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.

STATE OF MISSISSIPPI'S SUBMISSION OF THE CREDENTIALS OF ITS EXPERT WITNESSES

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Counsel for the State of Mississippi

Plaintiff, State of Mississippi, pursuant to Section I.A.(1) of the Special Master's Corrected Pre-Hearing Scheduling Order (Dkt. No. 69), provides the Special Master with the credentials of its expert witnesses, as follows:

Richard K. Spruill, Ph.D., P.G.
Principal Hydrogeologist
Groundwater Management Associates, Inc.
4300 Sapphire Court, Suite 100
Greenville, North Carolina 27834
Curriculum vitae attached hereto as Exhibit "A"

David A. Wiley, P.G.
Principal Hydrogeologist
WSP USA, Inc.
2202 Westshore Blvd., Suite 300
Tampa, Florida 33607
Curriculum vitae attached hereto as Exhibit "B"

Respectfully submitted, this the 14th day of September, 2018.

THE STATE OF MISSISSIPPI

BY: */s/ C. Michael Ellingburg*

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CERTIFICATE OF SERVICE

Pursuant to Paragraph 3 of the Case Management Plan (Dkt. No. 57), I hereby certify that all parties on the Special Master's approved service list have been served by electronic mail, this the 14th day of September, 2018.

/s/ C. Michael Ellingburg
C. Michael Ellingburg

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Richard K. Spruill, Ph.D, PG
President/Principal Hydrogeologist

Education
Ph.D. Geology, University of North Carolina, Chapel Hill, NC (1980)
M.S. Geology, East Carolina University, Greenville, NC (1978)
B.S. Geology, East Carolina University, Greenville, NC (1974)

Professional Registrations and Service
Professional Geologist in North Carolina (License #942)
President of National Association of State Boards of Geology (ASBOG), 2010
Executive Committee member National Association of State Boards of Geology (ASBOG) (2007-2012)
Founding Director of Coastal Water Resources Center, East Carolina Univ. (2010-2013)
Chairman, North Carolina Board for Licensing of Geologists (2006-2010)
Subject Matter Expert, National Association of State Boards of Geology (ASBOG) (2005-2007)

Professional Experience

Groundwater Management Associates, Inc. - Greenville, NC (1986 to Present)

President and Principal Hydrogeologist

Provides technical oversight, directs, and participates in hydrogeological projects, including groundwater resource evaluation and planning, wellfield and well design, borehole logging and evaluation, aquifer test design and interpretation, and other hydrological assessment projects. Clients include engineering firms, municipalities, industry, and attorneys.

Technical Expertise
- Groundwater hydrology
- Surface water hydrology
- Public water supply
- Groundwater resource evaluation and planning
- Wellfield and well design
- Coastal plain, piedmont, and mountain hydrogeology
- Safe yield of aquifers
- Groundwater policy education and implementation
- Aquifer storage and recovery (asr)
- Groundwater chemistry
- Coastal plain geology and geomorphology
- Mineralogy and mineral chemistry
- Igneous and metamorphic petrology
- Isotope geology

East Carolina University - Greenville, NC (1979 to Present)

Associate Professor of Geology, Department of Geological Sciences

Instructor for undergraduate and graduate geology and hydrogeology courses, supervising professor for graduate hydrogeology research projects, groundwater and surface water research, community (local and state) outreach and education concerning hydrological issues.

Graduate-Level Courses Taught at East Carolina University

- Groundwater Hydrology (GEOL 5710/5711)
- Seminar in Computer Applications in Hydrology (GEOL 6522)
- Advanced Groundwater/Surface Water Hydrology (GEOL 7920)
- Geochemistry (GEOL 6400)
- Tectonic Analysis of North America (GEOL 6570)
- Volcanology Seminar (GEOL 5500 and GEOL 6703)
- Readings in Isotope Geochemistry (GEOL 6532)

Teaching Recognition at East Carolina University

- Robert L. Jones Award for Teaching Excellence (1981)
- University-wide Outstanding Teacher Award – Finalist (1989, 1992)

Publications

McCoy, C.A., Corbett, D.R., Cable, J.E., and. Spruill, R.K, 2007. Hydrogeological characterization and quantification of submarine groundwater discharge in the southeast Coastal Plain of North Carolina, Journal of Hydrology, v. 339, p. 159-171

Heath, R.C., and Spruill, R.K., 2003, Cretaceous Aquifers in North Carolina: Analysis of Safe Yield Based on Historical Data: Hydrogeology Journal, v. 11, p. 249-258

Woods, T. L., Fullagar, P. D., Spruill, R.K., and Sutton, L. C., 2000, Strontium Isotopes and Major Elements As Tracers of Ground Water Evolution: Example from the Upper Castle Hayne Aquifer of North Carolina: Ground Water, v. 38, no. 5, p. 762-771

Reynolds, J.W., and Spruill, R.K., 1994, Groundwater Flow Stimulation for Management of a regulated Aquifer System: A case study in the North Carolina Coastal Plain: Journal of Groundwater, v.29, no. 10, p.

Spruill, R.K., Reynolds, J.W., 1993, Hydrogeology and Groundwater Management Activities at the Lee Creek Mine of Texasgulf Inc.: The Compass, v.70, no. 1, p. 36-44.

Mauger, R.L., Spruill, R.K., Christopher, M.T.., and Shafiquallah, M., 1983, Petrology and Geochemistry of Peralkaline Metagranite and Metarhyolite Dikes, Fountain Quarry, County, North Carolina: Southeastern Geology, v.24, no. 2, p. 67-89

Spruill, R.K., Lawrence, D.P., and Moncla, A.M., 1987, Petrochemical, Geochemical and Geophysical Evaluation of the Rocky Mount Igneous Complex, Northeastern Piedmont, North Carolina, in, Whittecar, G.R. (ed.) Geological Excursions in Virginia and North Carolina: Guidebook for Field Trips 1-7: Geological Society of America, Southeastern Section, p. 229-237

Mauger, R.L., Spruill, R.K., Lawrence, D.P., and Moncla, A.M., 1987, Geology and Petrology of the Fountain and Rocky Mount Granite Quarries, Eastermost Piedmont, North Carolina, in Whittecar, G.R. (ed), Geological Excursions in Virginia and North Carolina: Guidebook for Field Trips No. 1-7: Geological Society of America, Southeastern Section, p. 219-229

Abstracts

Spruill, R.K., 1977, Geology of the Rancho Penas Azules Area, Chihuahua, Mexico, Geological Society of America, Abstracts with Programs, v.9, p. 75

Spruill, R.K., 1980, Petrology and Geochemistry of Peralkaline Volcanics of the Sierra Campana, Chihuahua, Mexico: Geological Society of America, Abstracts with Programs, v.12, p. 211

Wedemeyer, R.C., and Spruill, R.K., 1980, Geochemistry and Geochronology of the Sims Granite, Eastern Carolina State Belt: Geological Society of America, Abstracts with Programs, v.12, p. 211

Spruill, R.K., McDowell, F.W. and Mauger, R.L., 1981, Strontium Isotope Geochemistry and K-Ar ages of Cretaceous to Oligocene rocks from the Calera-del Nido Range. Chihuahua, Mexico: Geological Society of America, Abstracts with Programs, v.13, p. 107-108

Stirewalt, G.W., Harper, S.B., and Spruill, R.K., 1981, Mesoscopic Structure and Geochronology of the Buckhorn Pluton and enveloping Rocks of the Raleigh Belt. Chatham County, North Carolina—Evidence of late Paleozoic Movement in the Eastern Piedmont: Geological Society of America, Abstracts with Programs, v.13, p. 36

Spruill, R.K., 1983, Petrologic and Strontium Isotopic Evidence for the Origin of Andesites from the Upper Volcanic Supergroup, Chihuahua, Mexico: Geological Society of America, Abstracts with Programs, v. 15. p. 90

Mauger, R.L., Spruill, R.K., and Shafiquallah, M., 1983, Petrology and Geochronology of a Metamorphosed Cambrian (?) Peralkalic Granite from Fountain, Eastern Carolina State Belt, North Carolina: Geological Society of America, Abstracts with Programs, v. 15, p. 45

Riggs, S.R., Snyder, S.W., and Spruill, R.K., 1984, Ferruginization and Phosphatization of Foraminifera in Pleistocene/Holocene Sands of the Mid-Atlantic Continental Shelf: American Association of Petroleum Geologists Bulletin. V.68, no. 4, p. 521

Sans, J.R., Spruill, R.K., Muchlenbachs, K. and Mauger, R.L., in 1984, Oxygen and Strontium Isotope Data for a Peralkaline Metagranite from Fountain, Eastern Carolina State Belt: Geological Society of America, Abstracts with Programs, v. 16, no.2, p. 86

Snyder, S.W., Hale, W.R., Riggs, S.R., Spruill, R.K., and Waters, V.J., 1984, Occurrence of Clinoptilolite as Moldic Fillings of Foraminiferal Tests in Continental Margin Sediments: Geological Society of America, Abstracts with Programs. V.16, no. 6, p. 662

Danahy, T.V., Neal, D.W., and Spruill, R.K., 1984, Diagenesis in the Hillsdale Limestone (Miss.), Virginia: Geological Society of America, Abstracts with Programs, v. 17, no.2, p. 460

Corbitt, C.L., and Spruill, R.K., 1986, Geology of the Portis Gold Mine, Eastern Carolina Slate Belt, Franklin County, North Carolina: Geological Society of America, Abstracts with Programs, v. 17, no. 2, p. 85

Campbell, S.K., and Spruill, R.K., 1986, Geology , Petrology, and Geochemistry of the Lemon Springs Pluton and Associated Rocks, Lee County, North Carolina Geological Society of America, Abstracts with Programs, v. 18, no 2., p. 214

Spruill, R.K., Mauger, R.L., and McDowell, F.W., 1986, Geochemistry and Petrogenesis of Intraplate Peralkaline Ash-flow Rhyolites, Central Chihuahua, Mexico: International Volcanological Congress, New Zealand Section, p. 209

Mauger, R.L., and Spruill, R.K., 1987, A Geologic Excursion to Fountain Quarry, Easternmost Piedmont, Pitt County, North Carolina: Geological Society of America. Abstracts with Programs, v.19, p. 96

Moncla, A.M., and Spruill, R.K., 1987, Petrology, Geochemistry, and Geochronology of the Rocky Mount Igneous Complex, Northeastern NC Piedmont: Geological Society of America, Abstracts with Programs, v. 19, p. 119

Schiappa, C.S., Lawrence, D.P., and Spruill, R.K., 1987, Petrology and Geochemistry of the Coronaca Pluton, Greenwood County, South Carolina: Geological Society of America, Abstracts with Programs, v. 19, p. 127

Spruill, R.K. and Johnson, J.J., 1988, Hydrology of the Lower Castle Hayne Aquifer near Washington, North Carolina: Geological Society of America, Abstracts with Programs, v. 20, no. 2, p. 60

Spruill, R.K., and Tarravechia, R.J., 1989, An Evaluation of Rn-222 Levels in Groundwater from Granite and Sedimentary Cover, with results of an In-situ Remediation Technique: Geological Society of America, Abstracts with Programs, v.21, no. 3, p. 41

Volosin, M. L., and Spruill, R. K., 2001, The Position of the Fresh Water-Salt Water Interface in Aquifers Underlying Six Counties In Northeastern North Carolina: GSA Abstracts with Programs, v. 33, no. 2, p. 62

Foldesi, C. P., and Spruill, R. K., 2001, Utilization of the Cretaceous Aquifer System for Aquifer Storage and Recovery of Treated Surface Water in Greenville, NC: GSA Abstracts with Programs, v. 33, no. 2, p. 62.

Spruill, R. K., 2008, The ASBOG Fundamental and Practice Examinations: The Development and Administration of a National Examination: Third International Professional Geology Conference, Flagstaff, AZ, accepted, Abstract Volume to be determined

Humphrey, M. B., Gould, R. G., Muse, D. A., and Spruill, R. K., 2008, Wastewater Reclamation Utilizing an Abandoned Limestone Quarry – An Innovative Non-Discharge Alternative: Submitted to the North Carolina Water Works Association – accepted, Abstract Volume to be determined

Holley, J.K., and Spruill, R.K., 2012, Groundwater Resource Management and Saltwater Intrusion Mitigation, Roanoke Island, Dare County, North Carolina, Geological Society of America Annual Meeting, Charlotte, North Carolina.

Holley, J.K., Campbell, S.K., and Spruill, R.K., 2015, Challenges and Lessons Learned in the Construction and Operation of Aquifer Storage Recovery (ASR) Wells, North Carolina AWWA-WEA, Contemporary Topics in Water/Wastewater Construction, Greenville, NC.

Holley, J.K., Campbell, S.K., Spruill, R.K., and Smith, K.A., 2015, The Hydrostratigraphic Framework of Onslow County, North Carolina, North Carolina AWWA-WEA, 14th Annual Spring Conference, Wilmington, NC.

Litigation Support

2016 Expert witness deposition in the case of State of North Carolina et al. Vs. Duke Energy Progress, LLC, Superior Court for Wake County, North Carolina, File Number 13-CVS-11032 and in the case of State of North Carolina et al. Vs. Duke Energy Carolinas, LLC, Superior Court for Mecklenburg County, North Carolina, File Number 13-CVS-14661.

Retained by John Suttles, Southern Environmental Law Center, Chapel Hill, North Carolina.

2011 Expert witness trial testimony in Onslow Water and Sewer Authority v. Boggs and Rogers, Onslow County Superior Court. Retained by David Nash, Hogue Hill Jones Nash & Lynch, LLP.

2011 Expert witness trial testimony in Michael Allison, et al. v. ExxonMobil Corporation, et al., Circuit Court for Baltimore County, No. 03-C-07-003809. Retained by Theodore M. Flerlage, Law Office of Peter G. Angelos, PC.

2010 Expert witness testimony, Frye-Reed Hearing in Michael Allison, et al. v. ExxonMobil Corporation, et al., Circuit Court for Baltimore County, No. 03-C-07-003809. Retained by Theodore M. Flerlage, Law Office of Peter G. Angelos, PC.

2010 Expert witness deposition in Michael Allison, et al. v. ExxonMobil Corporation, et al., Circuit Court for Baltimore County, No. 03-C-07-003809. Retained by Theodore M. Flerlage, Law Office of Peter G. Angelos, PCs.

2008 Expert witness trial testimony in Kurt Peterson et al., v. D.R. Horton, Inc., Circuit Court for Montgomery County, Maryland, Case No. 268778-V (Consolidated with cases: 269276-V; 270293-V; 272020-V; 272479-V; 272480-V). Retained by Theodore M. Flerlage, Law Office of Peter G. Angelos, PC.

2007 Expert witness deposition in Kurt Peterson et al., v. D.R. Horton, Inc., Circuit Court for Montgomery County, Maryland, Case No. 268778-V (Consolidated with cases: 269276-V; 270293-V; 272020-V; 272479-V; 272480-V). Retained by Theodore M. Flerlage, Law Office of Peter G. Angelos, PC.

2006 Expert witness deposition in Hope Koch, et al. v. John R. Hicks, et al., United States District Court, Southern District of New York, No. 05-cv-05745-SAS. Retained by Mary V. Koch, Law Office of Peter G. Angelos, PC.

2006 Expert witness deposition in Curl, et al. v. American Multimedia, Inc., et al., and Brown et al. v. American Multimedia, Inc., et al., Superior Court of Alamance County, North Carolina, File Nos. 03 CVS 493 and 03 CVS 663. Retained by Richard Watson and James F. Hopf.

2006 Expert witness deposition in Richard A. Smith and April L. Smith v. Thomas Brothers Oil & Gas, Inc, et al., Superior Court of Caswell County, North Carolina, File No. 03 CVS 226. Retained by James F. Hopf.

2005 Expert witness trial testimony in Ellison v. Gambill Oil Company, Inc., et al., Superior Court of Watauga County, North Carolina, File No. 03 CVS 428. Retained by Warren A. Hutton.

2004 Expert witness deposition in Vines, et al. v. Gambill Oil Company, Inc., et al., Superior Court of Watauga County, North Carolina, File Nos. 02 CVS 467, 02 CVS 498, 02 CVS 776 and 03 CVS 428. Retained by James F. Hopf, Claude D. Smith, Warren A. Hutton and Paul R. Dickinson, Jr.

2003 Expert witness deposition in Joel & Janice Drum v. Schronce and Superior Petroleum and Fuel Company, Inc., Superior Court of Catawba County, North Carolina, File No. 01 CVS 3998. Retained by James F. Hopf.

1999 Expert witness deposition in Robert J. & Kathleen Leary, et al. v. Eastern Fuels, Inc., Superior Court of Currituck County, North Carolina, File No. 97 CVS 326. Retained by James F. Hopf.

1998 Expert witness deposition in King, et al. v. Conoco, Inc., et al., Superior Court of New Hanover County, North Carolina, File Nos. 97 CVS 02670 & 97 CVS 02672. Retained by James F. Hopf.

1998 Expert witness trial testimony in Grant, et al. v. E.I. Dupont, Inc., United States District Court, Eastern District of North Carolina, File No. 4:91-CV-55-H. Retained by Marvin Blount, Jr. and James F. Hopf.

1994 Expert witness trial testimony in Shamrock Fuels, Inc., et al. v. McGraw Edison Company, Cooper Industries, Inc., et al., United States District Court, Eastern District of Kentucky at London, Civil Action No. 92-129. Retained by Marvin Blount, Jr. and James F. Hopf.

DAVID A. WILEY, P.G.

Principal Hydrogeologist

Years with WSP USA, INC.
1

Years with Leggette, Brashears & Graham, Inc.
32

Years with SWFWMD
5

Years total
38

Professional qualifications

Professional Geologist: Florida, (PG119)

Professional Geologist: Arkansas, (# 165)

Professional Geologist: California, (#4901)

Professional Geologist: Georgia, (PG740)

Professional Geologist: North Carolina, (#1749)

Professional Geologist: Indiana, (#862)

Professional Geologist: Tennessee, (#1462)

Areas of practice
Hydrogeology, Water Resources

Languages
English; Limited Spanish

CAREER SUMMARY

David Wiley has over 38 years of experience in consulting and water management that includes design, operation, and analyses of aquifer tests, safe yield analyses for groundwater withdrawals of major public-supply well fields, computer model development, mine dewatering operations, groundwater monitoring, sampling and analyses, preparation of applications for water-use permits, development of state water plans, brackish groundwater studies for R.O. process, R.O. well design, well-field management plans, ASR and injection wells, project management, long-range planning, surface-water management, contamination assessment reports, remediation design, transport modeling, wetland enhancement, surface-water management, technical presentations, project and personnel management, budget development and management, artificial recharge, well rehabilitation, technical review, salt-water intrusion studies and expert testimony. As a Principal Hydrogeologist with WSP, Mr. Wiley negotiates and manages contracts, coordinates and manages technical staff, makes presentations to Boards, Commissions and other entities, and ensures that work product is technically sound. He has also provided expert witness testimony when necessary.

Dave Wiley's 5 years of experience with the SWFWMD prior to consulting included design, performance, and analyses of aquifer tests, computer modeling to predict local and regional impacts as a result of groundwater withdrawals, water use permit review, geophysical field work; including logging and resistivity surveys, supervision of well installation and sampling, supervision of the evaluation of public supply permits, design, testing and permitting of injection wells. Extensive experience included study of hydrogeologic formations in Florida, monitoring of ground and surface water impacts as a result of major well-field withdrawals, design and analysis of aquifer tests for major public supply well fields, project management for projects dealing with impacts on the water resources as a result of large regional groundwater withdrawals. His experience also includes direct communications with other regulatory agencies and government entities; testimony before the Department of Administrative Hearings, Florida, as an expert in hydrogeology; rule development for the review and issuance of consumptive use permits.

EDUCATION

B.A., Geology, University of South Florida, Tampa, Florida 1980

PROFESSIONAL MEMBERSHIPS

American Institute of Professional Geologists 1985

PROFESSIONAL EXPERIENCE IN WATER RESOURCES

— City of Clearwater Groundwater Replenishment Project, Clearwater, Florida (2010 – Ongoing): principal-in-charge and senior review in performing a feasibility study on groundwater replenishment for the City of Clearwater. The project consists of indirect recharge using purified waste water to enhance the aquifer conditions for supplementing groundwater withdrawals to meet the City's water demands. The treated wastewater is to be injected by wells into a limestone aquifer immediately below the limestone aquifer used for water supply. A detailed feasibility study that included the development of a calibrated groundwater flow model to simulate the hydrologic system and the use of MODPATH for particle tracking was developed for FDEP UIC permitting requirements. A geochemical analysis was also performed to evaluate the potential for the mobilization of arsenic and dissolution of carbonate rock. An exploratory test well was installed and a 6-month recharge test performed successfully. Final design, permitting and construction is currently being completed.

- City of Clearwater RO Concentrate Disposal System Project, Clearwater, Florida (2012-2015year): principal-in-charge for the development of a RO concentrate disposal system for the City of Clearwater. The project consisted of the permitting, installation and testing of an injection well located at the City's new RO 2 facility. Prepared an application package to construct a Class I Exploratory Injection well for disposal of concentrate from the new R.O. 2 Water Treatment Plant. The application included an Area of Review Report, a detailed drilling and testing plan, and technical specification for well construction and testing. A Contract Document and Technical Specifications Document were also prepared for bids to construct the exploratory well.
- Well Field System Evaluation, Dunedin, Florida (ongoing): project manager and principal investigator for the evaluation of the City's well field system. Activities included evaluation of salt-water intrusion, pumping tests, statistical analysis, modeling and permitting. An investigation was also performed by constructing test wells to locate a source of brackish ground water to supply the City's RO Plant. Finally, a well-field management plan was developed that included the use of existing wells and new brackish water wells.
- Development of Alternative Water Supply, Tarpon Springs, Florida (2007-current): principal hydrogeologic investigator for assisting the City of Tarpon Springs with the development of an alternative water supply from a brackish groundwater supply source. The project included assistance with obtaining funding to build the project, well field design, well installation and aquifer testing, water-quality analysis, groundwater modeling using the SWFWMD Model, water use permitting, and RO treatment design. Expert testimony was provided in state hearing for the challenge of issuance for the water use permit.
- Upper Floridian Aquifer, Tarpon Springs, Florida (2007-current): project manager and principal investigator for Upper Floridian Aquifer at Tarpon Springs, Florida for development of water supply wells and its effect on salinity intrusion. Model calibration was done on heads and chloride concentrations on monitoring wells. Various scenario runs were conducted to determine salinity impacts to shallow aquifer to intermediate aquifers due to long term pumping effects. Client: Name.
- Hydrogeologic Evaluation to Expand City's Wellfield, Clearwater, Florida (2007-2010): responsible for conducting a detailed hydrogeologic evaluation for expanding the City's existing wellfield and in support of an application for modifying the Water Use Permit. A three-dimensional groundwater flow model was developed using DWRM2 to evaluate drawdown in the surficial and Upper Floridian aquifers at the proposed permitted quantities. The drawdown information was used to assess potential impacts to adjacent users, wetland levels, and movement of the freshwater/saltwater interface. A well field management plan was developed to minimize drawdown impacts, and a water level monitoring plan was prepared. The permit was approved for the requested wellfield expansion. Client: Name.
- Manatee County (2009-2010) - Principal-in-charge of the development, implementation and evaluation of an Aquifer Performance Test of the Intermediate aquifer for Manatee County Utilities at the Erie Road water storage facility. Services included the preparing of a testing program required by the SWFWMD as part of a WUP for the new North County Well Field. Services also included the preparation of well specifications, hiring of a drilling contractor, installation of monitoring equipment, monitoring of the 10-day test and evaluation of the data. The data is being used to assist in final well field design.
- WUP Renewal for Spring Hill and West Hernando, Hernando County, Florida: responsible for preparing WUP renewal/modifications for the Spring Hill and West Hernando systems. Hydrogeologic impact analysis included preparation of

groundwater flow models to evaluate drawdown impacts. Developed the source identification component of a recent 20-year Mater Water Supply Plan. Also, managed the design, construction, and testing of several water supply wells. Designed, implemented and analyzed several aquifer performance tests to calculate aquifer characteristics. Utilized a particle tracking model to develop wellhead protection zones around several new public supply wells. Client: Name.

- Evaluation of Groundwater Conditions, Sarasota, Florida: project manager and principal investigator for the evaluation of groundwater conditions in and around the City of Sarasota. Evaluated groundwater quality, levels and effects due to pumping through the use of a 3D model. Also, assisted in the design of RO wells and evaluated pumping tests. Project management for the evaluation of groundwater conditions around the City's Verna Well Field and the development of a 3D, five-layer model to determine impacts on the City's wells as a result of regional pumping. Expert testimony was provided for the City in a challenge to a large agricultural operation adjacent to the City's Verna Well Field.
- Hydrogeologic Investigation of Existing East Co. Well Field, Manatee County, Florida (2010): principal-in-charge for hydrogeologic investigation to assist with the expansion of Manatee County's existing East Co. Well Field by two mgd average annual and four mgd peak month. The increase, which was located outside of the MIA of the SWUCA was facilitated by a reduction in pumping inside the MIA by a transfer of permitted quantity from an agricultural WUP to the East Co. Well Field WUP. Services included groundwater flow modeling using the SWFWMD's Southern District Model for permitting, well design, construction and testing. Client:
- Development of New Groundwater Supply, Manatee County, Florida (2008-2010): principal-in-charge for hydrogeologic investigation to assist with development of a new groundwater supply for Manatee County at the North County Regional Wastewater Treatment Facility. The project is inside of the MIA of the SWFWMD SWUCA. To get the project permitted, several aquifers were utilized and the County traded reclaimed water for existing agricultural permits. Hydrogeologic services consisted of aquifer testing, groundwater modeling using the SWFWMD's Southern District Model, well field design and permitting.
- Evaluation of Deep Injection Well Program, St. Petersburg, Florida: performed continuous evaluations regarding the City's deep injection well program for treated waste water and for AST of the treated water. Project work included the design, permitting, construction and testing of new wells for the deep injection well program.
- Clearwater, Florida – Principal investigator and Project manager for the evaluation of hydrologic data associated with the City of Clearwater's annual reporting requirements for its WUP with the SWFWMD. Evaluation included analysis of groundwater quality trends, water-level trends, lake levels and pumpage for City production and monitoring wells.
- City of Tarpon Springs Class I Well Operating Permit, Tarpon Springs, Florida (2017): principal-in-charge for preparation of the application for a Class I Injection Well Operating permit for the City's reverse osmosis treatment plant concentrate injection well. The application package included preparation of the operational test period monitoring report. The report included a graphical analysis and summary of well operating parameters and water-quality data for the monitoring well system. An Operating Permit was successfully obtained in 2017.
- City of St. Petersburg NWWRF Class I Monitoring Well Construction, St. Petersburg, Florida (2006): principal-in-charge of well construction and test plan for a FDEP permit to construct two injection well system monitoring wells at the Northwest Water Reclamation Facility. The wells were designed and construction in order to

bring the monitoring system into compliance with current regulations. The construction and testing of these wells was also managed for the City of St. Petersburg.

- City of Sarasota Class I Dual Purpose Injection Well, Sarasota County, Florida (2016 – 2017): principal-in-charge for completion of the application for a Class I Injection Well Operating permit for the City's dual purpose reverse osmosis treatment plant concentrate and wet weather reclaimed water disposal injection well. Assisted with analysis of operational data to address a compliance issue involving potential upward migration of injected reclaimed water. A permit condition based on a maximum allowable well head during periods of wet weather storage was included in the Operating Permit.
- Manatee County ASR Well Field Permitting Project, Manatee County, Florida (2016 – 2017): principal-in-charge for application of a Class V ASR Well Operating permit for the ASR well field at the County Water Treatment Plant. The ASR system has operating under a testing permit since 2002, and this was the first Operating Permit for the facility. The application package included preparation of the operational test period monitoring report. The report included a graphical analysis and summary of well operating parameters and water-quality data for the monitoring well system, and an updated Area of Review Report. An Operating Permit was successfully obtained in 2017.
- Principal-in-Charge for the modification of Manatee Counties consolidated WUP. This project involved the transfer of permitted quantities of water from an agricultural operation to one of the Counties well fields. Both the County well field and the agricultural operation are located in the Southern Water Use Caution Area (SWUCA), and the Most Impacted Area (MIA) of the SWUCA where new groundwater withdrawals are either prohibited or limited unless credits can be received by the transfer of currently permitted quantities. In order to obtain the transfer credits, the County provided reclaimed water to the agricultural operation to offset the water use. Groundwater modeling using the District's DWRM3 model was performed in order to assess the transfer of water and for determining the amount available to the County. The project was successfully completed and a water use permit obtained for the additional amount of water.
- Project Manager assisting Pasco County Utilities with the evaluation of a public supply well with high iron content in the groundwater. Video survey, geophysical logs were reviewed, pumping packer tests performed and water quality analysis conducted to determine the potential source of the high iron groundwater and determine if there was faulty well construction. It was recommended that the well water be treated. The recommended treatment for this water supply was a combination of oxidation and filtration. The simplest form of this treatment would utilize sodium hypochlorite for chemical oxidation. Since sodium hypochlorite is required for disinfection of the raw water, a single storage tank could be used for both oxidation and disinfection.
- Project Manager for the evaluation and modification of brackish water well for the City of Tarpon Springs that had high iron content in the groundwater. Work included performance of packer tests at various depths, water quality analysis, liner installation and deepening of the open bore-hole. The well modification was successful in eliminating the high iron concentrations.
- Project Manager for the Public Water Supply System permitting through the FDEP of four existing wells for the City of Tarpons Springs located along Disston Avenue in Duke Energy corridor. Due to set back distance requirements for a hot oil pipeline for the power company and a storm water pond, variances were required for permitting the wells. We were able to show through a risk assessment that there was no threat from the hot oil line and that the storm water pond was not a

risk because of a confining layer separating it from the aquifer producing the water in the wells.

- Project Manager and principal investigator for the preparation of annual well field hydrologic reports for the City of Tarpon Springs Florida. The work included evaluation of groundwater quality data for both the Cities brackish water well field and its fresh water wells, groundwater quality and groundwater levels for the Cities dedicated monitoring wells, statistical analysis of hydrologic data including water quality, water levels, pumpage and rainfall, review of well field operations and analysis for regulatory control levels. Annual report includes all maps, figures, graphs, tables necessary to support conclusions.
- Project Manager and principal investigator for the annual analysis of brackish water well filed water quality for the City of Tarpon Springs Florida. The work included evaluation of groundwater quality data for the Cities brackish water well field, groundwater quality and groundwater levels for the Cities dedicated monitoring wells, statistical analysis of hydrologic data including water quality, water levels, pumpage and rainfall, analysis for chloride concentration regulatory control levels and preparation of a technical report. Report includes all maps, figures, graphs, tables necessary to support conclusions.
- Project Manager for water use permit renewal for the City of Dunedin Florida's brackish water well filed. Work included groundwater modeling, groundwater quality analysis, groundwater level analysis, evaluation for water demand, addressing regulatory requirements, addressing well field operations and water conservation, and report preparation.
- Project Manager and principal investigator for the preparation of a Well Field Management Plan for the City of Clearwater Florida. The plan includes a description of the operations and management of the 3 City well fields, description of the monitoring of pumpage and water quality from the production wells, a description of the monitoring of water quality and water levels in the dedicated monitoring wells, development and description of chloride control regulatory levels in the monitoring wells, maps/figures showing all well locations with service area and treatment plants, tables listing all wells with their construction characteristics and the WUP issued by the SWFWMD.
- Project Manager for the evaluation of Sarasota Counties Carlton Memorial Well Field and development of a Well Field Management Plan. Groundwater quality and groundwater levels for production wells and monitoring wells were all evaluated with respect to pumpage and the aquifer from which the wells penetrate. After the evaluation was completed, the Well Field Management Plan was developed. The plan described the well field, well field conditions and operations, hydrogeology, groundwater quality and developed chloride control regulatory levels for monitoring wells and the methodology used to determine the levels, which was agreed to by the SWFWMD regulatory staff.
- Project Manager for the evaluation of existing wells and development of new wells for the Pilgrim's Pride chicken processing facility in Live Oak Florida. Evaluation of 5 existing wells was performed and 3 new wells were designed, permitted, constructed and tested. Field services were provided for the evaluation, construction and testing of all wells and associated facilities.
- Project Manager for a desk-top evaluation for developing a new groundwater supply for Pilgrim's Pride chicken processing facility in Walker County Georgia. Work included evaluation of USGS reports and information from others on the local hydrogeology for the project area. Recommendations were made regarding the aquifer to develop the water from and the quantities likely to be available.
- Project Manager for a desk-top evaluation for developing a new groundwater supply for Bartow County Georgia. Work included evaluation of USGS reports and

information from others on the local hydrogeology for various potential sites in the County. Recommendations were made regarding the aquifers to target for development of water, the best sites for development, and the quantities likely to be available.

- A hydrogeologic analysis was performed for Tampa Bay Water in Hillsborough County, Florida to assess the effect of pumping from the Morris Bridge Sinkhole for augmentation of a public supply reservoir. A graphical and statistical analysis of water-level data from several observation wells were used to assess the amount of drawdown induced by the withdrawals. Aquifer characteristics were calculated from the drawdown data, and a groundwater flow model was prepared using MODFLOW to evaluate potential drawdown impacts on flows in the Hillsborough River. A water balance of the reservoir system was developed to assess the benefit of the withdrawal on the water supply.
- Principal-in-Charge and principal investigator in Mitchell County Georgia for hydrogeologic assessment at the site of a proposed ethanol plant. The assessment consisted of the collection and evaluation of available hydrogeologic data including detailed information on the local geology, the character and quality of the aquifers beneath the property, the interaction between surface water with groundwater and the local use of the groundwater. The assessment was used to support an application for a Water Withdrawal Permit as required by the GADNR EPD. The objective of the application was to describe the intended use and quantity of water to be withdrawn and to demonstrate its beneficial use and that there would be no adverse impacts. A permit was approved by the state. Groundwater flow modeling using MODFLOW was performed to simulate the effects of the withdrawal to evaluate the potential impact in the area. The model was constructed as a two layer model with aquifer parameters that were derived from a USGS report of the area. The model was calibrated to the potentiometric surface elevation derived from the USGS and demonstrated that the drawdown associated with the withdrawal did not pose an adverse impact to any other groundwater users in the area. A particle tracking model using WinFlow was also developed to assess potential impacts from a nearby landfill. The aquifer parameters used in the MODFLOW model were incorporated into the particle-tracking model. Results of this effort indicated no expected impacts at the ethanol plant. Assisted in explaining the project at a public meeting held near the site.
- Principal in charge of detailed hydrogeologic impact analysis reports prepared in support of application for several of the Hernando County Utilities Department's public supply Water Use Permits in Hernando County. The SWFWMD's DWRM2 was used to evaluate drawdown in the surficial and Upper Floridian aquifers at the proposed permitted quantities. In all cases changes were made to aquifer characteristics in portions of the focus model to improve calibration with actual potentiometric surface contour maps. The drawdown information was used to assess potential impacts to adjacent users, wetland levels, movement of the freshwater/saltwater interface and other MFL's. Well field management plans were developed to minimize drawdown impacts, and a water level monitoring plan was prepared.
- Principal in charge of detailed development of a calibrated groundwater flow model to evaluate the effects of depressurizing the confined aquifer system for operation of an open-pit phosphate mine in Aurora North Carolina. Several scenarios were modeled to evaluate the withdrawal quantities required to simultaneously mine multiple areas of the mine property. The model results have been used successfully to operate the depressurizing system, and to support permitting activities. Annually, the model is recalibrated and used to assess new

mine plan conditions for determining the number and placement of depressurizing wells, and the necessary pumpage quantities for safe mining conditions.

- Principal in charge of a 20-year Master Water Supply Plan developed for Hernando County, Florida which included preparation of demand projections, identification of new water source and use of a groundwater flow model to access potential impacts due to projected groundwater withdrawals. The project also included testing and evaluation of several production wells to assist in evaluation of the existing facilities.
- Principal in charge of an Impact Management Plan prepared for the West Hernando Dispersed Well Field. The plan included an evaluation of long-term trends in groundwater and surface water levels to identify the effects of rainfall variation and groundwater pumping. Trigger levels to indicate the potential for adverse impacts were identified, and actions were identified that would be implemented at designated drought levels to attempt to reduce or mitigate adverse impact.
- Principal in charge for Tampa Bay Water project of two existing unused wells at the Eagles Development that were investigated to evaluate the potential for providing 0.2 mgd of additional supply to the regional system. Geophysical logs and a video survey were performed to assess the physical condition of the wells, and identify the water producing zones. Specific capacity tests were performed to evaluate the producing capacity of the wells and groundwater modeling performed for water use permitting.
- Principal-in-Charge for assisting the State of Mississippi in the evaluation of Memphis groundwater withdrawals on effects to the aquifer conditions in northern Mississippi. The evaluation consisted of the utilization of a USGS model to determine the historical volumes of aquifer water being diverted out of Mississippi due to the Memphis well field pumping. Expert testimony has been provided and the case is currently pending in the US Supreme Court.
- Principal-in-Charge for performing groundwater modeling of Duke Energy facility in North Carolina. An existing MST3D model was provided to LBG for updating, revising, recalibrating and simulating effects of contaminant migration. The modeling effort was completed quickly due to requirements of the state.
- Principal in charge of preparing several Annual Well Field Operation and Hydrologic Monitoring Reports for Pinellas County Utility's Eldridge-Wilde Well Field. Well field pumpage, water level, water quality, and rainfall data were used to assess hydrologic conditions in the well field. A graphical and statistical analysis of data from two consecutive water years was used to identify short-term changes in hydrologic conditions, while a 20-year data record was used to identify long term trends and relationships between water quality, water levels, and rainfall.
- Principal in charge for the forensic investigation of a catastrophically flooded limestone aggregate quarry pit for Vulcan Materials Company and the assessment of karstic features hydraulically connecting the pit to a nearby stream in Polk County, Rockmart Georgia. Responsibilities included site inspections with field reconnaissance to identify karst features; geophysical surveys using electrical resistivity to identify water-bearing fractures; installation and monitoring of Mini-TROLL® water level recorders in site wells, the flooded quarry pit, and a stream gauging station; collection and management of water level and meteorological data; preparation of tables and graphs; data analysis; and reporting.
- Principal in charge for the assessment of a limestone aggregate surface mine expansion for Vulcan Materials Company in Whitfield County, Dalton Georgia. The goal of the project was to evaluate the impact that proposed quarry dewatering activities may have on ambient groundwater conditions in a karst regime, and assess the potential risk of the acceleration of land subsidence. Responsible for:

event scheduling; participation in several pumping tests to evaluate aquifer characteristics; packer installations to separate water-bearing fractures; operation and maintenance of a HOBO® weather station and In-Situ Mini-TROLL® submersible water level recorders; collection and management of meteorological and water level data; interpretation of electromagnetic borehole flowmeter test results; borehole logging using a downhole video camera; field reconnaissance to identify karst features; well surveys; GIS mapping and classification of natural resources including streams, wetlands, riparian woodlands, etc.; lithologic cross-section preparation; preparation of tables and graphs; preparation of borehole logs utilizing various software packages; data analysis; and reporting.

- Principal in charge for the assessment of a proposed limestone aggregate quarry site for Vulcan Materials Company in Polk County, Aragoneorgia. Phased assessment activities included development of conceptual hydrogeologic models; air-rotary reaming of existing monitor wells for conversion to pumping wells; participation in pumping tests; operation and maintenance of a HOBO® weather station and Mini-TROLL® water level recorders; collection and management of meteorological and water level data; downhole video camera logging; preparation of tables and graphs; preparation of borehole logs; data analysis; and reporting.
- Hydrogeologic services in support of additional water supply development and an application to modify On Top Of the World's, a large residential development with several golf courses, commercial use and agricultural use, water use permit in Marion County, Florida. Services included planning studies to document available information at the 13,000 acre development, a comprehensive field investigation to evaluate local aquifer hydraulics and water quality, and groundwater modeling studies with the SWFWMD's DWRM2 Model to obtain critical data to proceed with new groundwater supply development. Field work was carried out to determine existing supply well capacities and assess aquifer hydraulics, geophysical log of existing wells up to 700 feet deep, and water-quality testing to evaluate the vertical and lateral distribution of sulfate and chloride content across the site.
- Principal in charge of several groundwater supply investigations conducted for well field development in the Arecibo municipality for Puerto Rico Aqueduct & Sewer Authority from 2009 to 2012. Projects completed in the Rio Grande de Arecibo valley included groundwater flow modeling analyses, test well drilling, and aquifer analyses to assess the potential for development of 10 million gallons per day of groundwater from the carbonate aquifers beneath the valley; selection of candidate sites for well field construction, well field design, and well construction assistance.
- Principal in charge for developing a brackish water supply well field to supply a planned 2 mgd reverse osmosis treatment facility at the site of the existing Myakkahatchee Creek softening plant for the City of North Port, Florida. Six 12-inch diameter wells were cased to a depth of 240 feet and completed to 320 feet drawing from Intermediate aquifer limestone production zone PZ-3. LBG and Water District staff worked closely to fulfill requirements for test well installation, aquifer testing and analyses, and groundwater flow model calibration to obtain permit authorization within 90 days after the application was filed. Expedited testing and permitting was critical for the City to meet contract obligations for construction of the reverse osmosis treatment facility. Aquifer testing was conducted for 10 days to define hydraulic properties of the Intermediate production zone and overlying leakance units, and to size supply wells and pumps. Groundwater flow modeling was employed to assess the potential for water supply development of the Intermediate aquifer in the area, and to simulate surficial aquifer responses to long term withdrawals. The Water District's regional DWRM

model was calibrated by matching water level drawdown measured during aquifer testing in the production zone and overlying formation.

- Principal in charge of an assessment conducted for Tampa Bay Water to examine the influence of basin drainage improvements along with changes in well field withdrawals to explain water table recovery and localized flooding. Reductions in groundwater withdrawals at regional well field facilities have been carried out by Tampa Bay Water to comply with area MFLs. In the case of Eldridge Wilde Well Field, long-term withdrawals averaging more than 25 million gallons per day have been reduced to less than 15 mgd. Analyses consist of statistical methods to determine the long term relationship of groundwater levels, rainfall, and pumpage.
- Principal in charge of hydraulic testing of existing supply wells at Matadero and Ojo de Agua well fields for Puerto Rico Aqueduct and Sewer Authority to better match pumping rates with well capacities. Capacity testing was initially conducted at 12 existing wells to screen candidate wells to assess water quality changes at the increased pumping rate. Increased pumping rates at four wells my supply an additional 1,500 gpm once wells are properly cleaned. Additional testing, if conducted as recommended, may indicate the potential for higher pumping rates at three other existing supply wells at Matadero and Bajadero. The study demonstrated that that elevated turbidity and microbial contamination at Ojo de Agua well field are generally associated with highly developed solution channels in areas beneath the valley.
- Principal-in-charge for construction of a horizontal test well adjacent to the City of North Port's Myakkahatchee Creek water treatment plant using directional drilling equipment to a maximum depth of 70 feet. Testing of the horizontal well was conducted to assess well hydraulics, determine the capacity of the limestone aquifer, and demonstrate its feasibility as a long-term source of drinking water. Despite well construction challenges, hydraulic analyses demonstrate that the horizontal test well has significant performance advantages where the length of the horizontal open borehole is appreciably greater than the thickness of the aquifer. The 12-inch diameter horizontal supply well was constructed with a 240-foot open borehole completed into limestone and no well screen to a maximum depth of 70 feet using directional drill equipment and mud-rotary drilling methods. The limestone aquifer is sufficiently transmissive to induce radial flow and to meet conditions for application of one-dimensional solutions to aquifer test data shortly after the start of pumping. Water-level drawdown in the horizontal well stabilized at about 36 feet at a flow rate of 345 gpm. Drawdown in the limestone aquifer was about 20 feet at distances of 10 feet and 95 feet from the horizontal test well resulting in an aquifer transmissivity of 900 ft2/day and hydraulic conductivity of 45 ft/day.
- Principal in charge of services to On Top Of The World in Marion County, Florida for providing support of future water supply development and included timely authorization for installation of four high capacity supply wells to meet potable demands through year 2021. On Top of the World Communities is a regional development with water, wastewater, and reclaimed water services provided by its affiliated utility Bay Laurel Center Community Development District. The utility serves a growing population of 10,000 within a 20 square mile service area. An active cattle ranch, agricultural crops, and three golf courses are integrated components of the water reuse facilities. Planning studies documented available information for the 12,000 acre development, a comprehensive field investigation to evaluate local aquifer hydraulics and water quality, and groundwater flow modeling studies to demonstrate the capability of area water resources to sustain increased groundwater development. Initial planning studies were completed to document existing public supply, agricultural, and golf course irrigation supply

wells, well pump capacities and pumpage history, area supply wells, local hydrogeologic conditions, long-term water levels records, and groundwater quality. Field work was carried out to determine existing supply well capacities and to assess aquifer hydraulics, to geophysical log existing wells up to 700 feet deep, water quality testing to evaluate the vertical and lateral distribution of sulfate and chloride content across the site. On-going services include evaluation of water use records to assess recent and future water use per capita data, irrigation application rates for residential homes, golf course irrigation, and conservation measures to reduce residential irrigation and improve irrigation efficiency.

- Principal in charge of preparing an operating guidance document for supply wells at Sarasota County's University Parkway well field and for assessing current and future well conditions requiring maintenance. The report summarizes well construction information and well capacity testing conducted in 2012. Adjustments to individual well production rates were recommended to better match pump and formation capacities. Capacity benchmarks were established for determining when well maintenance should be performed. Benchmarks were set to maintain a minimum of 30 feet of pump submergence to prevent surging at the maximum discharge rate upon startup. Deepening pump settings at selected wells was proposed to improve pump performance. Well development is to be conducted to recover capacities and to better protect pump equipment. Constraints to individual well pumping rates and to overall wellfield capacity are presented based on well and pump hydraulics and on local hydrogeologic conditions. Water-quality conditions related to chloride control levels are examined. A pumpage and water-quality database was provided to the County in spreadsheet format to assist with review of historical records and to more easily maintain future data collection efforts.
- Principal in charge of groundwater flow analyses carried out for a planned 1,680-acre limestone aggregate quarry using open-pit bench mining at the Santee Cooper Power Corporation Limestone Quarry at Cross, South Carolina. Excavation of the approximately 80-foot thick Santee Limestone to a depth of 10 feet below NGVD will require dewatering and water control measures be made in stages. Model calibration from simulation of water level drawdown demonstrates that the flow model approximates with reasonable certainty observed drawdown values measured during aquifer pump testing. Residual value and sensitivity analyses of simulated declines to a range of hydraulic properties were presented. Mine cut inflow rates were determined for eight mine pits as each cut advances laterally after the previous cut has reached its terminal excavation depth. Groundwater level declines and inflow rates associated with proposed mine pit dewatering were simulated using flow model initial conditions and boundaries developed. An inflow rate of 21.3 mgd occurs at the end of excavation of the final mine cut. Recharge trenches were simulated to maintain water levels above the Santee Limestone at the property boundaries. Water pumped during excavation will be discharged to trenches. Trench dimensions incorporated bottom elevations and dimensions derived from model simulations to insure suitable hydraulic performance. Of the combined 21.3 mgd pumping rate during proposed dewatering, approximately 20.7 mgd is discharged to maintain water stages at the recharge trenches and at selected completed mine cuts.
- Principal-in-charge of Sarasota County's University Well Field evaluation. Sarasota County's University Parkway Well field consists of seven Floridan aquifer supply wells bordering University Parkway immediately south of the Manatee County line. Supply well construction details and well capacity testing were examined to assess present conditions. Water-quality conditions related to chloride concentration

limits were examined and recommendations provided to plan for pending water use permit requirements. Capacities have declined at all wells where records are available. Specific capacity benchmarks for determining when well maintenance should be performed were developed to maintain a minimum pump submergence to prevent surging at the maximum discharge rate. Recent trends suggest that chloride control levels may be reached at Wells 1 and 4 within one to three years. Chloride at Well 2 may remain stable or begin to rise as has been the case with other nearby wells. Well 5 exceeded its chloride trigger level in 2008 and Wells 3, 6, and 7 have recently reached their trigger levels. The rate of increase in chloride content at individual wells cannot be attributed to differences in water level gradients observed during capacity testing. No direct relationship can be attributed to pumping rates since individual and combined rates have declined during transition periods of rising chloride concentrations. Limited construction information suggests that total well depth may be a factor to partially explain differences in chloride concentration and rates of concentration increase observed in recent years. Well field capacity cannot be predicted or evaluated solely on water-quality fluctuations as indicated by monthly records beginning in year 2000. Long term variations in chloride and TDS are largely independent of pumping rate changes with no direct relationship apparent from graphical examination.

- Principal-In-Charge of a detailed hydrogeologic impact analysis report prepared in support of an application for a public supply Water Use Permit at Spring Hill Florida. A three-dimensional groundwater flow model was developed to evaluate drawdown in the surficial and Upper Floridian aquifers at the proposed permitted quantities. The drawdown information was used to assess potential impacts to adjacent users, wetland levels, and movement of the freshwater/saltwater interface. A well field management plan was developed to minimize drawdown impacts, and a water level monitoring plan was prepared. The permit was approved with the requested increase in withdrawal rates.
- Principal-in-Charge for the evaluation of Sarasota Counties Carlton Memorial Well Field which withdraws water from both the Intermediate and Upper Floridan aquifers. The project consisted of the analysis of historical water-quality data for both production wells and dedicated monitoring wells. The work also included analysis of historical groundwater levels in the monitoring wells and the historical well field pumpage. Of particular interest was the relationship between historical groundwater quality, well location and well field pumpage. The SWFWMD WUP assigned chloride concentration trigger levels on each production for regulating well field production. The goal of the project was to eliminate the trigger levels from production wells and have them developed for the monitoring wells instead, which serve to provide a better tracker of the condition of groundwater resources for the area.
- Principal-In-Charge for a wellhead protection zone model prepared for three new supply wells at Spring Hill, as required by Hernando County's wellhead protection ordinance. The evaluation was performed using an analytical groundwater flow/particle trace model. A prohibited use survey was performed within the model delineated protection zones.
- Managed the performance of a testing and evaluation program of existing supply wells for City of St. Petersburg well fields. Activities included geophysical logging, borehole videos, pumping tests and a well field management plan. Other activities for the City have included evaluations of conditions of lakes in the region, environmental augmentation plan development, domestic well investigations and continuous interaction with the SWFWMD and WCRWSA.
- Principal-In-Charge and management for a testing and evaluation program on three regional well field for Tampa Bay Waters. Hydrogeologic data from

geophysical logs, video surveys, and pumping tests were used to evaluate the performance and condition of 65 production wells. A technical report was prepared that provided an evaluation of the condition, productivity, and water quality of each well. A plan for well rehabilitation and well field management recommendations was also prepared.

- Principal-In-Charge for preparation of the WUP renewal for Florida Water Service's Sugarmill Woods water supply facility in Citrus County. Per capita water uses and projected needs were calculated, and adjacent user's information was compiled. Hydrogeologic impact analysis included preparation of a groundwater flow model to evaluate drawdown impacts, and a trend analysis of water-quality data.
- Principal-In-Charge for preparation of the WUP renewal for Florida Water Service's Citrus Springs water supply facility in Citrus County. Per capita water uses and projected needs were calculated, and adjacent user's information was compiled. Hydrogeologic impact analysis included preparation of a groundwater flow model to evaluate drawdown impacts, and a trend analysis of water-quality and water-level data.
- Principal-In-Charge for preparation of the WUP renewal for Florida Water Service's Marion Oaks water supply facility in Marion County. Per capita water uses and projected needs were calculated, and adjacent user's information was compiled. Hydrogeologic impact analysis included preparation of a groundwater flow model to evaluate drawdown impacts.
- Principal-In-Charge for the design, construction, and testing of a water supply well at Marion Oaks in Marion County. Construction and testing specifications were prepared. Construction oversight was provided during critical construction and testing procedures. An eight-hour step drawdown test was performed on the supply well, and the data were analyzed to calculate aquifer transmissivity and optimum pumping rate. Geophysical logs were interpreted to delineate producing intervals in the well.
- Principal-inCharge of a water balance analysis conducted to assess loading rates and wet-season storage requirements for Manatee County's regional reclaimed water system for through year 2030 and for intermediate time periods. The County operates three water reclamation facilities having a combined permitted capacity of 40.5 million gallons per day (mgd). System-wide reclaimed water flows averaged 14.8 mgd through year 2010. Water balance calculations demonstrate that the permitted loading rates are more than suitable during a 10-year design rainfall condition. A storage requirement of 428 million gallons in 2010 and 1,007 million gallons in 2030 was proposed to meet the design criteria.
- Project manager and principal investigator for the investigation of groundwater supply potential for Tamp Bay Water beneath the Cone Ranch property northeast of Tampa. The investigation included the permitting, construction, testing and monitoring of Floridan aquifer wells and a hydrogeologic evaluation of the area. Activities also included preliminary well field design and the development of a three-dimensional groundwater flow model to assess impacts from pumping at approximately 50 million gallons per day.
- Project manager and principal investigator for the development of several new well fields for Orlando Utilities Commission and expansion of several existing facilities. The projects included well design, construction and hydrogeologic testing of numerous wells capable of producing 5 - 7 gallons per day wells. Groundwater flow modeling was also performed to assist in permitting new well field facilities through the SFWMD.
- Project manager and principal investigator for the development of the safe yield at five large public supply well fields for the WCRWSA. The investigation included the review of groundwater levels, state regulatory criteria, pumping rates,

permitting criteria and hydrogeologic characteristics. Analysis and results represent a worst-case scenario based on a 1 in 20 year drought.

- Principal investigator for assisting engineers with the Peace River Manasota Regional Water Supply Authority and their Water Alliance in Developing a Water Supply Plan. The study included the evaluation of a number of water utilities and their respective supply sources and demands. Water sources included, fresh ground water and surface water, reverse osmosis, and fresh water and reclaimed water ASR.
- Project manager and principal investigator for an evaluation of present and future public water supplies for the Lee County Utilities Department. The investigation included evaluating existing well-field sources, hydrogeology of the county, water use permits, potential sources of contamination and groundwater flow modeling. After all hydrogeologic and water use data were reviewed, the modeling was performed to determine potential future resource areas. Also, evaluated potential for developing brackish ground water for R.O. treatment and evaluated potential for ASR using surface water.
- A groundwater investigation for the City of Dunedin using the dual-tube drilling process to identify potential sites for developing brackish water. Five sites were tested and found favorable for designing and constructing wells for providing water to the City's R.O. plant.
- Project manager and principal investigator for the development of a new public supply well field in Orlando, Florida for Orange County Utilities. The project included the evaluation of existing well characteristics and test data, new well design, construction supervision and hydrogeologic testing of five 5-million gallons per day wells.
- Project Manager and principal investigator for an evaluation of hydrologic conditions and relationships in the area of the three City of St. Petersburg Well Fields. The investigation included the evaluation of groundwater levels, streamflow, lake levels, historical development, historical rainfall, pumpage and factors affecting hydrologic conditions. Drought, drainage, development and drawdown (4Ds) are the primary factors. A surface water management program was developed for the study area. Expert testimony was provided before the state hearing officer for the water use permit.
- Project Manager and principal investigator for a well rehabilitation project at the City of Sarasota's Verna Well Field. The project included redevelopment of 30-year old wells through the use of a reverse air rotary drilling rig and acidizing. All wells were pump tested prior to the redevelopment work, geophysically logged and video surveyed. After the redevelopment work, the wells were pump tested again. Positive results were obtained by significant increases in specific capacity.
- Performance and evaluation of MITs for injection wells at Pinellas County's South Cross Bayou and McKay Creek WWTPs. The work included full time field supervision by a Professional Geologist, geophysical logging and tracer analysis.
- Project Manger and principal investigator for Tampa Bay Water's Well Mitigation Program. When Tampa Bay water outsourced the administration of the construction portion of the Program, he assisted in developing the procedures for the revised Mitigation Program that includes management of drilling contractor operations. Work included the review and approval invoices from contractors and reports from LBG staff. Conducted initial site visits, which includes field mapping, preparation of site plans, researching property ownership and signing access agreements, performed field inspections of drilling contractor activity and final inspections. Preliminary well evaluations were conducted that included downhole video surveys, pumping tests and water sampling. The final inspection included an evaluation of well equipment and water quality analysis using field methods. The

public supply permitting process was completed for several applications for the well construction and operation of limited use and other public supply wells.

- Principal investigator for hydrogeologic services on a combination surficial rehydration/artificial recharge project at the Section 21 Well Field for Tampa Bay Water. The project included the use of ground-penetrating radar, installation of soil borings, core sampling and analysis, aquifer testing, hydrologic monitoring, groundwater flow modeling, particle tracking and solute transport modeling. A risk assessment was required because the sources of water for recharge are a canal that captures stormwater runoff and reclaimed water. The recharge area is located at the Section 21 potable supply well field.
- Project Manager and principal investigator for a value engineering study of an ASR well field expansion design. This ASR well field is an important element of the water supply for the Peace River/Manasota Regional Water Supply Authority. Water is withdrawn from the Peace River, treated, piped to an off-stream reservoir and then injected down wells for storage in the Floridan aquifer. The water is then withdrawn from the ASR wells during times of high demand. LBG found cost savings in the well field expansion design through this value engineering study.
- Assisted the City of Orlando's engineering consultant in performing a feasibility analysis of injecting and storing treated wastewater into the Upper Floridan aquifer. The project included a detailed evaluation of the hydrogeologic framework, aquifer characteristics, water quality and FDEP regulations.
- Assisted the City of Dunedin, Florida in performing a preliminary feasibility analysis for the use of Aquifer Storage and Recovery (ASR) with the City's treated waste water. The evaluation included a detailed evaluation of hydrogeologic conditions aquifer characteristics, water quality, modeling, area water use, FDEP regulations and cost.
- Project Manager for the investigation of a long-term water supply for Pinellas Counties Solid Waste Resource Recovery Facility. Work included feasibility analysis for developing a groundwater supply and utilizing ASR of reclaimed water from St. Petersburg.
- Project Manager for the design of a dewatering system at the City of Clearwater Florida's East Water Reclamation Facility. A permanent dewatering system of the water table aquifer was installed for use during maintenance activities at the facilities clarifiers so that the clarifiers would not be damaged due to potential buoyancy effects.
- Project Manager for the design of a dewatering system at the City of Tarpon Springs Florida's waste water treatment facility. A permanent dewatering system of the water table aquifer was installed for use during maintenance activities at the facilities clarifiers so that the clarifiers would not be damaged due to potential buoyancy effects.

SPECIFIC EXPERIENCE IN GROUNDWATER CONTAMINATION

- Conducted groundwater soil contamination and remediation that resulted from leaking underground fuel tanks at the City's motor pool in Arcadia Florida. Also performed assessment of fuel lines and closure of several underground fuel tanks.
- Represented Gulf Power Company in Bay County Florida in an investigation to identify sources of elevated radiological activity in ground water in the vicinity of a fly ash disposal pond at an electric generating power plant (Plant Smith) in Bay County (1995). Regulators with the Florida Department of Environmental Protection (FDEP) suspected that radionuclides leached from fly ash were the sources of high gross-α, gross-β, ^{226}Ra, and ^{228}Ra in ground water. Laboratory analyses of core samples demonstrated that surficial sediments have naturally-occurring high concentrations of the parent elements uranium (U) and thorium

(Th); results of leach tests indicated little potential for release of radionuclides from fly ash; and plots of chloride vs. gross-α and gross-β showed a high degree of correlation between total dissolved solids (TDS) and radiological activity.

- Assisted Gulf Power Company in a hydrogeologic investigation for elevated levels of arsenic in groundwater at the Plant Scholz in Sneads, Jackson County Florida with respect to an on-site ash pond. Our analysis indicated that the arsenic was naturally occurring and liberated as a result of variable pH and redox conditions.
- Assisted Gulf Power Company in a hydrogeologic investigation for elevated levels of arsenic in groundwater at the Plant Crist in Pensacola, Florida with respect to an on-site ash pond. Our analysis indicated that the arsenic was not associated with the pond and likely to be from another source or background.
- Conducted groundwater soil contamination and remediation that resulted from leaking underground fuel tanks at the City's motor pool in Dunedin Florida. Periodic reporting was completed and new above ground tanks designed and installed. A remediation plan was developed and has been implemented.
- Represented Gulf Power Company in a second investigation involving the occurrence of elevated radiological activity in ground water in the vicinity of a stormwater runoff pond at an electric power generating plant (Plant Crist) in Escambia County (1998). Regulators suspected that ash was the source of the radioactivity. Laboratory analyses of sediments indicated high concentrations of U and Th in clays, and nonparametric sign tests supported the conclusion that the U and Th concentrations in local sediments were higher than normal for sedimentary rocks of that type. Column tests showed that radionuclides were leached from sediments but not from ash.
- Provided technical assistance in the development of a contaminant transport model to determine movement of contaminants in Guayama, Puerto Rico. Also, simulated effects of groundwater pumping from a proposed remediation system.
- Project manager and principal investigator for the assessment of potential contamination for West Coast Regional Water Supply Authority on proposed well field property in Hillsborough County Florida as a result of an adjacent phosphate processing plant. Activities included monitor well site selection, design of deep and shallow wells, supervision of construction and well development.
- Project manager and principal investigator for Hillsborough County Expressway Authority for the assessment of potential contamination on highway right-of-ways at new Veterans Expressway corridor. Activities included regulatory file reviews, monitor well construction and sampling, underground storage tank removal, surface geophysics and initial remedial actions.
- Principal investigator to Pinellas County on Lake Tarpon Groundwater Nutrient Study. The project included performance of groundwater monitoring to refine nutrient loading estimates to Lake Tarpon and to better evaluate the effects of nearby septic tanks on water quality. Twenty-three monitoring wells were installed to depths ranging from 20 to 40 feet below land surface, groundwater samples were collected and analyzed for a number of Cations, Anions and Nutrients. Additionally, samples were analyzed for the analysis of isotopic nitrogen ratios (15N/14N). Slug tests were conducted on monitoring wells to establish the hydraulic conductivity. LBG compiled, reduced, analyzed, and interpreted data so that computation of surficial aquifer water and nutrient fluxes to the lake could be performed. This was accomplished in the form of a model that adequately depicts nutrient flux to Lake Tarpon. Basis for the model was from collected water level, hydraulic conductivity data, and chemical analysis data. The groundwater flux from the surficial aquifer system (SAS) to the lake was calculated using an analytical model. The data analysis and modeling assisted in determining the relationship of land use to nitrate loading.

- Project Manager and principal investigator for evaluation of closed landfill for the City of Tarpon Springs Florida. Project consists of the evaluation of groundwater quality, groundwater levels and flow direction, and gas vent monitoring. Semi-annual reports, along with 5-year summary reports have been prepared on the landfill conditions and submitted to the FDEP as required by permit.
- Project Manager for the quarterly monitoring and assessment of active Cedar Trail Landfill operated by Republic Services in Bartow Florida. Project includes groundwater quality monitoring, groundwater level and flow monitoring, periodic surface water sampling and analysis, report preparation and submittal to the FDEP.
- Project Manager for the semi=annual monitoring and assessment of closed 545 Landfill operated by Republic Services near Orlando Florida. Project includes groundwater quality monitoring, groundwater level and flow monitoring, report preparation and submittal to the FDEP.
- Project Manager for assisting the City of Tarpon Springs with groundwater monitoring of its reclaimed water land application. The project included evaluation of groundwater quality and groundwater level data of the three existing land application sites at that time. From the evaluation, a new Groundwater Monitoring Plan was developed that eliminated monitoring at two of the sites and modified the monitoring at the third site using existing wells. The FDEP accepted and approved the new plan.
- Project Manager assisting Manatee County Florida with the renewal of it Master Reuse System Permit through the FDEP. An evaluation of the groundwater monitoring data from 17 wells at 5 sites was performed. Results of the evaluation led to a recommendation that no additional or change in monitoring was necessary.
- Project consultant assisting with contamination assessment of the shallow groundwater system at the Luis Muñoz Marin International Airport in San Juan Puerto Rico operated by Caribbean Airport Facilities. Groundwater samples were collected as part of the Subsurface Investigation Plan ("SIP") developed to delineate the vertical and horizontal extent of subsurface contamination with jet fuel products in the soils and groundwater in the vicinity. From our evaluation, no measurable vertical seepage component was indicated by water levels in shallow and deep monitoring wells. Relatively uniform plume geometries indicated movement was controlled predominantly by dispersion related to water-level fluctuations rather than by advection in the direction of prevailing groundwater movement. Results were reported to the USEPA as required.
- Project Manager for the evaluation of groundwater monitoring of the Master Reuse Water System for Pasco County Florida. Work included the evaluation of groundwater data for 11 reclaimed water irrigation sites. Recommendation were made to modify the FDEP permit and reduce the monitoring. Recommendations were accepted by FDEP and the permit modified accordingly.
- Project Manager for assisting FDEP with contamination assessment and remediation of petroleum contaminated sites under the Florida's petroleum restoration program. Sites assessed are former fueling stations that contained underground fuel tanks. Work included installation of monitoring wells for soil and groundwater assessment and measurement of groundwater levels. Work also included design, installation and management of remediation systems. Reports were prepared as required for all sites and submitted to the FDEP. Field services were provided for all sites.
- Project manager and principal investigator for environmental site assessment of existing shopping center to be remodeled in Lakeland, Florida for land developer. Investigation included a Phase I site assessment, testing for radon in air, sampling for asbestos containing materials and review of dry-cleaning operations.

- Conducted supplemental contamination assessment of petroleum product discharge resulting from leaking underground storage tanks in Orlando Florida. Project involved monitor well construction, groundwater sampling and reporting.
- Project manager and principal investigator for a rock mining operation in coastal Pasco County, Florida. Investigation included the design, construction and testing of a monitor well. Sampling of new and existing monitor wells for analysis of salt-water intrusion due to dewatering operations. Development of a water balance and pumping rates for the mining operation were determined to assist in obtaining a water-use permit. Fuel storage and use areas were also investigated for contamination and assistance provided in obtaining a discharge permit from the FDER.
- Project manager and principal investigator for the performance of initial remedial actions and contamination assessments in association with underground storage tank removal at numerous sites in Hillsborough and Pasco Counties Florida. Investigations included the review of regulatory records, construction and sampling of monitor wells, review of aerial photography and inspection of domestic well records.
- Responsible for operation, maintenance and monitoring of remedial system addressing chlorinated solvent contaminated soil and ground water at a dry cleaning facility in Pembroke Pines Florida. Preparation of monthly NPDES reports and annual status reports.
- Project manager and principal investigator for preliminary contamination assessments at numerous gasoline stations in Pinellas County, Florida. Activities included sampling of existing monitor wells, supervision of construction of temporary monitor wells, groundwater flow directions and receptor surveys.
- Project manager and principal investigator for a preliminary contamination assessment of former mobile home manufacturing company in Palm Harbor Pinellas County Florida. Investigation included a site assessment, the installation of temporary monitor wells, sampling and analyses of ground water for potential contaminants.
- Quantification Of The Role Of Shallow Groundwater Nutrient Enrichment On Exporting Nutrient Into The Lower St. Johns River Basin. Principal investigator in order to describe shallow groundwater quality existing under 4 predominant land use patterns: natural forest; row crop agriculture; residential development on septic tank waste disposal systems; and land disposal of domestic waste and identify the potential sources of nitrogen and phosphorus in shallow groundwater in the selected areas. LBG compiled and reviewed existing data from a number of sources, identified 17 sites and installed 50 monitoring wells for sampling and water analysis. Groundwater samples were collected on a quarterly basis during and analyzed for a number of cations, anions nutrients and other analytes. Additionally, samples were collected for analysis of isotopic nitrogen ratios (15N/14N). Slug tests were conducted to evaluate the hydraulic conductivity of the surficial aquifer. LBG used a combination of geochemical diagrams and statistical analyses to identify similarities and differences in water quality between and within the four land use groups.
- Directed the assessment of soils, sediment, groundwater and surface water at a former Manufactured Gas Plant in Sanford Florida. Soil borings and monitoring wells were installed. Water ad soils were analyzed for VOC's, PAH's and metals. A water supply well survey and historical aerial survey were also performed.
- Project manager and principal investigator for the evaluation of well decommissioning operations near two salt domes in south central Mississippi near Richton. Activities involved the review of area hydrogeology, well construction, geophysical logs, reports on nuclear repository potential, groundwater models, plugging

procedures and results and calculations for vertical and lateral movements of fluids through the natural groundwater system. Review meetings were held with the DOE and the state regulatory agency and recommendations made for necessary mitigation due to the potential for contamination migration.

- Conducted groundwater contamination assessment activities at major league baseball complex (Ed Smith Stadium) constructed on former landfill in Sarasota Florida. Developed a monitoring plan for the facility following the conclusion of the site assessment. After natural attenuation monitoring for a number of years, the site was given no further action status by the FDEP.
- Conducted groundwater soil contamination and remediation that resulted from leaking underground fuel tanks at the City of Sarasota's motor pool. Periodic monitoring and reporting was also completed. Limited remediation was completed by soil removal with follow-up monitoring. Eventually a no further action was issued by the FDEP
- Project manager and principal investigator for environmental site assessments on two tracts of land in Sarasota Florida. Investigations included site assessments, sampling of existing wells, review of local, state and federal regulatory records, review of aerial photography, inspection of domestic water well records and review of activities on adjacent properties.
- Project manager and principal investigator for the assessment of soils and groundwater at a former landfill located on City property at the Ed Smith Stadium Baseball Facility in the City of Sarasota. This work was performed to comply with the FDEP requirements. Monitoring wells were installed, soil and groundwater analysis performed, soil-vapor surveys conducted, private well surveys conducted, plumes defined, and technical reports prepared. The site was closed with no further action obtained.
- Project manager and principal investigator for the assessment of soils and groundwater at a former landfill located on City property at the Marion Anderson Place Brownfields site in City of Sarasota. This work was performed to comply with the FDEP requirements. Monitoring wells were installed, soil and groundwater analysis performed, soil-vapor surveys conducted, private well surveys conducted, plumes defined, and technical reports prepared. Limited remediation was completed through the use of temporary pits for dewatering and treatment of the water at the City's waste water treatment plant. The site was ultimately closed with no further action obtained.
- Project manager and principal investigator for a preliminary contamination assessment of previously developed property in St. Petersburg, Florida. The investigation included a site assessment, review of potential impacts from adjacent properties, review of local, state and federal regulatory records, construction of temporary monitor wells and analyses of ground water for potential contamination.
- Directed a contamination assessment of soil and groundwater associated with area of former underground pipelines for transporting No. 2 fuel oil at the Indiana River Power Plant operated by Orlando Utilities Commission, Titusville Florida. Assessment activities included the installation of soil borings, deep and shallow monitoring wells, soils analysis, groundwater analysis, pumping tests and a domestic water supply well inventory. Based on the results of all assessment activities, the site qualified for no further action status with the state of Florida DEP.

  Performed assessment of groundwater quality associated with monitoring programs of reclaimed water use at Lake Venice Golf Course and Bay Indies Subdivision in Venice Florida. Variances were obtained from the FDEP on iron concentration based on ambient conditions.