3.60
1976	4.18	4.18	4.18	3.60
1977	4.18	4.18	4.18	3.60
1978	4.18	4.18	4.18	3.60
1979	4.18	4.18	4.18	3.60
1980	4.18	4.18	4.18	3.60
1981	4.18	4.18	4.18	3.60
1982	4.18	4.18	4.18	3.60
1983	3.60	3.60	3.60	3.60
1984	3.60	3.60	3.60	3.60
1985	3.60	3.60	3.60	3.60
1986	3.60	3.60	3.60	3.60
1987	3.60	3.60	3.60	3.60
1988	3.60	3.60	3.60	3.60
1989	3.60	3.60	3.60	3.60
1990	3.60	3.60	3.60	3.60
1991	3.60	3.60	3.60	3.60

1992	3.60	3.60	3.60	3.60
1993	3.60	3.60	3.60	3.60
1994	3.60	3.60	3.60	13.05
1995	13.04	13.04	13.04	13.05
1996	13.04	13.04	13.04	13.40
1997	13.04	13.04	13.04	13.40
1998	13.04	13.04	13.04	13.40
1999	13.04	13.04	13.04	13.40
2000	13.43	13.43	13.43	13.40
2001	13.43	13.43	13.43	14.00
2002	13.43	13.43	13.43	14.00
2003	13.43	13.43	13.43	14.00
2004	13.43	13.43	13.43	14.00
2005	13.97	13.97	13.97	14.00
2006	14.47	14.47	14.47	

MS SCT 016199-West TN Water System 2007 Pumpage Data

PWS_ID	MA_NAME	L_SI	SOURCE	YEAR	JANAVER	JANMAX	FEBAVER	FEBMAX	MARAVE	MARMAX	APRAVER	APRMAX	MAYAVE	MAYMA	UNAVE	UNMA	ULAVER	ULMAX	UGAVE	AUGMAX	SEPAVER	SEPMAX	OCTAVE	OCTMAX	NOVAVE	NOVMA	DECAVER	DECMAX
TN0000126	COLLIERVILLE WATER DEPT		PLANT #1	2007	4.387	4.928	4.575	5.823	5.806	8.294	5.912	8.417	9.286	12.351	10.67	12.98	9.399	11.95	14.08	16.791	8.961	13.46	7.331	10.468	5.409	6.593	4.685	5.747
TN0000126	COLLIERVILLE WATER DEPT		PLANT #2	2007	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TN0000126	COLLIERVILLE WATER DEPT		PLANT #3	2007	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TN0000126	COLLIERVILLE WATER DEPT		PLANT #4	2007	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TN0000126	COLLIERVILLE WATER DEPT		PLANT #5	2007	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TN0000262	GERMANTOWN WATER DEPT		SOUTHERN AV W P	2007	4.761	5.592	4.927	5.66	5.562	8.429	6.759	9.497	7.994	10.262	8.731	10.36	7.431	10.89	11.19	11.984	6.877	11.34	6.876	9.026	6.079	7.909	5.063	5.676
TN0000262	GERMANTOWN WATER DEPT		JOHNSON RD F P	2007	0.514	0.973	0.506	1.284	0.62	0.999	0.717	1.366	3.665	6.445	4.845	6.401	4.582	6.399	5.752	7.253	4.896	6.988	4.648	5.917	0.868	1.512	0.74	1.158
TN0000262	GERMANTOWN WATER DEPT	02	MLGW	2007	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TN0000450	MEMPHIS LIGHT, GAS, & WATER		ARLINGTON (2)	2007	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TN0000450	MEMPHIS LIGHT, GAS, & WATER		MORTON ST(17)	2007	0.1784	21.59	16.92	18.75	16.85	19.11	17.86	20.19	19.33	22.54	19.25	20.99	19.12	20.99	22.01	23.7	19.3	22.32	17.77	19.57	17.81	19.26	16.96	18.25
TN0000450	MEMPHIS LIGHT, GAS, & WATER		SHEAHAN ST(22)	2007	13.07	14.74	13.1	14.34	13.28	18.85	11.97	17.85	18.16	24	24.05	29.12	21.69	26.77	26.43	31.67	18.74	26.87	14.03	21.14	8.92	11.78	7.89	9.91
TN0000450	MEMPHIS LIGHT, GAS, & WATER		ALLEN ST(26)	2007	17.29	19.49	17.52	19.52	17.36	20.57	17.84	20.13	20.26	22.76	22.67	25.31	21.82	24.85	24.06	27.49	21.37	24.84	19.53	24.35	17.76	20.33	16.74	20.15
TN0000450	MEMPHIS LIGHT, GAS, & WATER		McCORD ST(24)	2007	13.78	14.67	13.1	15.43	13.75	17.34	17.16	19.1	18.95	21.53	19.47	23.25	18.24	21.15	20.71	25.32	17.72	20.73	15.93	18.6	15.37	17.89	14.16	16.05
TN0000450	MEMPHIS LIGHT, GAS, & WATER		LICHTERMAN(23)	2007	16.51	18.14	16.87	20.04	17.2	20.57	18.92	22.26	21.01	25.12	22.8	26.16	21.41	25.44	26.95	0.3418	22.28	25.8	20.8	24.77	17.93	22.22	15.55	17.3
TN0000450	MEMPHIS LIGHT, GAS, & WATER		DAVIS ST(19)	2007	18.35	20.84	19.39	21.53	20.6	23.21	20.3	23.39	23.12	25.98	23.65	27	23.19	27.07	25.23	28.3	24.1	28.2	21.43	24.3	20.08	22.74	17.93	18.25
TN0000450	MEMPHIS LIGHT, GAS, & WATER		LNG ST(3)	2007	0	0	0	0	0	0	0.47	0.68	0.51	0.69	0.56	0.7	0.47	0.77	0.7	0.96	0.45	0.82	0.37	0.52	0.35	0.46	0.44	0.57
TN0000450	MEMPHIS LIGHT, GAS, & WATER		MALLORY ST(23)	2007	13.07	15.17	13.88	15.84	13.98	16.9	14.5	16.73	17.2	21.34	20.93	25.13	19.6	25.53	23.21	27.48	18.5	25.55	15.89	20.72	13.06	14.87	12.21	13.99
TN0000450	MEMPHIS LIGHT, GAS, & WATER		SHAW ST(17)	2007	17.43	20.3	18.09	19.96	18.79	21.71	20.07	25.09	24.74	30.81	28.56	33.14	26.56	33.24	33.07	37.05	24.64	33.55	23.47	28.11	19.26	22.03	19.87	21.88
TN0000450	MEMPHIS LIGHT, GAS, & WATER		PALMER ST(4)	2007	4.15	4.35	4.27	4.55	4.23	4.74	4.17	4.42	4.25	4.53	4.26	4.74	4.12	4.5	4.2	4.7	3.96	4.65	4.08	4.62	4.12	4.53	4.27	4.74
TN0000463	MILLINGTON WATER DEPT		CLEARWELL	2007	0.525	0.69	0.531	0.649	0.533	0.708	0.531	0.641	0.619	0.782	0.667	0.812	0.607	0.719	0.702	0.959	0.655	1.141	0.599	1.244	0.531	0.627	0.535	0.706
TN0000463	MILLINGTON WATER DEPT	02	MLGW	2007	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TN0000468	NSA - MIDSOUTH		CLEARWELL	2007	0.501	0.718	0.517	0.788	0.408	0.572	0.409	0.554	0.551	0.903	0.624	0.781	0.596	1.067	0.682	1.4	0.581	0.776	0.441	0.624	0.394	0.636	0.34	0.554
TN0000765	BARTLETT WATER SYSTEM		O. T. YATES	2007	4.947	6.027	5.178	7.515	5.282	7.193	5.516	7.739	7.85	12.591	10.16	13.12	8.386	10.92	12.47	15.575	8.029	12.69	6.622	8.19	5.393	6.577	5.228	5.648
TN0000765	BARTLETT WATER SYSTEM		A. G. WARNER	2007	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TN0000765	BARTLETT WATER SYSTEM		BARTLETT #4	2007	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

PWS_ID	MA_NAME	L_SI	SOURCE	YEAR	JANAVER	JANMAX	FEBAVER	FEBMAX	MARAVE	MARMAX	APRAVER	APRMAX	MAYAVE	MAYMA	UNAVE	UNMA	ULAVER	ULMAX	UGAVE	AUGMAX	SEPAVER	SEPMAX	OCTAVE	OCTMAX	NOVAVE	NOVMA	DECAVER	DECMAX
TN0000126	COLLIERVILLE WATER DEPT		PLANT #1	2008	4.732	5.777	4.25	4.902	4.327	5.183	4.842	5.74	6.171	8.352	9.558	12.12	11.316	13.48	8.819	11.997	7.025	9.32	6.126	8.814	4.68	5.929	4.239	4.946
TN0000126	COLLIERVILLE WATER DEPT		PLANT #2	2008	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TN0000126	COLLIERVILLE WATER DEPT		PLANT #3	2008	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TN0000126	COLLIERVILLE WATER DEPT		PLANT #4	2008	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TN0000126	COLLIERVILLE WATER DEPT		PLANT #5	2008	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TN0000262	GERMANTOWN WATER DEPT		SOUTHERN AV W P	2008	4.771	6.887	4.831	5.916	4.658	5.431	4.621	5.857	5.262	7.085	8.279	11.23	9.274	11.23	7.381	10.526	6.794	8.888	5.448	8.389	4.749	7.253	4.83	5.715
TN0000262	GERMANTOWN WATER DEPT		JOHNSON RD F P	2008	0.879	1.238	0.908	2.351	0.876	1.208	1.483	3.171	2.339	4.089	3.336	5.202	4.721	6.756	3.761	5.228	3.111	3.887	2.624	4.34	1.526	2.561	0.76	0.844
TN0000262	GERMANTOWN WATER DEPT	02	MLGW	2008	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TN0000450	MEMPHIS LIGHT, GAS, & WATER		ARLINGTON (2)	2008	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TN0000450	MEMPHIS LIGHT, GAS, & WATER		MORTON ST(17)	2008	18.19	20.54	18.84	19.7	16.04	18.95	15.97	17.54	16.64	18.29	18.02	19.37	18.91	21.9	17.51	22.7	17.22	18.4	16.51	18.4	15.81	17.07	16.43	17.43
TN0000450	MEMPHIS LIGHT, GAS, & WATER		SHEAHAN ST(22)	2008	8.67	12.15	8.88	17.92	8.31	14.37	8.58	12.37	12.37	18.05	20.42	25.07	23.64	27.91	20.84	26.64	17.77	25.4	13.39	20.7	10.41	12.52	11.41	14.4
TN0000450	MEMPHIS LIGHT, GAS, & WATER		ALLEN ST(26)	2008	18.1	20.87	17.09	19.13	15.79	18.17	17.58	19.98	19.88	23.1	22.95	0.256	23.9	26.73	22.46	27.51	21.92	25.22	20.36	23.78	17.2	21.3	18.61	25.15
TN0000450	MEMPHIS LIGHT, GAS, & WATER		McCORD ST(24)	2008	14.52	16.12	14.46	16.41	14.13	15.49	14.37	15.83	14.98	17.42	16.77	19.25	18.56	23.1	17.77	21.9	17.59	20.42	15.99	17.73	15.32	17.18	15.16	16.96
TN0000450	MEMPHIS LIGHT, GAS, & WATER		LICHTERMAN(23)	2008	16.12	18.38	16.03	20	14.94	18.31	15.91	18.92	18.06	21.58	20.25	24.65	22.5	26.8	21.09	27.04	19.36	22.57	18.53	22.63	16.67	19.32	15.18	18.06
TN0000450	MEMPHIS LIGHT, GAS, & WATER		DAVIS ST(19)	2008	18.81	21.6	19.07	21.53	19.2	22.17	20.35	28.56	19.18	24.53	21	22.75	21.63	23.45	20.26	22.54	19.68	21.69	19.34	21.89	17.26	20.29	15.97	19
TN0000450	MEMPHIS LIGHT, GAS, & WATER		LNG ST(3)	2008	0.4	0.63	0.4	0.64	0.42	0.62	0.43	0.56	0.47	0.57	0.62	0.85	0.73	0.87	0.67	0.93	0.45	0.71	0.39	0.51	0.33	0.5	0.35	0.51
TN0000450	MEMPHIS LIGHT, GAS, & WATER		MALLORY ST(23)	2008	12.19	14.05	0.1136	13.38	10.77	12.35	12.21	14.02	14.03	16.7	17.77	20.68	19.29	21.45	19.33	22.26	17.18	20.43	14.01	18.2	13.6	18.5	0.1313	0.1526
TN0000450	MEMPHIS LIGHT, GAS, & WATER		SHAW ST(17)	2008	20.95	23.27	20.34	23.6	20.72	22.79	20.67	22.8	22.5	27.09	27.86	32.49	31.3	36.35	27.15	35.44	20.8	29.52	20.61	29.82	20.64	22.51	19.79	21.2
TN0000450	MEMPHIS LIGHT, GAS, & WATER		PALMER ST(4)	2008	4.14	4.49	4.09	4.41	3.61	4.22	3.38	4.21	4.09	4.26	4.06	4.35	4.03	4.36	4.19	4.82	4.06	4.22	4.07	4.25	4.21	4.53	4.1	4.6
TN0000463	MILLINGTON WATER DEPT		CLEARWELL	2008	0.509	0.976	0.48	0.628	0.465	0.587	0.506	0.852	0.513	0.855	0.587	0.717	0.661	0.817	0.62	0.963	0.558	0.667	0.542	1.103	0.488	0.579	0.457	0.586
TN0000463	MILLINGTON WATER DEPT	02	MLGW	2008	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TN0000468	NSA - MIDSOUTH		CLEARWELL	2008	0.38	0.536	0.494	0.663	0.521	1.2966	0.524	0.703	0.626	0.998	0.722	1.131	0.731	1.365	0.558	0.816	0.469	0.756	0.426	0.694	0.389	0.725	0.349	0.57
TN0000765	BARTLETT WATER SYSTEM		O. T. YATES	2008	5.226	5.908	5.078	6.133	5.188	6.085	5.186	5.89	6.195	8.386	8.178	10.51	10.489	12.21	8.136	14.285	6.781	8.436	5.996	8.092	5.139	8.419	4.962	6.111
TN0000765	BARTLETT WATER SYSTEM		A. G. WARNER	2008	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TN0000765	BARTLETT WATER SYSTEM		BARTLETT #4	2008	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

PWS_ID	MA_NAME	L_SI	SOURCE	YEAR	JANAVER	JANMAX	FEBAVER	FEBMAX	MARAVE	MARMAX	APRAVER	APRMAX	MAYAVE	MAYMA	UNAVE	UNMA	JULAVER	ULMAX	UGAVE	AUGMAX	SEPAVER	SEPMAX	OCTAVE	OCTMAX	OVAVE	NOVMA	DECAVER	DECMAX
TN0000126	COLLIERVILLE WATER DEPT		PLANT #1	2009	4.257	4.569	4.236	4.882	4.312	4.958	4.876	6.843	5.77	7.968	8.706	12.34	8.609	12.71	8.068	10.327	6.878	9.438	5.003	6.072	4.592	5.399	0.4245	4.678
TN0000126	COLLIERVILLE WATER DEPT		PLANT #2	2009	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TN0000126	COLLIERVILLE WATER DEPT		PLANT #3	2009	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TN0000126	COLLIERVILLE WATER DEPT		PLANT #4	2009	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TN0000126	COLLIERVILLE WATER DEPT		PLANT #5	2009	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TN0000262	GERMANTOWN WATER DEPT		SOUTHERN AV W P	2009	4.743	5.542	4.737	5.347	4.518	5.498	5.461	7.661	6.534	9.043	10.13	10.76	7.498	10.75	7.642	9.701	6.792	8.321	4.127	8.141	2.482	3.114	3.48	6.315
TN0000262	GERMANTOWN WATER DEPT		JOHNSON RD F P	2009	0.707	0.899	0.849	1.731	0.795	1.216	0.679	1.165	1.763	2.923	3.372	8.297	5.156	8.023	4.732	6.245	2.576	6.685	3.03	3.954	3.048	3.312	1.926	4.683
TN0000262	GERMANTOWN WATER DEPT	02	MLGW	2009	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TN0000450	MEMPHIS LIGHT, GAS, & WATER		ARLINGTON (2)	2009	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TN0000450	MEMPHIS LIGHT, GAS, & WATER		MORTON ST(17)	2009	16.34	18.95	16.08	16.88	15.81	17.03	15.97	16.98	16.56	18.74	18.46	20.25	18.82	21.85	18.1	20.42	18.33	250.3	18.04	19.32	17.91	18.96	18.44	19.66
TN0000450	MEMPHIS LIGHT, GAS, & WATER		SHEAHAN ST(22)	2009	12.04	14.62	10.44	11.75	11.42	14.85	11.15	14.3	12.21	15.48	18.71	28.2	18.37	28.8	16.7	20.91	13.05	17.72	10.58	12.69	9.76	11.47	10.31	11.7
TN0000450	MEMPHIS LIGHT, GAS, & WATER		ALLEN ST(26)	2009	18.98	22.07	17.59	19.84	16.85	19.62	17.23	20.43	19.11	22.72	22.85	27.49	22.63	26.57	22.61	26.39	20.73	24.35	17.7	21.82	16.52	19.55	16.07	18.7
TN0000450	MEMPHIS LIGHT, GAS, & WATER		McCORD ST(24)	2009	15.11	16.43	14.77	16.2	15.19	17.11	16.01	17.92	16.76	19.22	19.18	23.98	18.56	22.66	18.62	21.78	17.63	19.59	16.52	18.22	16.41	18.91	15.8	17.25
TN0000450	MEMPHIS LIGHT, GAS, & WATER		LICHTERMAN(23)	2009	15.94	18.1	15.64	19.18	15.52	18.35	15.76	17.93	17.35	20.71	19.29	25.61	20.28	25.39	19.19	22.55	20.12	23.5	17.04	22.5	14.74	16.96	15.43	17.17
TN0000450	MEMPHIS LIGHT, GAS, & WATER		DAVIS ST(19)	2009	14.5	18.91	16.39	17.63	16.39	17.68	17.53	19.3	18.04	19.93	19.7	21.48	19.39	21.9	19.29	20.9	18.03	19.73	17.15	18.57	17.07	18.48	16.73	18.42
TN0000450	MEMPHIS LIGHT, GAS, & WATER		LNG ST(3)	2009	0.39	0.54	0.41	0.61	0.37	0.56	0.39	0.57	0.37	0.57	0.45	0.75	0.49	0.72	0.49	0.86	0.48	0.79	0.41	0.6	0.36	0.5	0.36	0.57
TN0000450	MEMPHIS LIGHT, GAS, & WATER		MALLORY ST(23)	2009	13.28	17	11.76	13.66	12.01	13.79	12.74	14.93	13.29	16.84	16.36	20.9	16.01	20.73	16.47	20.89	15	20.92	12.33	15.55	12.1	14.44	11.78	14.28
TN0000450	MEMPHIS LIGHT, GAS, & WATER		SHAW ST(17)	2009	20.3	22.03	19.16	20.95	19.48	21.23	19.95	21.63	20.73	24.34	24.93	29.52	23.66	30.01	25.27	28.11	23.4	29.96	20.48	23.49	19.76	21.64	19.07	20.31
TN0000450	MEMPHIS LIGHT, GAS, & WATER		PALMER ST(4)	2009	4.5	4.91	4.17	4.48	4.09	4.4	4.14	4.72	4.15	4.58	4.26	4.87	4.14	4.39	4.15	4.2	4.15	4.48	4.19	4.73	4.09	4.45	4.05	4.29
TN0000463	MILLINGTON WATER DEPT		CLEARWELL	2009	0.492	1.159	0.899	0.807	0.907	0.614	0.948	0.941	1.012	0.995	1.116	1.364	1.091	0.675	1.068	1.224	1.031	1.187	0.997	1.563	0.958	1.081	0.96	1.142
TN0000463	MILLINGTON WATER DEPT	02	MLGW	2009	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TN0000468	NSA - MIDSOUTH		CLEARWELL	2009	0.392	0.618	0.358	0.714	0.463	0.954	0.523	0.951	0.562	0.972	0.551	1.196	0.65	1.44	0.64	1.302	0.447	0.777	0.38	0.696	0.35	0.717	0.32	0.626
TN0000765	BARTLETT WATER SYSTEM		O. T. YATES	2009	5.199	8.382	4.462	5.912	4.722	7.552	4.576	5.551	5.431	7.705	7.444	11.62	8.059	12.07	6.976	8.56	5.873	8.035	4.922	6.36	4.462	5.614	5.089	7.165
TN0000765	BARTLETT WATER SYSTEM		A. G. WARNER	2009	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TN0000765	BARTLETT WATER SYSTEM		BARTLETT #4	2009	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

MS SCT 016202-West TN Water System 2010 Pumpage Data

PWS_ID	MA_NAME	L_SI	SOURCE	Year	JANAVER	JANMAX	FEBAVER	FEBMAX	MARAVE	MARMAX	APRAVER	APRMAX	MAYAVE	MAYMA	UNAVE	UNMA	ULAVER	ULMAX	UGAVE	AUGMAX	SEPAVER	SEPMAX	OCTAVE	OCTMAX	NOVAVE	NOVMA	DECAVER	DECMAX
TN0000126	COLLIERVILLE WATER DEPT		PLANT #1	2010	4.652	6.577	4.365	4.995	4.358	4.86	5.61	7.278	6.304	8.226	0.855	11.22	9.624	11.84	10.04	11.644	10.7	11.9	8.605	10.196	5.178	7.137	4.414	4.922
TN0000126	COLLIERVILLE WATER DEPT		PLANT #2	2010	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TN0000126	COLLIERVILLE WATER DEPT		PLANT #3	2010	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TN0000126	COLLIERVILLE WATER DEPT		PLANT #4	2010	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TN0000126	COLLIERVILLE WATER DEPT		PLANT #5	2010	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TN0000262	GERMANTOWN WATER DEPT		SOUTHERN AV W P	2010	2.792	4.344	3.69	4.614	2.121	3.924	0	0	3.805	6.06	0	0	4.394	7.622	6.738	4.663	0	0	4.259	6.227	2.073	3.178	2.259	4.363
TN0000262	GERMANTOWN WATER DEPT		JOHNSON RD F P	2010	2.859	3.45	1.399	2.992	2.954	3.12	0	0	4.107	7.797	0	0	7.153	8.859	7.093	7.921	0	0	6.775	7.589	4.928	6.298	3.244	4.211
TN0000262	GERMANTOWN WATER DEPT	02	MLGW	2010	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TN0000450	MEMPHIS LIGHT, GAS, & WATER		ARLINGTON (2)	2010	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TN0000450	MEMPHIS LIGHT, GAS, & WATER		MORTON ST(17)	2010	18.67	22.21	17.46	18.61	17.25	18.56	17.28	19.13	17.84	19.26	18.97	21.03	19.19	21.82	19.1	21.07	18.67	21.28	18.11	19.7	16.85	18.1	17.62	19.09
TN0000450	MEMPHIS LIGHT, GAS, & WATER		SHEAHAN ST(22)	2010	11.72	16.41	10.57	12.06	9.45	10.73	11.53	14.03	12.72	15.22	19.86	27.22	21.61	26.19	21.83	26.1	19.15	22.48	15.99	19.32	10.87	13.28	10.78	13.08
TN0000450	MEMPHIS LIGHT, GAS, & WATER		ALLEN ST(26)	2010	20.06	27.31	19.13	22.11	17.19	19.98	17.2	21.78	18.27	22.3	21.36	24.56	23.53	26.6	22.86	25.45	21.56	24.16	19.05	22.16	15.76	19.83	17	20.84
TN0000450	MEMPHIS LIGHT, GAS, & WATER		McCORD ST(24)	2010	17.3	20.9	16.6	17.97	15.66	17.55	16.23	18.49	15.88	17.52	18.55	21.85	19.99	22.62	19.97	21.77	21.58	24.1	19.89	21.74	17.44	19.49	17.52	20.21
TN0000450	MEMPHIS LIGHT, GAS, & WATER		LICHTERMAN(23)	2010	17.65	24.22	15.2	17.05	14.91	16.87	16.55	20.67	18.97	29.28	22.69	25.65	22.21	24.99	24.17	27.94	23.22	25.88	21.98	26.36	16.44	20.61	16.48	19.56
TN0000450	MEMPHIS LIGHT, GAS, & WATER		DAVIS ST(19)	2010	17.95	22.79	17.12	19.04	16.95	19.31	17.91	19.75	18.7	21.07	20.92	22.67	20.19	22.35	21.22	22.26	20.63	22.85	21.01	22.64	19.09	20.61	18.19	20.32
TN0000450	MEMPHIS LIGHT, GAS, & WATER		LNG ST(3)	2010	0.35	0.59	0.37	0.69	0.43	3.55	0.39	0.55	0.41	0.68	0.49	0.7	0.54	0.7	0.89	0.98	0.48	0.74	0.54	3.77	1.41	33	0.36	0.53
TN0000450	MEMPHIS LIGHT, GAS, & WATER		MALLORY ST(23)	2010	14.08	20.13	12.7	14.4	11.85	13.56	14.1	17.44	15.87	20.43	21.02	24.58	20.46	24.16	18.95	24.04	17.91	21.79	15.22	18.8	12.8	17.76	12.49	14.42
TN0000450	MEMPHIS LIGHT, GAS, & WATER		SHAW ST(17)	2010	20.3	23.52	20.15	24.74	20.3	23.03	21.41	23.84	22.95	25.53	26.66	29.51	26.79	31.86	25.3	27.89	23.83	26.61	22.39	24.79	20.49	22.97	20.84	23.03
TN0000450	MEMPHIS LIGHT, GAS, & WATER		PALMER ST(4)	2010	4.39	4.88	4.23	4.85	3.83	4.41	3.52	4.25	3.28	4.21	3.7	4.28	4.27	4.65	3.6	4.64	3.7	3.74	4.19	4.71	4.41	4.73	4.23	4.74
TN0000463	MILLINGTON WATER DEPT		CLEARWELL	2010	0.983	1.4	0.928	1.494	0.883	0.618	1.009	1.473	1.03	1.169	1.072	0.692	1.118	1.831	1.15	1.343	1.098	0.696	1.02	1.223	0.896	1.186	0.896	1.107
TN0000463	MILLINGTON WATER DEPT	02	MLGW	2010	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TN0000468	NSA - MIDSOUTH		CLEARWELL	2010	0.38	0.739	0.25	0.468	0.224	0.488	0.225	0.402	0.239	0.413	0.279	0.453	0.315	0.632	0.377	0.701	0.3	0.477	0.274	0.645	0.364	0.753	0.341	0.764
TN0000765	BARTLETT WATER SYSTEM		O. T. YATES	2010	5.328	7.066	4.466	6.06	4.728	5.816	5.151	7.255	5.776	7.737	7.129	10.11	8.336	11.96	7.962	9.773	7.789	11.44	6.805	8.529	5.238	6.59	5.04	6.231
TN0000765	BARTLETT WATER SYSTEM		A. G. WARNER	2010	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TN0000765	BARTLETT WATER SYSTEM		BARTLETT #4	2010	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

PWS_ID	MA_NAME	L_SI	SOURCE	YEAR	JANAVER	JANMAX	FEBAVER	FEBMAX	MARAVER	MARMAX	APRAVER	APRMAX	MAYAVER	MAYMAX	JUNAVER	JUNMAX	JULAVER	JULMAX	AUGAVER	AUGMAX	SEPAVER	SEPMAX	OCTAVER	OCTMAX	NOVAVER	NOVMAX	DECAVER	DECMAX
TN0000126	COLLIERVILLE WATER DEPT		PLANT #1	2011	4.727	3.758	4.258	4 8	4.449	5.432	4.941	5.819	5 902	8.159	9.834	12.16	10.135	11.716	9 589	12.7	8.497	11.739	6 881	8.997	4 882	5.992	4 313	4.777
TN0000126	COLLIERVILLE WATER DEPT		PLANT #2	2011	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TN0000126	COLLIERVILLE WATER DEPT		PLANT #3	2011	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TN0000126	COLLIERVILLE WATER DEPT		PLANT #4	2011	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TN0000126	COLLIERVILLE WATER DEPT		PLANT #5	2011	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TN0000262	GERMANTOWN WATER DEPT		SOUTHERN AV W P	2011	2.756	4.402	2.371	3.64	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3 273	4.634	0	0	0	0
TN0000262	GERMANTOWN WATER DEPT		JOHNSON RD F P	2011	2.541	3.172	2 96	3.491	0	0	3.378	7.083	0	0	0	0	0	0	0	0	0	0	5.419	8.059	0	0	0	0
TN0000262	GERMANTOWN WATER DEPT	02	MLGW	2011	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TN0000450	MEMPHIS LIGHT, GAS, & WATER		ARLINGTON (2)	2011	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TN0000450	MEMPHIS LIGHT, GAS, & WATER		MORTON ST(17)	2011	17.01	18.56	16.46	18.08	15.9	17.15	16.41	18.03	0	0	17.39	19.23	18.35	20.02	18.55	20 29	18.28	20 52	17.95	20.04	16.59	18.27	16.54	19.21
TN0000450	MEMPHIS LIGHT, GAS, & WATER		SHEAHAN ST(22)	2011	10.36	11.88	10 04	11.76	10.28	11.7	11.06	13.18	0	0	18.85	26.45	19.27	22.8	18.19	23 57	16.06	20 96	12.45	15.93	10.32	12.79	9.57	13.1
TN0000450	MEMPHIS LIGHT, GAS, & WATER		ALLEN ST(26)	2011	17.88	21.81	17.14	20.42	16.3	20.98	7.68	20.64	0	0	23.9	26.24	22.85	25.5	21.02	26.65	19.87	23.17	17.74	21.02	14.31	17.24	13.77	16.53
TN0000450	MEMPHIS LIGHT, GAS, & WATER		McCORD ST(24)	2011	16.1	18.21	15.2	17.29	15.25	16.99	16.17	18.83	0	0	21.25	25.03	21.86	24.03	21.11	23 91	20	23.64	18.78	21.55	16.88	19.24	15.86	18.47
TN0000450	MEMPHIS LIGHT, GAS, & WATER		LICHTERMAN(23)	2011	16.9	19.58	15 52	18.6	16.75	19 8	18.25	21.16	0	0	23.94	28.1	22.57	27.8	22.52	27 21	19.5	25 58	19.1	22.42	15.92	19.04	14.85	17.14
TN0000450	MEMPHIS LIGHT, GAS, & WATER		DAVIS ST(19)	2011	17.81	19.67	17 97	20.01	17.69	19.59	18.52	21.02	0	0	21.68	24.06	21.37	23.57	20.86	23.19	20.1	23.13	18.2	21.25	18.41	19.92	17.54	20.02
TN0000450	MEMPHIS LIGHT, GAS, & WATER		LNG ST(3)	2011	0.4	0.6	0.43	0.62	0.32	0.7	0.46	2.12	0	0	0 55	0.84	0.54	0.74	0.53	0 84	0.57	0.79	0.4	0.75	0.38	0.55	0.39	0.74
TN0000450	MEMPHIS LIGHT, GAS, & WATER		MALLORY ST(23)	2011	12.57	14.64	12 89	16.05	12.8	15.14	14.13	17.37	0	0	19.11	23.59	19.96	22.95	18.09	23.45	15.36	20 84	13.93	15.92	12.2	13.97	11.84	13.25
TN0000450	MEMPHIS LIGHT, GAS, & WATER		SHAW ST(17)	2011	20.66	22.65	20 96	23.03	20.89	22.06	20.67	23.25	0	0	25.55	27.96	25.7	27.76	25.03	28 52	22.85	26 95	22.01	25.39	20.01	23.65	19.78	21.51
TN0000450	MEMPHIS LIGHT, GAS, & WATER		PALMER ST(4)	2011	3.18	4.28	4 05	4.56	3.81	4.36	0	0	0	0	0	0	4.26	5.12	4.73	5 09	4.76	5 02	4.69	5.04	4.59	5.25	4.27	5.02
TN0000463	MILLINGTON WATER DEPT		CLEARWELL	2011	0.906	1.013	0.903	1.1	0 877	1.101	0.901	1.471	0 949	1.174	1.188	1.643	1 288	1 883	1.119	1.354	1 034	1.581	1 005	1.638	0 966	1.175	0 841	1.028
TN0000463	MILLINGTON WATER DEPT	02	MLGW	2011	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TN0000468	NSA - MIDSOUTH		CLEARWELL	2011	0.385	1.146	0.349	0.723	0 377	0.766	0.385	0.729	0 399	0.892	0.579	1.038	0.605	1 085	0.609	1.143	0.488	0.923	0 379	0.8	0 328	0.77	0 357	0.794
TN0000765	BARTLETT WATER SYSTEM		O. T. YATES	2011	4.773	5.742	4.739	5.564	5 312	7.428	4.583	7.361	5.471	8.851	7.649	9.946	8 895	10 559	8 508	11.588	5.04	6.231	6.171	9.049	4.703	6.733	4 338	5.306
TN0000765	BARTLETT WATER SYSTEM		A. G. WARNER	2011	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TN0000765	BARTLETT WATER SYSTEM		BARTLETT #4	2011	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

PWS_ID	MA_NAME	L_SI	SOURCE	YEAR	JANAVER	JANMAX	FEBAVER	FEBMAX	MARAVER	MARMAX	APRAVER	APRMAX	MAYAVER	MAYMAX	JUNAVER	JUNMAX	JULAVER	JULMAX	AUGAVE	AUGMAX	SEPAVER	SEPMAX	OCTAVER	OCTMAX	NOVAVER	NOVMAX	DECAVER	DECMAX
TN0000126	COLLIERVILLE WATER DEPT		PLANT #1	2012	4.263	5.05	4.197	4.6	4.312	5.568	5.965	8.804	5.535	11.772	9.571	15.472	11.123	14.543	9.496	12.226	6.996	7.896	5.438	6.181	4.356	5.258	4.009	4.417
TN0000126	COLLIERVILLE WATER DEPT		PLANT #2	2012	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TN0000126	COLLIERVILLE WATER DEPT		PLANT #3	2012	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TN0000126	COLLIERVILLE WATER DEPT		PLANT #4	2012	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TN0000126	COLLIERVILLE WATER DEPT		PLANT #5	2012	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TN0000262	GERMANTOWN WATER DEPT		SOUTHERN AV W P	2012	1.714	2.328	1.62	2.557	2.328	3.456	0	0	4.72	6.993	6.335	9.247	6.232	9.376	5.983	7.497	0	0	3.799	6.851	2.868	3.65	0	0
TN0000262	GERMANTOWN WATER DEPT		JOHNSON RD F P	2012	2.949	4.894	3.143	4.443	2.998	3.983	0	0	5.575	7.131	5.38	9.433	6.022	8.073	5.633	6.614	0	0	3.202	4.099	3.268	3.826	0	0
TN0000262	GERMANTOWN WATER DEPT	02	MLGW	2012	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TN0000450	MEMPHIS LIGHT, GAS, & WATER		ARLINGTON (2)	2012	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TN0000450	MEMPHIS LIGHT, GAS, & WATER		MORTON ST(17)	2012	16.24	18.16	15.91	17.84	15.81	17.24	17.21	18.71	18.68	21.11	18.55	21.1	19.32	21.89	18.69	20.79	17.4	20.5	16.85	18.48	16.68	18.22	16.78	18.09
TN0000450	MEMPHIS LIGHT, GAS, & WATER		SHEAHAN ST(22)	2012	9.88	10.9	10.04	13.13	9.72	12.18	12.15	17.17	15.41	19.26	15.71	23.12	18.64	24.94	17.1	22.03	13.23	15.27	12.16	13.87	11.13	12.79	11.49	13.39
TN0000450	MEMPHIS LIGHT, GAS, & WATER		ALLEN ST(26)	2012	14.14	17.96	11.97	15.86	15.01	19.07	16.9	19.89	20.36	26.45	22.56	26.7	23.84	26.81	18.85	24	17.3	21.58	16.67	20.39	14.41	17.3	13.95	17.61
TN0000450	MEMPHIS LIGHT, GAS, & WATER		McCORD ST(24)	2012	15.89	18.53	15.87	20.51	15.66	17.95	16.19	18.47	19.57	22.04	18.7	23.26	19.82	23.38	18.43	20.95	16.74	19.52	14.76	16.69	14.45	16.43	14.25	16.06
TN0000450	MEMPHIS LIGHT, GAS, & WATER		LICHTERMAN(23)	2012	14.77	16.97	14.71	17.5	14.41	18.09	17.26	20.8	21.11	27.6	23.68	29.58	23.16	27.79	24.52	28.31	22.56	25.12	18.68	35.83	15.69	19.79	13.68	16.87
TN0000450	MEMPHIS LIGHT, GAS, & WATER		DAVIS ST(19)	2012	17.36	20.12	17.64	20.47	17.77	19.37	18.18	20.37	19.87	21.84	20.87	24.36	21.2	23.02	21.63	23.17	20.48	22.45	18.74	21.69	17.78	19.19	16.94	18.67
TN0000450	MEMPHIS LIGHT, GAS, & WATER		LNG ST(3)	2012	0.36	0.52	0.44	0.59	0.46	0.67	0.39	0.54	0.37	0.58	0.57	0.9	0.66	0.93	0.62	0.86	0.47	0.7	0.36	0.58	0.43	0.67	0.41	0.66
TN0000450	MEMPHIS LIGHT, GAS, & WATER		MALLORY ST(23)	2012	12.21	19.2	12.38	15.53	12.19	13.77	13.52	15.8	16.29	20.6	17.62	23.3	19.17	24.76	19.39	24.54	16.12	20.37	13.04	15.66	12.44	14.55	12.7	14.66
TN0000450	MEMPHIS LIGHT, GAS, & WATER		SHAW ST(17)	2012	19.67	21.32	19.41	20.86	19.83	21.76	21.26	25.59	23.32	26.98	25.45	32.21	26.83	32.06	25.64	30.05	23.39	27.74	21.69	34.04	19.73	21.8	19.23	23.59
TN0000450	MEMPHIS LIGHT, GAS, & WATER		PALMER ST(4)	2012	4.81	9.89	4.58	4.95	4.65	4.95	4.66	4.9	4.69	4.97	4.58	4.78	4.53	4.68	4.33	6.02	3.69	4.14	3.82	4.01	3.55	3.83	3.41	3.58
TN0000463	MILLINGTON WATER DEPT		CLEARWELL	2012	0.839	1.048	0.862	1.089	0.958	1.598	1.033	1.337	0.982	1.106	1.027	1.329	1.139	1.347	1.082	1.352	0.969	1.115	0.884	0.943	0.836	0.991	0.838	1.042
TN0000463	MILLINGTON WATER DEPT	02	MLGW	2012	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TN0000468	NSA - MIDSOUTH		CLEARWELL	2012	0.381	0.784	0.381	0.813	0.414	0.904	0.374	0.766	0.485	0.8924	0.536	0.927	0.573	1.018	0.596	1.096	0.415	0.832	0.335	0.729	0.198	0.467	0.273	0.689
TN0000765	BARTLETT WATER SYSTEM		O. T. YATES	2012	4.264	5.1091	4.354	5.671	4.717	7.042	5.704	8.488	7.666	9.919	8.338	13.404	9.32	14.3	7.44	10.56	5.9	6.94	4.75	6.65	4.033	5.022	4.173	5.41
TN0000765	BARTLETT WATER SYSTEM		A. G. WARNER	2012	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TN0000765	BARTLETT WATER SYSTEM		BARTLETT #4	2012	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

2012 Net Monthly Pumpage
(MG)

2012	Net Monthly Pumpage	Net Monthly Pumpage	Net Monthly Pumpage	Net Monthly Pumpage	Net Monthly Pumpage	Net Monthly Pumpage	Net Monthly Pumpage	Net Monthly Pumpage	Net Monthly Pumpage	Net Monthly Pumpage	Net Monthly Pumpage	Net Monthly Pumpage	
	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	
Mallory	368.1	358.5	380.1	402.8	500.8	521.2	585.8	595.3	472.9	383.4	354.9	383.5	5,307.3
Sheahan	295.5	278.0	287.2	346.6	462.1	461.0	576.7	536.7	386.6	357.0	314.8	343.7	4,645.9
Allen	447.5	353.7	465.6	508.8	613.0	668.3	729.1	576.7	510.7	516.8	447.0	431.7	6,268.9
Lichterman	448.0	418.4	430.1	507.3	624.7	699.4	715.9	743.2	661.2	562.2	465.2	416.4	6,692.0
Morton	493.7	447.2	480.8	498.9	556.9	540.9	579.2	557.6	497.2	506.1	486.5	504.2	6,149.2
Davis	525.9	500.8	533.5	533.2	617.8	616.0	644.8	665.0	590.5	571.5	520.8	518.3	6,838.1
McCord	473.6	455.9	475.1	481.5	601.5	539.8	608.6	565.5	494.9	456.8	429.8	440.6	6,023.6
Shaw	601.0	568.0	610.2	611.6	674.7	714.2	742.4	721.3	660.2	661.5	572.6	580.3	7,718.0
LNG	10.7	12.3	12.3	13.8	6.1	15.0	20.1	16.7	13.8	11.1	13.9	13.6	159.4
Palmer	141.5	134.5	142.8	138.2	141.4	134.7	136.5	135.1	115.4	124.2	115.4	109.2	1,568.9
Total	3,805.5	3,527.3	3,817.7	4,042.7	4,799.0	4,910.5	5,339.1	5,113.1	4,403.4	4,150.6	3,720.9	3,741.5	51,371.3

2012	Monthly Net Average	Daily Net Average (MGD)
Mallory	442.3	14.5
Sheahan	387.2	12.7
Allen	522.4	17.1
Lichterman	557.7	18.3
Morton	512.4	16.8
Davis	569.8	18.7
McCord	502.0	16.5
Shaw	643.2	21.1
LNG	13.3	0.4
Palmer	130.7	4.3

Plants	Yearly Net pumpage by Station Past 5 years				
	2011	2010	2009	2008	2007
Mallory	5,515.4	5,515.4	4,745.7	5,242.1	5,754.8
Sheahan	5,235.9	5,235.9	4,377.9	4,733.9	5,775.0
Allen	6,814.4	6,814.4	6,683.2	6,984.8	6,960.3
Lichterman	6,794.3	6,794.3	6,111.2	6,363.5	7,014.1
Morton	6,523.2	6,523.2	6,195.9	5,973.1	6,409.9
Davis	6,951.5	6,951.5	6,291.7	6,828.3	7,603.7
McCord	6,291.9	6,291.9	5,914.0	6,243.4	6,209.7
Shaw	8,158.5	8,158.5	7,640.7	8,030.8	8,059.8
LNG	146.7	146.7	149.8	184.2	140.7
Palmer	1,439.3	1,439.3	1,498.8	1,475.3	1,519.7
Total	53,871.1	53,871.1	49,608.9	52,059.4	55,447.8

SAMPLE PUMPAGE VOLUME CONVERSIONS

Year	MLGW Well Fields	Table 1 Report (gpd)	Table 1 gpd converted to cfs (1 gpd = .00000155) (rounded conversion factor)	Rate In Model (cfs)	Rate in Model cfs converted to gpd (1 cfs = 646,315.20 gpd)
1995	Allen	22,800,548	35.34084932	35.34	22,840,779
1995	Davis	12,569,863	19.48328767	19.48	12,590,220
1995	Lichterman	21,915,342	33.96878082	33.97	21,955,327
1995	LNG	529,589	0.820863014	0.82	529,978
1995	Mallory	16,029,315	24.84543836	24.85	16,060,933
1995	McCord	17,398,082	26.9670274	26.97	17,431,121
1995	Morton	17,106,301	26.51476712	26.51	17,133,816
1995	Palmer	4,903,562	7.600520548	7.60	4,911,996
1995	Shaw	14,177,260	21.97475342	21.97	14,199,545
1995	Sheahan	20,570,137	31.88371233	31.88	20,604,529
1995	Total	148,000,000	(Table 1)		148,258,244

Table 2 Value (mgd) rounded	148.30

PWS_ID	MA_NAME	PL_SID	SOURCE	YEAR	JANAVER	JANMAX	FEBAVER	FEBMA	MARAVE	MARMAX	APRAVE	APRMAX	MAYAVE	MAYMA	UNAVE	UNMA	ULAVER	JULMAX	UGAVE	AUGMAX	EPAVE	SEPMAX	CTAVE	OCTMA	NOVAVE	NOVMAX	DECAVE	DECMAX	Annual Avg
TN0000126	COLLIERVILLE WATER DEPT		PLANT #1	2006	4.582	5.245	4.583	5.379	4.686	5.334	6.214	8.869	7.195	9.891	9.601	13.22	11.57	14.123	11.36	16.142	7.82	10.09	6.667	8.858	4.861	5.648	4.641	5.469	
TN0000126	COLLIERVILLE WATER DEPT		PLANT #2	2006	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
TN0000126	COLLIERVILLE WATER DEPT		PLANT #3	2006	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
TN0000126	COLLIERVILLE WATER DEPT		PLANT #4	2006	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
TN0000126	COLLIERVILLE WATER DEPT		PLANT #5	2006	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
TN0000262	GERMANTOWN WATER DEPT		SOUTHERN AV W P	2006	3.674	4.659	3.586	4.552	3.96	6.563	5.985	8.637	7.677	11.359	8.695	10.7	8.803	12.073	8.255	12.098	6.862	9.812	5.636	7.839	5.054	6.485	4.887	5.493	
TN0000262	GERMANTOWN WATER DEPT		JOHNSON RD F P	2006	0.406	0.857	0.506	1.056	0.526	2.016	0.536	1.816	0.486	1.1	1.733	5.055	4.442	7.845	3.918	5.221	3.033	3.64	2.409	3.053	0.577	2.772	0.625	5.179	
TN0000262	GERMANTOWN WATER DEPT	02	MLGW	2006	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
TN0000450	MEMPHIS LIGHT, GAS, & WATER		ARLINGTON (2)	2006	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
TN0000450	MEMPHIS LIGHT, GAS, & WATER		MORTON ST(17)	2006	17.31	18.28	17.62	19.16	17.32	18.96	17.52	19.33	18.12	19.41	19.09	21.3	20.58	22.29	20.39	22.74	18.34	20 8	17.79	19.34	18.63	20.43	19.07	21.22	18,481,667
TN0000450	MEMPHIS LIGHT, GAS, & WATER		SHEAHAN ST(22)	2006	10.24	12.01	10.69	13.53	8.93	10.76	11.31	15.94	15.58	22.9	22.46	28.23	26.02	31.81	26.44	31.51	0.212	0.256	18.1	23.93	13.77	17.02	13.11	18.67	14,738,500
TN0000450	MEMPHIS LIGHT, GAS, & WATER		ALLEN ST(26)	2006	19.65	23.37	19.18	24	18.3	21.2	20.23	23.13	22.17	26.41	26.2	29.24	28.25	32.04	25.85	30.96	0.224	0.268	20.03	25	18.01	19.84	18.37	23	19,705,325
TN0000450	MEMPHIS LIGHT, GAS, & WATER		McCORD ST(24)	2006	17.05	18.83	17	19.19	16.89	23.22	18.61	21.26	18.41	21.26	19.59	23.02	21.23	25.51	21.31	26.78	17.04	19.98	15.3	18.64	14.47	20.15	13.79	15.5	17,557,500
TN0000450	MEMPHIS LIGHT, GAS, & WATER		LICHTERMAN(23)	2006	16.33	19.24	16.25	19.42	15.83	19.56	19.13	23.69	20.08	25.4	22.89	25.88	24.33	28.16	24.51	30.08	21.43	0.255	20.31	24.03	17.51	22.31	16.91	19.82	19,625,833
TN0000450	MEMPHIS LIGHT, GAS, & WATER		DAVIS ST(19)	2006	17.79	19.89	18	20.38	18.24	21.78	20.57	22.81	21.96	24.55	23.17	25.35	23.51	25.95	23.64	27.68	0.212	0.255	21.16	23.18	20.01	21.95	18.87	22.06	18,927,667
TN0000450	MEMPHIS LIGHT, GAS, & WATER		LNG ST(3)	2006	0.4	0.6	0.3	0.66	0.38	0.94	0.44	0.77	0.46	0.74	0.56	0.95	0.59	0.78	0.51	0.7	0.44	0.84	0.38	0.71	0	0	0	0	371,667
TN0000450	MEMPHIS LIGHT, GAS, & WATER		MALLORY ST(23)	2006	13.43	15.12	13.22	15.95	12.93	14.08	15.11	18.96	16.29	22.3	19.84	24.11	0.217	0.2527	22.53	27.59	20.15	23.92	17.05	21.97	14.05	16.08	13.5	19.18	14,859,758
TN0000450	MEMPHIS LIGHT, GAS, & WATER		SHAW ST(17)	2006	19.76	22.65	19.99	21.52	20.05	21.63	21.58	25.61	21.33	25.46	24.73	29.84	26.24	30.68	25.99	31.86	21.46	27.4	19.54	22.99	17.65	20.33	17.5	21.19	21,318,333
TN0000450	MEMPHIS LIGHT, GAS, & WATER		PALMER ST(4)	2006	4.25	4.6	4.07	4.82	4.39	4.72	4.21	4.61	4.03	5.02	4.32	5	4.15	4.67	4.14	5.08	4.09	4.46	4.14	4.7	4.2	4.89	4.25	4.7	4,186,667
TN0000463	MILLINGTON WATER DEPT		CLEARWELL	2006	0.468	0.59	0.476	0.624	0.537	1.026	0	0	0.604	0.861	0.62	0.763	0.654	0.824	0.636	0.782	0.584	1.153	0.564	1.035	0.508	0.588	0.517	0.601	
TN0000463	MILLINGTON WATER DEPT	02	MLGW	2006	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
TN0000468	NSA - MIDSOUTH		CLEARWELL	2006	0.512	0.924	0.557	0.729	0.599	0.763	0.626	0.916	0.77	1.484	0.873	1.246	0.847	1	0.856	1.638	0.655	0.924	0.541	1.209	0.954	0.686	0.663	0.449	
TN0000765	BARTLETT WATER SYSTEM		O. T. YATES	2006	4.834	5.551	5.24	7.388	5.098	5.822	5.835	7.326	6.2996	11.137	7.251	9.464	6.848	9.233	9.113	11.318	7.746	10.67	6.203	9.944	5.43	6.36	5.109	5.659	
TN0000765	BARTLETT WATER SYSTEM		A. G. WARNER	2006	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
TN0000765	BARTLETT WATER SYSTEM		BARTLETT #4	2006	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
																													149,772,917