

**BEFORE THE OKLAHOMA WATER RESOURCES BOARD
STATE OF OKLAHOMA**

IN THE MATTER of Determining the Maximum)
Annual Yield for the Arbuckle-Simpson)
Groundwater Basin underlying parts of Murray,)
Pontotoc, Johnston, Garvin, Coal and Carter)
Counties.)

**CPASA'S FORMAL COMMENTS IN SUPPORT OF OWRB'S TENTATIVE
DETERMINATION OF MAXIMUM ANNUAL YIELD OF GROUNDWATER
FROM THE ARBUCKLE-SIMPSON GROUNDWATER BASIN**

COMES NOW Citizens for the Protection of the Arbuckle-Simpson Aquifer (herein "CPASA") and submits these comments in support of the Tentative Determination of the Maximum Annual Yield for the Arbuckle-Simpson Groundwater Basin (herein "TMAY Order"), which was unanimously approved by the Oklahoma Water Resources Board (herein "OWRB") on March 13, 2012.

BACKGROUND

CPASA is a grassroots citizens' organization whose mission is to protect and preserve springs and streams emanating from the Arbuckle-Simpson Aquifer (herein the "ASA" or "Aquifer"), as well as to protect the ASA itself, by preventing the waste, pollution or transfer of the Aquifer's invaluable water resources. The vast majority of CPASA's members depend upon the Aquifer's springs and streams for drinking water, recreational use, and domestic use.

In 2002, a group proposed to sell 80,000 acre-feet of Arbuckle-Simpson groundwater for export to municipalities in Canadian County. This proposal prompted the Oklahoma Legislature to pass Senate Bill 288 (herein "SB288"), which directed the

OWRB to conduct a scientific study of the ASA to determine the quantity of water that could be withdrawn without degrading the Aquifer's springs and streams. The OWRB, in conjunction with numerous federal and state agencies, embarked upon a six (6) year, multi-million dollar hydrologic study of the Aquifer. Based upon that hydrologic study, the OWRB recommended a Tentative Maximum Annual Yield (herein "TMAY") for the entire Aquifer of 78,404 acre-feet per year.

LEGAL LANDSCAPE

As the state agency charged with the administration and enforcement of Oklahoma's groundwater law, the OWRB possesses scientific experience, technical competence, and specialized knowledge relating to water resource management, particularly with regards to groundwater surveys, investigations, and management. Moreover, Oklahoma case law consistently upholds as constitutional the regulation of groundwater, including the regulation of groundwater through maximum annual yield determinations. *See, e.g., Jacobs Ranch, L.L.C. v. Smith*, 2006 OK 34, ¶53 (holding the restrictions on regular groundwater permits to be a "proper regulation of the state's water resources in the exercise of the Legislature's police power"); *Kline v. Oklahoma Water Resources Board*, 1988 OK 18, ¶6 (holding the Legislature's regulation of groundwater "does not infringe the constitutional inhibitions against the taking of property without due process of law").

Oklahoma agencies, such as the OWRB, are generally created by statute and may only exercise those powers granted by law. *See State ex rel. Okla. State Dep't of Health v. Robertson*, 2006 OK 99, ¶ 15 (internal citations omitted); *see also, Marley v. Cannon*,

1980 OK 147, ¶ 9; *Adams v. Professional Practices Commission, Okla.*, 524 P.2d 932 (1974); *Boydston v. Okla.*, 277 P.2d 138 (1954). It is recognized, however, that an officer or an agency has, by implication, powers not explicitly granted by statute. *City of Hugo v. State ex rel. Public Emples. Rels. Bd.*, 1994 OK 134, ¶ 18 (internal footnotes omitted). Such implied powers must be fairly implied from the statutory language. *Hill v. Kemp*, 2008 U.S. Dist. LEXIS 66302 (citing *Marley v. Cannon*, 1980 OK 147, 618 P.2d 401, 405 (Okla. 1980)).

To determine what authority is fairly implied from a statutory scheme, the “statute as a whole is considered; and the legislative intent must be determined.” *City of Hugo v. State ex rel. Public Emples. Rels. Bd.*, 1994 OK 134, ¶ 19 (internal footnotes omitted).

The Legislature’s intent is “ascertained from the whole act in light of its general purpose and objective considering relevant provisions together to give full force and effect to each.” *Hamby v. Cherokee Nation Casinos*, 2010 OK Civ. App. 21, ¶ 6. When the Legislature clearly expresses its intent, “the use of additional rules of construction are almost always unnecessary and a statute will be applied as written.” *Barnhill v. Multiple Injury Trust Fund*, 2011 OK 114, ¶ 11. A statute’s plain language is held conclusive except in the “rare case” when the results of a statute’s literal application are at odds with legislative intent. *Id.* When a statute’s language is ambiguous or unclear, the rule of statutory construction looks to the relevant legislative scheme in order to ascertain and give effect to legislative intent. *Hamby* at ¶¶ 6-7.

Through SB288, the Oklahoma Legislature set forth the framework for sustainable management of the ASA utilizing protections on both a macro and a micro scale. On the

macro level, SB288 contains an overarching goal of determining a per-acre equal proportionate share of groundwater basin-wide. Conversely, on a micro level, SB288 prohibits the issuance of an individual groundwater use permit if the proposed use is “likely to degrade or interfere with springs or streams emanating in whole or in part” from a sensitive sole source groundwater basin. 82 O.S. § 1020.9(2)(d).

Oklahoma statutes explicitly define two prerequisites to a TMAY Order. Specifically, the OWRB “shall make hydrologic surveys and investigations” prior to establishing a TMAY for a major groundwater basin. 82 O.S. § 1020.4(A). Additionally, the OWRB “shall prepare reports using information from hydrologic surveys and investigations of groundwater basins or subbasins having substantially the same geological and hydrological characteristics and data from wells in such basin or subbasins and other relevant information.” 82 O.S. § 1020.4(B). The OWRB is not, however, required to identify all possible subbasins within a major groundwater basin prior to conducting an initial hydrologic investigation of a groundwater basin. *See Kline*, 1988 OK 18, ¶7.

Factors to be addressed when establishing a TMAY for a sensitive sole source groundwater basin are then set forth in Oklahoma’s statutes.¹ The ASA is currently the only sensitive sole source groundwater basin in Oklahoma. *See* 82 O.S. § 1020.5(A) and

¹ A “sensitive sole source groundwater basin” is a major groundwater basin all or a portion of which has been designated as a Sole Source Aquifer by the U.S. Environmental Protection Agency (herein “EPA”). 82 O.S. § 1020.9A(B)(1). The EPA designated the Hunton (eastern) Anticline of the ASA as a Sole Source Aquifer in 1989. *See* 54 FR 39230. Currently, the ASA is the only sensitive sole source groundwater basin in Oklahoma.

82 O.S. § 1020.9A(B)(2). Pursuant to 82 O.S. § 1020.5(A), the OWRB shall make its TMAY Order based upon: (1) the total land area overlying the basin; (2) the amount of water in storage in the basin; (3) the rate of recharge to the basin and the total discharge from the basin; (4) the transmissibility of the basin; and (5) the possibility of pollution from natural sources. Additionally, the TMAY must ensure the removal of water will not reduce the natural flow of water from springs and streams emanating from the sensitive sole source groundwater basin². 82 O.S. § 1020.9A(B)(2).

As set forth below, the OWRB properly exercised both its statutorily-defined authority and its statutorily-implied authority in approving the TMAY Order. Moreover, the OWRB's hydrologic survey and investigation met, if not surpassed, the statutory requirements.

ARGUMENTS AND AUTHORITIES

A. The TMAY Order Satisfies Each of the Statutory Elements Required to Issue a Tentative Determination of the Maximum Annual Yield of Groundwater for the Arbuckle-Simpson Groundwater Basin.

1. *The OWRB's six year, multi-million dollar, peer reviewed, hydrologic study of the Arbuckle-Simpson Groundwater Basin satisfies—if not exceeds—the statutory prerequisites for establishing a tentative maximum annual yield.*

² Although 82 O.S. § 1020.5(B) provides that the maximum annual yield be based on a minimum basin life of 20 years from the effective date of the final MAY order, SB288 modifies the section to instead require that the maximum annual yield not reduce the natural flow of springs and streams emanating from a sensitive sole source groundwater basin.

Section 1020.4(A) of title 82 in the Oklahoma Statutes states that for all major groundwater basins³, the OWRB “shall make hydrologic surveys and investigations” prior to establishing a tentative maximum annual yield.

In compliance with this section, the OWRB, in conjunction with the U.S. Bureau of Reclamation, the U.S. Geological Survey, Oklahoma State University, the University of Oklahoma, and others⁴, conducted a six year comprehensive investigation of the Arbuckle-Simpson Aquifer to gather information necessary to determine the volume of water that could be withdrawn from the Aquifer while also protecting the natural flow of

³ A major groundwater basin is

a distinct underground body of water overlain by contiguous land and having substantially the same geological and hydrological characteristics and from which groundwater wells yield at least fifty (50) gallons per minute on the average basinwide if from a bedrock aquifer and at least one hundred fifty (150) gallons per minute on the average basinwide if from an alluvium and terrace aquifer, or as otherwise designated by the Board.

82 O.S. § 1020.1(3).

The OWRB tentatively determined the Arbuckle-Simpson Aquifer to be a major groundwater basin. The following studies support this determination:

- Puckette, Jim, Halihan, T., and Faith, J., 2009, Characterization of the Arbuckle-Simpson Aquifer, Final Report, at bates label MAY-00743, 00767, 00772;
- Halihan, Todd, Puckette, J., Sample, M., and Riley, M., 2009, Electrical Resistivity Imaging of the Arbuckle-Simpson Aquifer, Final Report, see generally; and
- Christenson, Scott, Osborn, N.I., Neel, C.R., Faith, J.R., Blome, C.D., Puckette, James, and Pantea, M.P., 2011, Hydrogeology and simulation of groundwater flow in the Arbuckle-Simpson aquifer, south-central Oklahoma: U.S. Geological Survey Scientific Investigations Report 2011-5029, at bates label MAY-00127-00128, 00129-00142, 00155, 00219.

⁴ Subsection (C) of 82 O.S. § 1020.4 authorizes the OWRB to “cooperate with state and federal agencies engaged in similar surveys and investigations and may accept and use the findings of such agencies.”

its springs and streams. The multidisciplinary team of scientists and researchers utilized numerous methods to obtain and interpret data relating to the climate, geology, groundwater, and streamflow of the area.

In addition, the U.S. Geological Survey developed a state-of-the-art digital groundwater-flow model, which simulates groundwater flow and discharge to streams, in order to estimate the effects on aquifer-scale groundwater withdrawals on streamflow. Specifically, the following surveys and investigations were conducted on the Arbuckle-Simpson Aquifer:

- Christenson, Scott, Hunt, A.G., and Parkhurst, D.L., 2009, Geochemical Investigation of the Arbuckle-Simpson aquifer, South-central Oklahoma, 2004-2006: U.S. Geological Survey Scientific Investigations Report 2009-5036, 50 p., see generally;
- Christenson, Scott, Osborn, N.I., Neel, C.R., Faith, J.R., Blome, C.D., Puckette, James, and Pantea, M.P., 2011, Hydrogeology and simulation of groundwater flow in the Arbuckle-Simpson aquifer, south-central Oklahoma: U.S. Geological Survey Scientific Investigations Report 2011-5029, 104 p., see generally;
- Faith, Jason, Blome, C., Pantea, M., Puckette, J., Halihan, T., Osborn, N., Christenson, S., and Pack, S., 2010, Three-Dimensional Geologic Model of the Arbuckle-Simpson Aquifer, South-Central Oklahoma: U.S. Geological Survey Open-File Report 2010-1123, see generally;
- Geochemistry of the Arbuckle-Simpson Aquifer, U.S. Geologic Survey, Fact Sheet 2009-3013, see generally;
- Halihan, Todd, Mouri, S., and Puckette, J., 2009, Evaluation of Fracture Properties of the Arbuckle-Simpson Aquifer, Final Report, see generally;
- Halihan, Todd, Puckette, J., Sample, M., and Riley, M., 2009, Electrical Resistivity Imaging of the Arbuckle-Simpson Aquifer, Final Report, see generally;
- Hydrosphere Resource Consultants, 2007, Arbuckle-Simpson Aquifer Special Study: Stream Water Management Network Model, see generally;
- Osborn, Noel I., 2009, Arbuckle-Simpson Hydrology Study, Final Report to the U.S. Bureau of Reclamation, see generally;

- Puckette, Jim, 2009, Analysis of Bit Cuttings, Wire-Line Logs and Flow Tests from a Deep Test Well in the Arbuckle-Simpson Aquifer, Johnston County, Oklahoma, Final Report, see generally;
- Puckette, Jim, Halihan, T., and Faith, J., 2009, Characterization of the Arbuckle-Simpson Aquifer, Final Report, see generally;
- Rahi, Khayyun, and Halihan, T., 2009, Estimating Selected Hydraulic Parameters of the Arbuckle-Simpson Aquifer from the Analysis of Naturally-Induced Stresses, Final Report, see generally;
- Seilheimer, Titus, 2008, Instream Flow Assessment of Streams Draining the Arbuckle-Simpson Aquifer, see generally;
- Seilheimer, Titus, Oklahoma Cooperative Fish and Wildlife Research Unit, 2009, Instream Flow Assessment of Mill Creek, A Stream Draining the Arbuckle-Simpson Aquifer, see generally;
- Smith, David, Deszcz-Pan, M., and Smith, B., 2009, Depth Section Imaging for Portions of an Airborne Geophysical Survey of the Hunton Anticline, South-Central Oklahoma, Final Administrative Report, see generally;
- Tarhule, Aondover, 2009, Hydroclimatic Reconstruction of the Arbuckle-Simpson Aquifer using Tree Rings, see generally;
- Tejan, Ellen, 2008, Indicators of Hydrologic Alteration (IHA) Analysis of Selected Streams of the Arbuckle-Simpson Aquifer, South Central Oklahoma, see generally;
- Vieux, Baxter and Moreno, M., 2008, Arbuckle-Simpson Hydrology Study: Distributed Water Resources Assessment, Final Report, see generally; and
- Young, Roger, Kennedy, B., Russian, C., 2009, Analysis of Seismic Reflection Data from the Hunton Anticline, Final Report, see generally.

Oklahoma statutes also require as a prerequisite to establishing a TMAY that reports be published “using information from hydrologic surveys and investigations of groundwater basins or subbasins having substantially the same geological and hydrological characteristics and data from wells in such basin or subbasins and other relevant information.” 82 O.S. § 1020.4(B). The following reports were published as part of the OWRB’s Arbuckle-Simpson Hydrologic Study and found the Arbuckle-

Simpson groundwater basin to have substantially the same geological and hydrological characteristics:

- Hydrosphere Resource Consultants, 2007, Arbuckle-Simpson Aquifer Special Study: Stream Water Management Network Model, at bates label MAY-00607-00609;
- Christenson, Scott, Hunt, A.G., and Parkhurst, D.L., 2009, Geochemical Investigation of the Arbuckle-Simpson aquifer, South-central Oklahoma, 2004-2006: U.S. Geological Survey Scientific Investigations Report 2009-5036, 50 p., at bates label MAY-00062;
- Christenson, Scott, Osborn, N.I., Neel, C.R., Faith, J.R., Blome, C.D., Puckette, James, and Pantea, M.P., 2011, Hydrogeology and simulation of groundwater flow in the Arbuckle-Simpson aquifer, south-central Oklahoma: U.S. Geological Survey Scientific Investigations Report 2011-5029, 104 p., at bates label MAY-00129-00132, Figure 3 on 00130, Table 1 on 00131;
- Faith, Jason, Blome, C., Pantea, M., Puckette, J., Halihan, T., Osborn, N., Christenson, S., and Pack, S., 2010, Three-Dimensional Geologic Model of the Arbuckle-Simpson Aquifer, South-Central Oklahoma: U.S. Geological Survey Open-File Report 2010-1123, at bates label MAY-00249-00250, 00252-00256, 00258, 00260-00262;
- Geochemistry of the Arbuckle-Simpson Aquifer, U.S. Geologic Survey, Fact Sheet 2009-3013, at bates label MAY-00276;
- Halihan, Todd, Mouri, S., and Puckette, J., 2009, Evaluation of Fracture Properties of the Arbuckle-Simpson Aquifer, Final Report, at bates label MAY-00294-00300;
- Halihan, Todd, Puckette, J., Sample, M., and Riley, M., 2009, Electrical Resistivity Imaging of the Arbuckle-Simpson Aquifer, Final Report, at bates label MAY-00369-00370, 00372, 00408-00411;
- Hydrosphere Resource Consultants, 2007, Arbuckle-Simpson Aquifer Special Study: Stream Water Management Network Model, at bates label MAY-00607, 00609;
- Osborn, Noel I., 2009, Arbuckle-Simpson Hydrology Study, Final Report to the U.S. Bureau of Reclamation, at bates label MAY-00636, 00639-00640, 00642-00643, 00646, 00652, 00655-00656, 00671;
- Puckette, Jim, 2009, Analysis of Bit Cuttings, Wire-Line Logs and Flow Tests from a Deep Test Well in the Arbuckle-Simpson Aquifer, Johnston County, Oklahoma, Final Report, at bates label MAY-00684, 00688-00689;

- Puckette, Jim, Halihan, T., and Faith, J., 2009, Characterization of the Arbuckle-Simpson Aquifer, Final Report, at bates label MAY-00720, 00725, 00758-00763, 00768-00769;
- Rahi, Khayyun, and Halihan, T., 2009, Estimating Selected Hydraulic Parameters of the Arbuckle-Simpson Aquifer from the Analysis of Naturally-Induced Stresses, Final Report, at bates label MAY-00781-00783, 00798-00799;
- Seilheimer, Titus, 2008, Instream Flow Assessment of Streams Draining the Arbuckle-Simpson Aquifer, at bates label MAY-00832, 00834, 00847, 00859-00860;
- Seilheimer, Titus, Oklahoma Cooperative Fish and Wildlife Research Unit, 2009, Instream Flow Assessment of Mill Creek, A Stream Draining the Arbuckle-Simpson Aquifer, at bates label MAY-00882-00886, 00890-00891, 00895-00896;
- Smith, David, Deszcz-Pan, M., and Smith, B., 2009, Depth Section Imaging for Portions of an Airborne Geophysical Survey of the Hunton Anticline, South-Central Oklahoma, Final Administrative Report, at bates label MAY-00939-00941;
- Tarhule, Aondover, 2009, Hydroclimatic Reconstruction of the Arbuckle-Simpson Aquifer using Tree Rings, see generally;
- Tejan, Ellen, 2008, Indicators of Hydrologic Alteration (IHA) Analysis of Selected Streams of the Arbuckle-Simpson Aquifer, South Central Oklahoma, at bates label MAY-01073;
- Vieux, Baxter and Moreno, M., 2008, Arbuckle-Simpson Hydrology Study: Distributed Water Resources Assessment, Final Report, at bates label MAY-01186-01190; and
- Young, Roger, Kennedy, B., Russian, C., 2009, Analysis of Seismic Reflection Data from the Hunton Anticline, Final Report, at bates label MAY-01264-01267.

Moreover, the following published reports utilized data from wells in the Arbuckle-Simpson groundwater basin and other information pertinent to the OWRB's hydrologic investigation:

- Osborn, Noel I., 2009, Arbuckle-Simpson Hydrology Study, Final Report to the U.S. Bureau of Reclamation, at bates label MAY-00636-637, 00647, 00651-00652, 00654, 00657-00659, 00670;
- Tejan, Ellen, 2008, Indicators of Hydrologic Alteration (IHA) Analysis of Selected Streams of the Arbuckle-Simpson Aquifer, South Central Oklahoma, at bates label MAY-01073-01074, 01076-01077;

- Hydrosphere Resource Consultants, 2007, Arbuckle-Simpson Aquifer Special Study: Stream Water Management Network Model, at bates label MAY-00607;
- Christenson, Scott, Osborn, N.I., Neel, C.R., Faith, J.R., Blome, C.D., Puckette, James, and Pantea, M.P., 2011, Hydrogeology and simulation of groundwater flow in the Arbuckle-Simpson aquifer, south-central Oklahoma: U.S. Geological Survey Scientific Investigations Report 2011-5029, 104 p., at bates label MAY-00132-00142, 00148-00154, Table 3 on 00148, Figure 13 on 00148, 00153-00154, 00157-00158, 00168, 00170, 00172;
- Christenson, Scott, Hunt, A.G., and Parkhurst, D.L., 2009, Geochemical Investigation of the Arbuckle-Simpson aquifer, South-central Oklahoma, 2004-2006: U.S. Geological Survey Scientific Investigations Report 2009-5036, 50 p., at bates label MAY-00058-00062, 00066-00071, 00073-00078, 00081, 00094;
- Tarhule, Aondover, 2009, Hydroclimatic Reconstruction of the Arbuckle-Simpson Aquifer using Tree Rings, bates label MAY-01026;
- Geochemistry of the Arbuckle-Simpson Aquifer, U.S. Geologic Survey, Fact Sheet 2009-3013, at bates label MAY-00275, 00277-00278;
- Vieux, Baxter and Moreno, M., 2008, Arbuckle-Simpson Hydrology Study: Distributed Water Resources Assessment, Final Report, at bates label MAY-01197;
- Seilheimer, Titus, 2008, Instream Flow Assessment of Streams Draining the Arbuckle-Simpson Aquifer, at bates label MAY-00836-00839, 00841-00847, 00852, 00861-00862, 00864-00865, 00868-00869;
- Puckette, Jim, Halihan, T., and Faith, J., 2009, Characterization of the Arbuckle-Simpson Aquifer, Final Report, at bates label MAY-00721, 00724, 00726-00727, 00743, 00745-00750, 00753, 00764-00765, 00767, 00769, 00772, Appendix 1, Appendix 4-6;
- Halihan, Todd, Mouri, S., and Puckette, J., 2009, Evaluation of Fracture Properties of the Arbuckle-Simpson Aquifer, Final Report, at bates label MAY-00294-00297, 00299-00344, 00347-00353;
- Puckette, Jim, 2009, Analysis of Bit Cuttings, Wire-Line Logs and Flow Tests from a Deep Test Well in the Arbuckle-Simpson Aquifer, Johnston County, Oklahoma, Final Report, at bates label MAY-00684-00707;
- Rahi, Khayyun, and Halihan, T., 2009, Estimating Selected Hydraulic Parameters of the Arbuckle-Simpson Aquifer from the Analysis of Naturally-Induced Stresses, Final Report, at bates label MAY-00781-00782, 00797, 00799-00802, 00813-00814, 00818-00820, 00823; and
- Smith, David, Deszcz-Pan, M., and Smith, B., 2009, Depth Section Imaging for Portions of an Airborne Geophysical Survey of the Hunton Anticline, South-

Central Oklahoma, Final Administrative Report, at bates label MAY-00939-00941, and Appendix 3 at 00945, and Appendix 12-15 at 00953-00955.

2. *Upon completion of its six year, multi-million dollar, peer reviewed, hydrologic study of the Arbuckle-Simpson Groundwater Basin, the OWRB properly established a tentative maximum annual yield based upon the enumerated statutory elements.*

Pursuant to 82 O.S. § 1020.5(A), the following five (5) factors must be considered when determining a groundwater basin's tentative maximum annual yield: (1) the total land overlying the basin or subbasin; (2) the amount of water in storage in the basin or subbasin; (3) the rate of recharge and total discharge from the basin or subbasin; (4) transmissibility of the basin or subbasin; and (5) the possibility of pollution of the basin or subbasin from natural sources. Additionally, 82 O.S. § 1020.9 prohibits the tentative maximum annual yield from reducing the natural flow of springs and streams emanating from sensitive sole source groundwater basins, such as the Arbuckle-Simpson Aquifer. Not only does the OWRB contemplate each of the required elements in its TMAY Order, but each element is amply supported by scientific data. Specifically, the OWRB's hydrologic study, including, but not limited to, the following reports, support the required factors:

1. **Total land area overlying the basin**—82 O.S. § 1020.15
 - a. Christenson, Scott, Hunt, A.G., and Parkhurst, D.L., 2009, Geochemical Investigation of the Arbuckle-Simpson aquifer, South-central Oklahoma, 2004-2006: U.S. Geological Survey Scientific Investigations Report 2009-5036, 50 p, at bates label MAY-00057, 00059;
 - b. Christenson, Scott, Osborn, N.I., Neel, C.R., Faith, J.R., Blome, C.D., Puckette, James, and Pantea, M.P., 2011, Hydrogeology and simulation of groundwater flow in the Arbuckle-Simpson aquifer, south-central Oklahoma: U.S. Geological Survey Scientific Investigations Report 2011--

5029, 104 p., at bates label MAY-00126, Figure 1 at 00126, 00129, Figure 3 at 00130, 00155-00163, 00219;

- c. Halihan, Todd, Mouri, S., and Puckette, J., 2009, Evaluation of Fracture Properties of the Arbuckle-Simpson Aquifer, Final Report, at bates label MAY-00298;
- d. Oklahoma Water Resources Board, The Arbuckle-Simpson Hydrology Study: Management and Protection of an Oklahoma Water Resource, Nov. 2003, at bates label MAY-01277;
- e. Osborn, Noel I., 2009, Arbuckle-Simpson Hydrology Study, Final Report to the U.S. Bureau of Reclamation, at bates label MAY-00636, 00639-00640; and
- f. Rahi, Khayyun, and Halihan, T., 2009, Estimating Selected Hydraulic Parameters of the Arbuckle-Simpson Aquifer from the Analysis of Naturally-Induced Stresses, Final Report, at bates label MAY-00797.

2. **Amount of water in storage**—82 O.S. § 1020.5

- a. Christenson, Scott, Hunt, A.G., and Parkhurst, D.L., 2009, Geochemical Investigation of the Arbuckle-Simpson aquifer, South-central Oklahoma, 2004-2006: U.S. Geological Survey Scientific Investigations Report 2009-5036, 50 p, at bates label MAY-00057, 00062-00065;
- b. Christenson, Scott, Osborn, N.I., Neel, C.R., Faith, J.R., Blome, C.D., Puckette, James, and Pantea, M.P., 2011, Hydrogeology and simulation of groundwater flow in the Arbuckle-Simpson aquifer, south-central Oklahoma: U.S. Geological Survey Scientific Investigations Report 2011-5029, 104 p., at bates label MAY-00165-00172, Table 11 at 00171-00172, Table 15 at 00181, 00221;
- c. Faith, Jason, Blome, C., Pantea, M., Puckette, J., Halihan, T., Osborn, N., Christenson, S., and Pack, S., 2010, Three-Dimensional Geologic Model of the Arbuckle-Simpson Aquifer, South-Central Oklahoma: U.S. Geological Survey Open-File Report 2010-1123, at bates label MAY-00272;
- d. Halihan, Todd, Puckette, J., Sample, M., and Riley, M., 2009, Electrical Resistivity Imaging of the Arbuckle-Simpson Aquifer, Final Report, at bates label MAY-00419;
- e. Hydrosphere Resource Consultants, 2007, Arbuckle-Simpson Aquifer Special Study: Stream Water Management Network Model, at bates label MAY-00607-00611, 00614, 00617-00622;
- f. Osborn, Noel I., 2009, Arbuckle-Simpson Hydrology Study, Final Report to the U.S. Bureau of Reclamation, at bates label MAY-00638, 00640, 00661-00662, 00666-00668;

- g. Puckette, Jim, Halihan, T., and Faith, J., 2009, Characterization of the Arbuckle-Simpson Aquifer, Final Report, at bates label MAY-00723-00724, 00726-00744, 00747-00748, 00751-00758, 00767, 00769, Appendix 3 and Appendix 7 at 00772;
 - h. Vieux, Baxter and Moreno, M., 2008, Arbuckle-Simpson Hydrology Study: Distributed Water Resources Assessment, Final Report, generally and at bates label MAY-01202-01203, 01208, 01218, 01226; and
 - i. Young, Roger, Kennedy, B., Russian, C., 2009, Analysis of Seismic Reflection Data from the Hunton Anticline, Final Report, at bates label MAY-01265.
3. **Rate of recharge and discharge**—82 O.S. § 1020.5
- a. Christenson, Scott, Osborn, N.I., Neel, C.R., Faith, J.R., Blome, C.D., Puckette, James, and Pantea, M.P., 2011, Hydrogeology and simulation of groundwater flow in the Arbuckle-Simpson aquifer, south-central Oklahoma: U.S. Geological Survey Scientific Investigations Report 2011-5029, 104 p., at bates label MAY-00149, Table 7 at 00151, 00152-00154, 00163-00165, Table 9 at 00166, 00169-00170, Table 15 at 00181, 00182, Figure 30 at 00183, Figure 31 at 00184, 00184-00185;
 - b. Halihan, Todd, Mouri, S., and Puckette, J., 2009, Evaluation of Fracture Properties of the Arbuckle-Simpson Aquifer, Final Report, at bates label MAY-00294;
 - c. Hydrosphere Resource Consultants, 2007, Arbuckle-Simpson Aquifer Special Study: Stream Water Management Network Model, at bates label MAY-00611-00613, 00615, 00617, 00620-00622;
 - d. Osborn, Noel I., 2009, Arbuckle-Simpson Hydrology Study, Final Report to the U.S. Bureau of Reclamation, at bates label MAY-00637-00638, 00640, 00643, 00646-00647, 00652-00655, 00661-00688;
 - e. Puckette, Jim, Halihan, T., and Faith, J., 2009, Characterization of the Arbuckle-Simpson Aquifer, Final Report, at bates label MAY-00720, 00743;
 - f. Rahi, Khayyun, and Halihan, T., 2009, Estimating Selected Hydraulic Parameters of the Arbuckle-Simpson Aquifer from the Analysis of Naturally-Induced Stresses, Final Report, at bates label MAY-00799-00800;
 - g. Seilheimer, Titus, 2008, Instream Flow Assessment of Streams Draining the Arbuckle-Simpson Aquifer, at bates label MAY-00835, 00841-00847, 00853-00858, 00862-00863, 00866-00867;

- h. Seilheimer, Titus, Oklahoma Cooperative Fish and Wildlife Research Unit, 2009, Instream Flow Assessment of Mill Creek, A Stream Draining the Arbuckle-Simpson Aquifer, at bates label MAY-00883-00884; and
 - i. Vieux, Baxter and Moreno, M., 2008, Arbuckle-Simpson Hydrology Study: Distributed Water Resources Assessment, Final Report, generally and at bates label MAY-01202-01203, 01208, 01211-01218, 01226.
4. **Transmissibility**—82 O.S. § 1020.5
- a. Christenson, Scott, Hunt, A.G., and Parkhurst, D.L., 2009, Geochemical Investigation of the Arbuckle-Simpson aquifer, South-central Oklahoma, 2004-2006: U.S. Geological Survey Scientific Investigations Report 2009-5036, 50 p., at bates label MAY-00069, 00082-00094;
 - b. Christenson, Scott, Osborn, N.I., Neel, C.R., Faith, J.R., Blome, C.D., Puckette, James, and Pantea, M.P., 2011, Hydrogeology and simulation of groundwater flow in the Arbuckle-Simpson aquifer, south-central Oklahoma: U.S. Geological Survey Scientific Investigations Report 2011-5029, 104 p., at bates label MAY-00165, 00167, 00172, 00221;
 - c. Geochemistry of the Arbuckle-Simpson Aquifer, U.S. Geologic Survey, Fact Sheet 2009-3013, at bates label MAY-00275-00276;
 - d. Halihan, Todd, Mouri, S., and Puckette, J., 2009, Evaluation of Fracture Properties of the Arbuckle-Simpson Aquifer, Final Report, at bates label MAY-00294, 00296-00298, 00300, 00309-00310, 00312-00318, 00332, 00334-00343, 00347-00353;
 - e. Osborn, Noel I., 2009, Arbuckle-Simpson Hydrology Study, Final Report to the U.S. Bureau of Reclamation, at bates label MAY-00637-00638, 00640-00644, 00647, 00656, 00659-00660, 00662;
 - f. Puckette, Jim, 2009, Analysis of Bit Cuttings, Wire-Line Logs and Flow Tests from a Deep Test Well in the Arbuckle-Simpson Aquifer, Johnston County, Oklahoma, Final Report, at bates label MAY-00684, 00697, 00699-00703, 00706-00707;
 - g. Puckette, Jim, Halihan, T., and Faith, J., 2009, Characterization of the Arbuckle-Simpson Aquifer, Final Report, at bates label MAY-00723-00724, 00726-00744, 00747-00748, 00751-00757, 00765, 00767-00769, Appendix 3 and Appendix 7 at 00772;
 - h. Rahi, Khayyun, and Halihan, T., 2009, Estimating Selected Hydraulic Parameters of the Arbuckle-Simpson Aquifer from the Analysis of Naturally-Induced Stresses, Final Report, at bates label MAY-00784-00796, 00799-00801, 00803-00823;

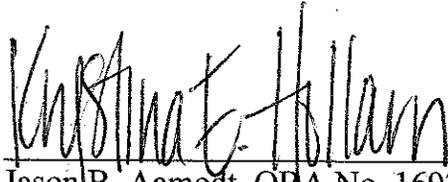
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 - j. Young, Roger, Kennedy, B., Russian, C., 2009, Analysis of Seismic Reflection Data from the Hunton Anticline, Final Report at bates label MAY-01265, 01267.
5. **Possibility of pollution from natural sources**—82 O.S. § 1020.5
- a. Christenson, Scott, Hunt, A.G., and Parkhurst, D.L., 2009, Geochemical Investigation of the Arbuckle-Simpson aquifer, South-central Oklahoma, 2004-2006: U.S. Geological Survey Scientific Investigations Report 2009-5036, 50 p., at bates label MAY-00072-00082, 00094;
 - b. Christenson, Scott, Osborn, N.I., Neel, C.R., Faith, J.R., Blome, C.D., Puckette, James, and Pantea, M.P., 2011, Hydrogeology and simulation of groundwater flow in the Arbuckle-Simpson aquifer, south-central Oklahoma: U.S. Geological Survey Scientific Investigations Report 2011-5029, 104 p., at bates label MAY-00125;
 - c. Geochemistry of the Arbuckle-Simpson Aquifer, U.S. Geologic Survey, Fact Sheet 2009-3013, at bates label MAY-00275; and
 - d. Tejan, Ellen, 2008, Indicators of Hydrologic Alteration (IHA) Analysis of Selected Streams of the Arbuckle-Simpson Aquifer, South Central Oklahoma, at bates label MAY-01077, 01087, 01091.
6. **Will not reduce natural flow of springs and streams**—82 O.S. § 1020.9
- a. Christenson, Scott, Osborn, N.I., Neel, C.R., Faith, J.R., Blome, C.D., Puckette, James, and Pantea, M.P., 2011, Hydrogeology and simulation of groundwater flow in the Arbuckle-Simpson aquifer, south-central Oklahoma: U.S. Geological Survey Scientific Investigations Report 2011-5029, 104 p., at bates label MAY-00152-00155, 00163-00165, 00203-00213, Table 22 at 00206, Tables 23 and 24 at 00210, Table 25 at 00216;
 - b. Halihan, Todd, Mouri, S., and Puckette, J., 2009, Evaluation of Fracture Properties of the Arbuckle-Simpson Aquifer, Final Report, at bates label MAY-00294, 00296, 00309-00310, 00312-00318, 00331-00343, 00352-00353;
 - c. Hydrosphere Resource Consultants, 2007, Arbuckle-Simpson Aquifer Special Study: Stream Water Management Network Model, at bates label MAY-00614, 00617-00619, 00622;
 - d. Osborn, Noel I., 2009, Arbuckle-Simpson Hydrology Study, Final Report to the U.S. Bureau of Reclamation, at bates label MAY-00636, 00638, 00640, 00647, 00654-00655, 00664-00668;

- e. Puckette, Jim, Halihan, T., and Faith, J., 2009, Characterization of the Arbuckle-Simpson Aquifer, Final Report, Appendix 2 at bates label MAY-00772;
- f. Rahi, Khayyun, and Halihan, T., 2009, Estimating Selected Hydraulic Parameters of the Arbuckle-Simpson Aquifer from the Analysis of Naturally-Induced Stresses, Final Report, at bates label MAY-00799;
- g. Seilheimer, Titus, 2008, Instream Flow Assessment of Streams Draining the Arbuckle-Simpson Aquifer, at bates label MAY-00832-00835, 00839, 00841-00847, 00850, 00853-00858, 00862-00863, 00870-00873; and
- h. Tejan, Ellen, 2008, Indicators of Hydrologic Alteration (IHA) Analysis of Selected Streams of the Arbuckle-Simpson Aquifer, South Central Oklahoma, at bates label MAY-01079-01091.

CONCLUSION

The Oklahoma Water Resources Board conducted a six (6) year, multi-million dollar, peer reviewed hydrologic study on the Arbuckle-Simpson groundwater basin according to its statutory directive. The Tentative Determination of the Maximum Annual Yield for the Arbuckle-Simpson Groundwater Basin, as approved by the Oklahoma Water Resources Board on March 13, 2012, properly considered each of the statutory factors necessary to make such a determination and utilized peer-reviewed scientific data in its decision. For the reasons stated herein, Citizens for the Protection of the Arbuckle-Simpson Aquifer support the Tentative Determination of the Maximum Annual Yield for the Arbuckle-Simpson Groundwater Basin.

Respectfully submitted this 9th day of May,



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