**WILLIAM W. WADE**

Energy and Water Economics

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**Previous Positions:**

Senior Vice President/Partner, Foster Associates, Inc

Vice President/Partner, Spectrum Economics, Inc.

Vice President/Partner, QED Research, Inc.

Manager of Economics, Dames and Moore Consulting Engineers

Corporate Economist/Financial Analyst, Standard Oil of California (Chevron)

**Key Qualifications: Energy**

Dr. Wade has worked as a Project Manager/Principal Investigator on dozens of decision-oriented energy economic and financial analyses within the utility and petroleum industries—upstream and downstream—over the last 30 years. He has testified before state and federal agencies on utility and petroleum industry policy issues. Expertise includes the utility rates and industrial electricity loads; supply, demand and price forecasts of petroleum products, pipeline services, delivered crude oil and natural gas; refinery processes to manufacture petroleum products; financial and engineering economic analysis of oil and gas development decisions, particularly in Alaska, California and the Gulf of Mexico; regional economic impacts of project development. He has worked extensively on OCS policy issues from Alaska to the Gulf of Mexico. He has 25 years experience managing and conducting financial and economic evaluations of policies and decisions bearing on natural resources and infrastructure. Experience with general financial analysis includes project feasibility evaluation, business valuations, business damages estimation and a host of ancillary methods of analysis. His realworld finance training began with various assignments while employed as a financial analyst at Chevron. Immediately, thereafter, he worked on a series of consulting assignments for Minerals Management Services over nearly five years evaluating the technical and economic feasibility of developing discovered oil and gas reserves in Arctic Alaska and Deepwater Pacific OCS.

Regulatory takings economics is a subspecialty that rests upon his financial expertise. Dr. Wade has written nine law journal articles and testified in several takings cases.

**Key Qualifications: Water and Natural Resources**

Dr. Wade specializes in issues related to environmental resources and water policy working with executives, lawyers, engineers and scientists on multi-discipline regulation, litigation, and planning projects. He has 30 years experience managing and conducting financial and economic evaluations of policies and decisions bearing on natural resources and infrastructure. Since 1986 he has conducted dozens of studies on various aspects of water supply problems, including tradeoffs between protection of instream fisheries, habitat and recreation values versus consumptive use and residential reliability values. In recent years, Dr. Wade has worked on significant natural resource policy issues related to multiple uses of several watersheds:

* Sacramento-San Joaquin Delta, California;
* ACT/ACF, GA-FL-AL;
* Tennessee Valley
* Harpeth River
* Duck River
* Buffalo River
* Piney River
* Republican River, Nebraska;
* Memphis Sands Reservoir;
* Missouri River, Upper Midwest.

Dr. Wade worked throughout much of 2002-2003 on TVA’s Reservoir Operations Study, conducting the economic analysis of alternative operations. From 1998 – 2001, he worked on issues related to the ACF/ACT Water Supply disagreement developing NED and RED benefit estimates for Atlanta water supply reliability and Lake Lanier recreation usage. From 1995 to 1999 he led a team of economists forecasting visitation and evaluating amenity options to implement the recreation master plan for Diamond Valley Reservoir, Riverside County, California. In California, he presented testimony at SWRCB Bay-Delta Hearings on supply shortage costs before CPUC and CA Legislative Committee on water rates to induce conservation by private water agencies, and presented information on drought impacts to California economy to Associated California Water Agencies Drought Hearings, and other forums. Other water agency clients include: TVA, Bay Area Water Supply & Conservation Association, State of Nebraska DNR, State of Mississippi, Santa Clara Valley Water District, California Urban Water Agencies, California Water Association, Los Angeles Department of Water and Power, USBR, CDWR, Army Corps of Engineers, Duck River Development Agency and Harpeth River Watershed Association.

**Recent & Selected Energy Publications & Reports:**

* “The Keystone XL Pipeline: REMI Estimates of Economic Impacts from Construction and Operations based on the Keystone Record,” 2012.
* “Evaluation of Parish economic damages related to BP oil spill,” 2012.
* “Evaluation of Nashville Gas Supply Plan with reference to MGT Eastern Extension,” FERC 2006.
* “Evaluation of Alternatives to MGT’s Eastern Extension Pipeline thru Tennessee,” 2005.
* "Selection of Discount Rates for MMS Evaluation of Lease Sale Bids," Draft Article, 2004.
* "Economic Valuation of Deepwater Gulf of Mexico Lease Prospect," 2003.
* “Survey of Panhandle Florida Coast Industries affected by Offshore Oil & Gas Activities,” 2003.
* "Regional Economic Analysis of Alternative Operating Regimes to enhance power supply, navigation, recreation and flood control: **TVA Re- Operations Study**," 2003.
* “Estimating Costs of Environmental Externalities related to MMS Five-Year Lease Sale Plan, 2002 – 2007,” 2001.
* “Evaluation of Application for Royalty Suspension in Deep Water Gulf of Mexico,” 2000.
* “Market Power of SFPP Oil Products Pipeline in California,” Testimony at CPUC, October, 2000.
* “Potential Gulf of Mexico Gas Supply Forecast,” 1999.
* “Regional Economic Effects of Coastal Alabama and Destin Dome Offshore Natural Gas Exploration, Development, and Production (Draft),” 1999.
* “Research and Modeling Challenges to Estimate Regional Economic Effects of Coastal Alabama Exploration and Development,” 1998.
* “Effects of Oil and Gas Support Industries on Florida and Panhandle Economy,” 1998.
* “History of Coastal Alabama Natural Gas Exploration and Development,” 1998.
* “Case Study of Coastal Alabama Mutual Use of Resources: Gas, Tourism and

 Fisheries,” 1997.

* “Regional Supply and Economic Effects of Mobile Bay and Florida Destin Dome Norphlet Gas Development and Production,” 1994, 1996, 1998.
* “California CARB Gas Phase-in Price Spike: Refinery Collusion or Market Effects,” Oil and Gas Journal, January 5, 1998.
* “(Draft) Rebuttal Testimony on SFPP Market Power,” ARCO, Mobil and Texaco v. SFPP, 1997.
* “Mobil Bay Gas Enjoying Banner Year Despite Production Problems,” Oil and Gas Journal, November 10, 1997.
* “Effects of Royalty Rate Reductions and Alternative Tax Regimes on California Onshore Crude Oil Production,” 1995 and 1996.
1. “Appropriate Refinery Modeling to Predict the Effects of CARB Phase II RFG Manufacture on Utility Electric Loads,” 1995.
2. “Effect of Gasoline Reformulation on Gulf Coast Refineries Electricity Loads,” 1994, 1995 and 1996.
3. “The Effect of the Btu Tax on California Petroleum Production and State of California Economy,” 1993.
4. “The Effect of the Btu Tax Exemptions on Refinery Electricity Purchase Decisions,” 1993.
5. "The Cost of Regulatory Compliance to California Petroleum Producers," 1993.
6. "Feasible Royalty Rates for California Offshore Producers,” 1992.
7. "Onshore Economic Impacts of California Offshore Production Environmental Compliance Expenditures,” 1992.
8. “Implication of Clean Air Act Amendments for Gulf Coast Refinery Electricity Loads,” 1992.
9. “Survey and Estimate of Liquid Fuel Conversion Potential to Natural Gas in Southern California,” 1992.
10. “Evaluation of Four Corners Pipeline Conversion to Natural Gas,” 1990.
11. “Gulf Coast Petroleum Refinery Conversion Requirements to Meet the 1990's Crude Slate,” 1990.
12. “Southern California Natural Gas Demand and Pipeline Requirements,” Testimony to CPUC, 1989.
13. “Pipeline Requirements To Serve Southern California,” 1989.
14. “Effect on Gas Prices of Fuel Oil Phase out in Southern California,” 1988.
15. “Ample Low Cost Gas Supply Seen For West Coast,” Oil & Gas Journal, July 25, 1988.
16. “Natural Gas Concepts for the Deregulated West Coast Gas Market,” 1988.

**Recent Resource Economics Publications & Reports:**

# Environmental Values and Trade-offs

* Water supply chemical contamination, Northeast US, ongoing consultant to Defendant.
* Re-evaluation of IWRP for Franklin TN water supply plan, ongoing.
* Regulatory Takings, Texas Groundwater and the *Edwards Aquifer Authority v. Day* decision, presentation to Austin TX Eminent Domain Super Conference, February 11, 2013.
* “Temporary Takings, Tahoe Sierra and The Denominator Problem,” 43 *Environmental Law Reporter* 10189, February 2013.
* “Evaluation of San Diego groundwater contamination damages,” lawsuit-representing defendant, summary judgment for defendant dropping water loss damages, December 2012.
* “Evaluation of values for Tampa Bay Water reservoir storage for M&I use,” lawsuit-representing defendant: Plaintiff’s damages dropped based on my testimony and analysis, 2011.
* “Review and Analysis of Duck River Water Supply Plan, 2010, 2011, 2012 & 2013.”
* “Reevaluation of Duck River watershed water demand forecast,” 2011 & 2013.
* “Estimated values of lost government revenues in Coastal Louisiana,” 2011.
* “Reevaluation of Duck River watershed water demand forecast,” 2011.
* “Review of and Analysis of Duck River Water Supply Plan, 2010.”
* “Valuation of contaminated groundwater supplies for residential use,” 2010.
* “Valuation of contaminated groundwater supplies for residential use,” (lawsuit representing plaintiff: decision for the plaintiff, award $9.0 million) 2009.
* “Regional Economic Impacts of large multi-use commercial, retail, residential development in Metro Nashville,” 2009.
* “Regional Economic Impacts of Nissan Corporate Headquarters relocation to Metro Nashville,” 2008.
* “Valuation of deficit irrigation due to water shortage,” 2008.
* “Valuation of Mississippi-owned groundwater used in MLGW service area,” 2008.
* “SB 3 - Environmental Flows Protection Requires Balancing with all Water Use Values at Stake,” Presentation to Texas Water Summit, San Antonio, December 3, 2007.
* “Evaluation of water supply alternatives contrasting M&I supply reliability and instream flow values at risk,” 2007.
* “Demand estimation in view of heterogeneous water agency residential user profiles,” 2007.
* “Demand estimation in view of heterogeneous water agency residential user profiles,” 2007.
* “Time series demand modeling of City of Memphis residential and commercial end user classes,” June 2007.
* “Final Critique of Engineering Economics and Financial Feasibility of City of Franklin Proposed Water Treatment Plant,” June 2007.
* “Evaluation of anticipated economic impacts of 2007 Drought-Induced Water Shortages in the San Francisco Bay Area,” ongoing.
* “Evaluation of Practicable Alternatives to Harpeth River Water Supply,” presentation to TNAWRA Water Resource Symposium, April, 2007.
* “Economic Criteria for Regional Water Supply Planning in Tennessee,” April, 2007.
* “Water Supply Planning for City of Franklin: Comparison of Expanded Water Supply Plant v. Instream Flow Values for Wastewater Dilution and other Resource Values,” October 2006.
* “Evaluation of water supply alternatives to meet City of Franklin future demand,” August 2006.
* “Estimation of indoor and outdoor water demand, price elasticities and estimated future water use for alternative rate structures, Western U.S.” ongoing.
* “Valuation of contaminated groundwater supplies for residential use,” ongoing.
* “ARAP and the economics of Piney River Supply Planning,” presentation to TNAWRA Water Resource Symposium, April, 2006.
* “Effect of increasing Hispanic population on California outdoor recreation preferences and facility needs,” 2006.
* “Evaluation of Environmental Benefits of Hetch Hetchy Dam Removal,” 2006.
* “Achieving Reliability and Sustainability in Water Supply Planning,” California Law and Water Policy Reporter, October 2005.
* “Evaluation of Water Supply Alternatives to serve rural Hickman County,” 2005.
* Lake Lanier National Economic Development Update: Water Supply, Hydropower & Recreation Benefits, Final, 2004.
* "Evaluation of Missouri River Master Water Control Plan," 2003.
* "Effect of Water Supply Allocations on Value of Republican River Watershed Agricultural Production," 2002 & 2003.
* "Policy Evaluation of Natural Resource Injuries Using Habitat Equivalency Analysis," presented (by co-author Brian Roach) at the U.S. Society for Ecological Economics Conference, Saratoga Springs, NY, May, 2003.
* "Economic Analysis of TVA Alternative Operating Regimes to enhance power supply, navigation, recreation and flood control: Reservoir Re-Operations Study," 2002-2003.
* "Franklin fails to see tourism dollars in battlefield site," 2002.
* "Spring Hill Land Use Planning Needs a Vision," 2001.
* "Economic Benefits and Minimum Instream Flows for Recreational Boating," 2001.
* "Recreation Values at Risk to Water Delivery Shortfalls,” 2001.
* "Predicted Recreation Visitation to Sacramento-San Joaquin Delta for Boating and Fishing,” 2001.
* *“*Atlanta MetroReliability Values for Least Cost Water Supply Planning,” 2000 - 2001.
* “Economic Shortcomings of *ACF EIS Water Supply, Recreation & Regional Impacts Appendices*,” Atlanta Regional Commission, 1999.
1. “Environmental Damages Related to Gulf of Mexico Coastal Sediment Contamination,” confidential litigation, 1995.
2. “The Role of Economics in Regulatory Takings Cases,” Litigation Economics Digest, 1,1, (Fall, 1995).
3. “Economic Considerations of Regulatory Takings Reform: Judicial Precedent and Administrative Law v. Legislative Intent,” BNA, Environmental Reporter, August 4, 1995.
4. “The Role of the Economist in a Regulatory Taking Claim,” California Land Use Law and Policy Reporter, March, 1995.
5. “Environmental Damages Related to Groundwater Contamination,” confidential litigation, 1994.
6. “Colorado River Critical Habitat Studies: Environmental Benefits v. Consumptive Losses,” 1994.
7. “Approach to Incorporate Existence and Option Values for Southwestern Native American Water Rights,” 1992 - 1994.
8. “Critique of Mono Lake Contingent Valuation Survey,” December 1993. Testified at SWRCB Dec. 1993.
9. “Natural Resource Damage Assessment: A Path Through the Pitfalls of Evolving Regulations,” Contemporary Studies in Financial Analysis, Vol. 74, ed. Thronton, R. and Aronson, R.J., Jai Press, New York, New York, 1993.
10. “Recreation Forecasts and Benefit Estimates for California Reservoirs: Recalibrating the California Travel Cost Travel,” 1991.
11. “Potential Freshwater Recreation Demand Forecast by California County - 1990 to 2035,” 1990.
12. “Recreation Benefits for California Reservoirs: A Multisite Facilities-Augmented Gravity Travel Cost Models,” April, 1989.
13. “Estimating Instream Flow Recreation Benefits on the American and Sacramento Rivers,” 1988.
14. “Trends in Fresh Water Recreation Demand in Southern California,” 1988.
15. “Critique of Contingent Valuation Studies Related to Bay Delta,” State Water Contractors Exhibit 90, 1987.
16. “Economic Evaluation of the Recreation Resources of California's State Water Project and the Sacramento-San Joaquin Delta,” State Water Contractors Exhibits 64 and 66, June and September 1987.
17. “Methods to Value Benefits to Natural Resources Associated with Bay-Delta Water Diversions,” 1987.

***Water Supply Planning and Reliability Valuation***

* “Evaluation of groundwater contamination damages,” lawsuit-ongoing.
* “Evaluation of values for reservoir storage for M&I use;” Plaintiff-claimed damages disallowed based on my testimony for defendant, 2011.
* “Review of and Analysis of Duck River Water Supply Plan, 2010.”
* “A Tale of Two Circuits:  *Penn Central’s* Ad Hocery Yields Inconsistent Takings Decisions,” forthcoming 42 The Urban Lawyer, summer 2010.
* “Federal Circuit’s Economic Failings Undo the *Penn Central* Test,” 40 Environmental Law Reporter 10914, September 2010.
* “Temporal Posture and Discount Rates for Groundwater Contamination Damages,” 40 Environmental Law Reporter 10262, March 2010.
* “Evaluation of Demand Forecast for Duck River Water Supply Plan,” March 2010.
* “Valuation of Mississippi-owned groundwater used in MLGW service area,” lawsuit-2009.
* “Valuation of contaminated groundwater supplies for residential use,” (lawsuit: decision for the plaintiff, award $9.0 million) 2009.
* “Regional Economic Impacts of large multi-use commercial, retail, residential development in Metro Nashville,” 2009.
* “Valuation of deficit irrigation due to water shortage,” confidential litigation, 2008.
* “Valuation of Water Supplies in Eastern Watershed Conflicts and Planning,” Eastern Water Law and Policy Reporter, v. 3, no. 8, August/September 2008.
	+ “SB 3 - Environmental Flows Protection Requires Balancing with all Water Use Values at Stake,” Presentation to Texas Water Summit, San Antonio, December 3, 2007.
* “Evaluation of water supply alternatives to meet City of Franklin future demand,” 2008-2009.
* “Estimation of indoor and outdoor water demand, price elasticities and estimated future water use for alternative rate structures,” 2008-2009.
* “Effect of $billion infrastructure capital investment on long run water demand,” ongoing.
* “ARAP and the economics of Piney River Supply Planning,” presentation to TNAWRA Water Resource Symposium, 2006.
* “Evaluation of Effect of SFPUC Water Supply Improvement Plan on San Francisco Bay Area Water Supply Reliability,” 2005.
* “Achieving Reliability and Sustainability in Water Supply Planning,” California Law and Water Policy Reporter, October 2005.
* “Evaluation of Piney River Economic Alternatives to Meet Water District Demand,” 2005.
* "Lake Lanier National Economic Development Update: Evaluation of Water Supply, Hydropower and Recreation Benefits,"*Final Draft, 2004.*
* "Evaluation of Missouri River Master Water Control Plan," 2004.
* "Economic Benefits of Municipal and Industrial Water Supply Reliability for Metropolitan Atlanta," Draft paper, May 2003.
* "Comparison of Irrigated Agricultural Economics Research Dealing with

Crop Water Use," 2002; revised 2003.

* "Economic Analysis of TVA Alternative Operating Regimes to enhance power supply, navigation, recreation and flood control: Reservoir Re-Operations Study," 2002-2003.
* "Effect of Water Supply Cutbacks of Midwest Irrigated Agriculture," 2002-2003.
* "IRP Approach To Water Supply Alternatives for Duck River Watershed,"

presentation at Tennessee AWRA Conference, April 2002.

* "Evaluation of Duck River Watershed Water Supply Alternatives," 2001.
* "Recreation Values for Lake Lanier water levels," 2001*.*
* “Metro Atlanta Water Supply Reliability Values,” 2001.
* “M&I Values at Risk to Water Supply Delivery Shortfalls,” 2000-1.

#### “Least Cost Water Supply Reliability Planning,” Tennessee Water Resources Symposium, April 2001.

* “Least Cost Water Supply Planning,” 2000-1.
1. “Water Supply Planning in the Duck River Watershed After the Fleecing,” TN Water Resources Symposium, April 2000.
2. “*Penn Central’s* Economic Failings Confounded Takings Jurisprudence,” The Urban Lawyer, spring 1999.
3. “Forecasting & Evaluating Reservoir Recreation Financial Feasibility and Regional Economic effects,” 1994 - 1999.
4. “Economic Considerations of Regulatory Takings*,”* Presentation, *Restructuring in California: The Morning After*, Law Seminars International Conference, Sacramento, CA, September 1998.
5. “California Water Supplies: Problem Solving through the 20th Century,” Presentation, Southeast Water Resources: Management and Supply Conference, Chattanooga, Tennessee, August 1998.
6. “Planning for Revenue Positive Freshwater-Related Recreation Projects,” Presentation, American Water Resources Association Annual Conference, Mobile, AL, 1998.
7. “Problems with Bay-Delta Recreation Visitation Estimates—Revisited,” 1998.
8. “Estimating Potential Demand for Freshwater Recreation Activities, Southern California: 1997-2020,” 1998.
9. “Freshwater Recreation Demand Forecasting in Southern California,” 1996 - 1999.
10. “Evaluation of Private/Public Alternatives for Municipal Reservoir Recreation Planning,” 1997.
11. “Financial Feasibility of Bass Fishery Enhancement in Southern California,” 1997.
12. “Economic Impacts, The *Bennett* Decision and Investment-Backed Expectations,” California Land Use Law Reporter, July 1997.
13. “Evaluation of Recreation Revenue Shortfalls at Lake Skinner,” 1996.
14. “Status of Efforts to Resolve California's Water Problems,” 1995.
15. “Economic Considerations of Regulatory Takings Reform: Judicial Precedent and Administrative Law v. Legislative Intent,” BNA Environmental Reporter, August 4, 1995.
16. “The Role of Economics in Regulatory Takings Cases,” with Robert Trout, Litigation Economics Digest, 1, 1, Fall 1995.
17. “California's Dual Water Crises: Add Fish and Feds and Shake Thoroughly,” California Water Law and Policy Reporter, March 1994.
18. “Economic Costs of EPA Bay Delta Water Quality Standards,” Presentation to California Water Resource Agencies, March 1994.
19. “California Water Supplies in the 1990's: Add Fish and Feds and Shake Thoroughly—or, The Increasing Unreliability of Consumer Supplies in the Environmental Age,” Presentation to Conference of California Public Utility Counsel, November 1993.
20. “Water Supply Planning Simulation and Estimated Shortage Costs Related to Mono Lake Diversion Alternatives,” August 1993. Testimony before SWRCB November, 1993.
21. “The Economic Effects of Implementing the Central Valley Project Improvement Act,” California Water Reporter, February, 1993.
22. “Water Supply Reliability Epochs: Revenue Instability for Retail Water Utilities,” Testimony to CPUC, November 1992.
23. “Drought Impacts on California Green Industries,” January, 1992; Submitted to SWRCB as State Water Contractors Exhibit 20, June, 1992.
24. Presentation to California Legislature, Assembly Utilities and Commerce Committee, “Investor Owned Water Utilities: Rates, Reliability, Regulation,” February 1992.
25. “Financial Impacts of Decreasing Wholesale Water Supply Reliability on Class A Water Utilities,” 1992.
26. Cost of Industrial Water Shortages, November, 1991.
27. “The Cost of Water Shortages: Case Study of Santa Barbara,” 1991.
28. “Planning for Reliability for California's Urban Water Agencies,” 1991.
29. “Impacts of Drought on California Economy, Testimony to ACWA Drought Conference,” October, 1990.
30. “Financial Partnerships to Assure Conservation's Role in California Water Supply Resource Planning,” Testimony to CPUC, June 1989.

**Education**:

Ph.D., Resource and Applied Economics, University of Minnesota

M.S., Agricultural Economics, University of Minnesota

B.S., English/Journalism, Spring Hill College

**Professional Activities**:

Treasurer, TN AWRA, 1999; Former Member of Economic Advisory Council, California Chamber of Commerce; Past President of San Francisco Chapter of National Association of Business Economists; American Economics Association; American Agricultural Economics Association; Association of Environmental and Resource Economics.

**Honors:**

Award for Professional Excellence for Quality of Published Research, 1979; (with others) American Agricultural Economics Association.