KAYRENE BROTHERS
529 EAST FAIRWAY ROAD
HENDERSON, NEVADA 89015
(702) 564-4872

EXPERIENCE:

4/02 – present **SOUTHERN NEVADA WATER AUTHORITY**
Deputy General Manager – Engineering and Operations, Las Vegas, NV

Overseeing the three SNWA Engineering and Operations Departments: Resources Department, Engineering Department and the Southern Nevada Water System. These departments are responsible for managing existing and acquiring future water resources, constructing necessary regional facilities, and treating and transmitting regional water supplies such as Colorado River water from Lake Mead.

8/95 – 4/02 **SOUTHERN NEVADA WATER AUTHORITY**
Director of Resources, Las Vegas, NV

Managing the Resource Department, which includes two technical Divisions: Resource Planning and Environmental Planning. The Resources Department is responsible for the assessment and evaluation of all regional water resources issues, including Colorado River water. The department, which encompasses over 30 professional staff, is active in hydrologic research, managing existing ground-water resources, and evaluating future ground- and surface water resources and the potential environmental impact resulting from development of these resources for the SNWA and District. The department is responsible for evaluating the hydrologic resources and environmental systems of the Colorado, Muddy and Virgin Rivers as well as other environmental, hydrologic, and resource issues for the SNWA as well as the District.

8/94 – 8/95 **CONSULTING HYDROLOGIST**
Las Vegas, NV

Consulting hydrologist specializing in computer modeling of ground- and surface water systems. Also a principal in Basic Concept Hydrologic (BCH) a firm which offers many hydrologic services including basic data collection, geochemical computer modeling, water quality sampling and evaluation of chemical analyses, as well as artificial recharge project management.

6/86 - 8/94 **LAS VEGAS VALLEY WATER DISTRICT**
Sr. Hydrologist, Las Vegas, NV

Supervised hydrologists and GIS technicians working on the development of ground- and surface-water resources in eastern and central Nevada, known as the Cooperative Water Project (CWP). Helped integrate various databases for the CWP including Landsat TM data, land use, digital elevations, and water rights through use of *AutoCAD*, *ERDAS*, and *ARCInfo* software. Developed a regional ground-water flow model using the USGS MODFLOW program, which encompasses 90 hydrographic basins to simulated potential impacts from proposed ground-water withdrawals. Developed computer models for individual ground-water basins and co-authored reports regarding these basins. Helped develop artificial recharge projects where treated Colorado River water is injected into the Las Vegas Valley principal aquifer and stored to meet future water demands.

10/84 - 6/86 **CLARK COUNTY DEPARTMENT OF COMPREHENSIVE PLANNING**
Principal Planner, Las Vegas, NV

Conducted flood control studies for areas of the County, using various computer models including TR-20, HEC-1, HEC-2, and FEMA FANS (for assessment of alluvial fans). Reviewed and prepared comments on DOE documents relating to siting a high level nuclear waste repository. Assessed various projects and their potential impacts on the Clark County 208 Plan and amended as necessary.

1/80 - 10/84 **KERR - McGEE CORPORATION**
Environmental Engineering Coordinator and Quality Control Supervisor

Henderson, NV: Supervised the operation of the on-site analytical laboratory which monitors process operating parameters as well as final quality for products such as ammonium perchlorate (oxidizer for the space shuttle), manganese dioxide, and boron. Established an extensive ground-water monitoring network for evaluating ground-water contamination migration and developed a ground-water mitigation program. Closed hazardous waste landfills and petitioned for delisting/decontaminating hazardous waste storage sites.

Oklahoma City, OK: Assessed impacts of various hazardous waste treatment / storage / disposal (TSD) facilities on ground water and obtained necessary RCRA permits for TSD facilities. Designed wastewater treatment and hazardous waste TSD facilities. Testified in public hearings regarding new environmental regulations.

6/77 - 10/80 **PHILLIPS PETROLEUM COMPANY**
Environmental Engineer

Albuquerque, NM: Reviewed and commented on environmental legislation and regulations relating to the uranium industry. Prepared permit and license applications. Designed and selected pollution control facilities.

Bartlesville, OK: Developed environmental process designs for petroleum refineries and petrochemical plants. Obtained NPDES permits for facilities and reviewed and commented on new environmental regulations impacting petroleum refineries and petrochemical plants.

EDUCATION:

B.S. Environmental Engineering, New Mexico Institute of Mining and Technology
May 1977. Graduated in top 5% of Class - Designated Tech Scholar

REFERENCES:

Terry L. Katzer, Consulting Hydrologist
Cordillerian Hydrologic, Inc.
(702) 853-7409

Patricia Mulroy, General Manager
Southern Nevada Water Authority
(702) 258-3104

David A. Donnelly

BIBLIOGRAPHY:

Katzer, Terry, Brothers, Kay, and Dixon, Gary, 1987, **The quest for ground water in an arid environment**: Geological Society of America, Cordilleran Section, Abstracts with program, V.20, No. 3, p. 172

Brothers, Kay, and Katzer, Terry, 1988, **Artificial recharge through public supply wells, Las Vegas Valley, Clark County, Nevada**: International Symposium on Class V Injection Well Technology, September 13-15, 1988, Las Vegas, Nevada

Brothers, Kay, and Katzer, Terry, 1988, **Ground-water chemistry changes resulting from stressed aquifer systems in Las Vegas Valley, Clark County, Nevada**: Nevada Department of Conservation and Natural Resources, (in press), 66 p.

Katzer, Terry, and Brothers, Kay, 1988, **Water conservation, myth or mandate, an arid southwest perspective**: American Water Resources Association, Proceedings of the Symposium on Water Data for Water Resource Management, Tucson, Arizona, August 1988, pp 273-281

Katzer, Terry, and Brothers, Kay, 1989, **Artificial recharge in Las Vegas Valley, Clark County, Nevada**: Journal of Ground Water, January-February, 1989, p. 50-56

Brothers, K., and Katzer, T., 1989, **Artificial recharge for peak water demands in Las Vegas Valley, Clark County, Nevada**: Proceedings of the 4th Symposium on Artificial Recharge of Groundwater in Arizona, May 23-24, 1989

Katzer, T., and Brothers, K., 1989, **Perils of progress -- hydrogeological hazards in Las Vegas Valley, Clark County, Nevada**: Proceedings of the American Water Resources Association Arizona Section, Volume 19

Katzer, T., and Brothers, K., 1990, **Moving toward the millennium**: Proceedings of the Symposium on Hydraulics/Hydrology of Arid Lands -- Int'l. Symposium HY & IR Div./ASCE, San Diego, CA/July 30-August 2, 1990, pp. 124-130

Brothers, K., and Katzer, T., 1990, **Water banking through artificial recharge, Las Vegas Valley, Clark County, Nevada**: Journal of Hydrology, 115 (1990) 77-103, Elsevier Science Publishers B.V., Amsterdam--Printed in the Netherlands

Brothers, K., Johnson, M, and Morris, T., 1990, **Hydraulics of artificial recharge through existing production wells, Las Vegas Valley, Clark County, Nevada**: Proceedings in the Third Annual Symposium-Arizona Hydrological Society "Survival in the Desert: Water Quality and Quantity Issues Into the 21st Century", pp. 191-199

Katzer, T., Brothers, K., Johnson, M., Morris, T., and Bernholtz, A., 1991, **Design and evaluation joint-use wells for water supply and artificial recharge in Las Vegas Valley, Clark County, Nevada**: Presented at AWWA Exposition, Philadelphia, PA, June 24-28, 1991

Bernholtz, A., Brothers, K., and Katzer, T., 1991, **Analyses of aquifer responses due to continued artificial recharge of treated Colorado River water, Las Vegas Valley, Clark County, Nevada**: Presented at the AIH Annual Meeting "Hydrology & Hydrogeology in the 90s", November 3-7, 1991, Orlando, Florida

Katzer, Terry, Brothers, Kay, Johnson, Michael, Bernholtz, Alan, Morris, Tom, and Monaco, Janet, 1992, Maximizing **earth and computer science disciplines for a regional water resource investigation in eastern and southern Nevada**: American Institute of Hydrology Proceedings, Portland, Oregon, October 16-22, 1992.

Katzer, Terry, and Brothers, Kay, 1992, **Meeting the urban water demands in Nevada, the Las Vegas proposal**: Proceedings of the Rocky Mountain Ground-Water Conference, June 15-17, 1992, Boulder, Colorado.

Johnson, M.E., Brothers, K., and Katzer, T.L., 1992, **The ultimate water witch: LANDSAT digital imagery of eastern and southern, Nevada**: AWRA 28th Annual Conference Abstract Proceedings, p. 18

Bernholtz, Alan and Brothers, Kay, 1993, **Changing Colorado River quality and its impact on artificial recharge in Las Vegas Valley, Nevada**: Sixth Biennial Symposium on Artificial Recharge of Groundwater Symposium Proceedings, p. 161-170

Miller, C.J., Wilson, L.G., Amy, G.L., and Brothers, Kay, 1993, **Fate of organochlorine Compounds During Aquifer Storage and Recovery: The Las Vegas experience**: Journal of Ground Water, Vol. 31, No. 3, May-June 1993, pp. 410-416

Brothers, Kay, Bernholtz, Alan, and Katzer, Terry, 1994, **Artificial ground-water recharge in Las Vegas Valley, Clark County, Nevada: Model Prediction - "No Cone of Depression Here"**: Published in the Proceedings of the Second International Symposium on Artificial Recharge of Ground Water, July 17-22, 1994 (Orlando, Florida)

Bernholtz, Alan, Brothers, Kay, and Katzer, Terry, **1994, Artificial ground-water recharge in Las Vegas Valley, Clark County, Nevada: Storing Today, Treating Tomorrow?**: Published in the Proceedings of the Second International Symposium on Artificial Recharge of Ground Water, July 17-22, 1994 (Orlando, Florida)

Cooperative Water Project Series

Brothers, K., Tracy, J., Katzer, T., Stock, M. Bentley, C., Zdon, A., and Kepper, J., 1992, **Hydrology and interactive computer modelling of ground and surface water in the Lower Virgin River Valley, primarily in Clark County, Nevada**: Las Vegas Valley Water District, Cooperative Water Project, Series Report No. 1, 90 p.

Woodward-Clyde Consultants, Dames and Moore, and the Las Vegas Valley Water District, 1992, **Environmental report of the Virgin River water resource development project, Clark County, Nevada**: Las Vegas Valley Water District, Cooperative Water Project, Series Report No. 2, 130 p.

Brothers, K., Buqo, T., and Tracy, J., 1993, **Hydrology and steady state ground-water model of Coal and Garden Valleys, Lincoln and Nye Counties, Nevada**: Las Vegas Valley Water District, Cooperative Water Project, Series Report No. 8, 52 p.

Brothers, K., Buqo, T., and Tracy, J., 1993, **Hydrology and steady state ground-water model of Snake Valley, East-Central Nevada, and West-Central Utah**: Las Vegas Valley Water District, Cooperative Water Project, Series Report No. 9, 66 p.

Brothers, K., Katzer, T., Mojib, R.M., Grinnell, G., Bernholtz, A., and Johnson, M., 1993, **Addendum to hydrology and interactive computer modelling of ground and surface water in the Lower Virgin River Valley, primarily in Clark County, Nevada**: Las Vegas Valley Water District, Cooperative Water Project, Series Report No. 1-A, 35 p.

Brothers, K., Buqo, T.S., Tracy, J., Kaufmann, R.F., Stock, M., Bently, C., Zdon, A., and Kepper, J., 1993, Hydrology **and steady state ground-water model of Cave Valley, Lincoln and White Pine Counties, Nevada**: Las Vegas Valley Water District, Cooperative Water Project, Series Report No.11, 48p.

Brothers, K., Buqo, T., Bernholtz A., and Tracy, J., 1994, **Hydrology and steady state ground-water model of Spring Valley, Lincoln and White Pine Counties, Nevada**: Las Vegas Valley Water District, Cooperative Water Project, Series Report No. 13, 69 p.

Broadbent, R.C., Katzer, T., and Brothers, K., 1995, **Mountain front runoff and ground-water recharge in east central Nevada**: Las Vegas Valley Water District, Cooperative Water Project, Series Report No. 17, 16p

Brothers, K., Katzer, T., and Johnson, M., 1996, Hydrology **and steady state ground-water model of Dry Lake and Delemar Valleys, Lincoln County, Nevada**: Las Vegas Valley Water District, Cooperative Water Project, Series Report No. 16,48 p.

Kenneth A. Albright
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Las Vegas, Nevada 89121
(702) 458-1152 (H) – (702) 862-3775 (W)

PROFESSIONAL EXPERIENCE

November 2002 to Present — **Director, Groundwater Resources Department, Southern Nevada Water Authority**

My current position with the Southern Nevada Water Authority is as the Director of the Resources Department, and I report to the Deputy General Manager of Engineering/Operations.

My departmental responsibilities include directing a multi-disciplinary team of staff, and consultants to ensure stewardship of regional issues including water resource acquisition, environmental compliance, ground-water acquisition and management, and conservation. Of key importance to carrying out these responsibilities is the need to foster both teamwork and understanding of all issues to ensure the long-term needs of stakeholders can be met.

April 2000 to November 2002 — **Director, Parks and Recreation, City of North Las Vegas, Nevada, Department of Parks and Recreation**

Reporting directly to the Assistant City Manager, responsibilities include the implementation of open space planning, the provision of diverse recreational programming, enhancement of cultural resources for the City, and maintenance of all City parks, open spaces, and landscape medians in concert with City and Department Goals. Daily provinces centered on managing a work force in excess of 100 full-time equivalent employees, fourteen separate budget totaling more than $20 million in operations and capital expenditures, and the responsibility of providing for the recreation and leisure needs of approximately 1,000,000 individual recreation days annually.

Within the purview of this position included daily interface with elected and appointed officials to ensure the coordinated efforts of myself, my staff, and the staff of the various other departments to help ensure quality, responsive government.

May 1996 to April 2000 — **Assistant Director of Public Works, City of North Las Vegas, Nevada, Department of Public Works**

Reporting directly to the Director of Public Works, responsibilities including managing, coordinating and directing staff and the activities of the Resources and Environmental Division, Maintenance Operations Division, Building Maintenance Division, Street Maintenance Division, and the Parks Maintenance Division. Total workforce included approximately 115 employees and operating budgets of $45 million. Other responsibilities included: negotiating interstate and interagency issues involving utility infrastructure planning and construction, water supply and wastewater agreements; addressing environmental concerns involving air and storm water

quality, and the Endangered Species Act; and carrying out the duties as Acting Department Director, when needed.

Accomplishments included 1) orchestrating the implementation of the City's water and wastewater utility expansion to encompass redundancies and capacity increases, which have supported the exponential growth rate of the City, and allow for uninterrupted utility service to the community; and, 2) realigning all maintenance facilities and functions which resulted in a greater availability of equipment and manpower to meet the overall needs of the City, and increase the ability to meet the specialized needs of each Division. This effort realized cost savings through non-duplication of manpower and equipment, and increased response time, as well as quality of overall maintenance.

January 1991 To May 1996
Administrator, Resource and Environmental Division
City of North Las Vegas, Nevada
Department of Public Works

Reporting directly to the Director of Public Works, administrative duties for these two distinct activities including directing long range utility planning, monitoring all business activities related to wastewater flow and characteristics, and acting as the City liaison to the Southern Nevada Water Authority.

Accomplishments included 1) facilitating the formation of the Southern Nevada Water Authority. As a result of the formation of this agency, southern Nevada's long-term water resources are being addressed and met in a unified manner; and 2) initiating the advancement of the City's water commitment process which effectively removed land speculators from the process, thereby affirming development without placing an undue burden on resource allocations.

March 1989 to January 1991
Civil Engineer
Las Vegas Valley Water District
Resources Department / Planning Division

May 1988 to March 1989
Civil Engineer III
Division of Water Resources / Planning Bureau
Illinois Department of Transportation, Springfield, Illinois

September 1985 to May 1988
Civil Engineer II
Division of Water Resources / Planning Bureau
Illinois Department of Transportation, Springfield, Illinois

February 1984 to September 1985
Civil Engineer I
Division of Water Resources / Resource Management Bureau
Illinois Department of Transportation, Springfield, Illinois

EDUCATION

University of Minnesota, Bachelor of Science, Civil Engineering, 1983.

LICENCES

Registered Professional Engineer
Nevada License #8487 (1989)
Illinois License #44928 (1988)

PROFESSIONAL ASSOCIATIONS AND REPRESENTATIONS

Colorado River Water Users Association
Director

National Water Resources Association
Director

American Public Works Association
Member

University of Nevada, Las Vegas
Civil and Environmental Engineering Advisory Board
Member

REFERENCES

E. James Gans
Vice President
Administrative Operations
Las Vegas Convention and Visitors Authority
(702) 892-2925

Doug Selby
City Manager
City of Las Vegas
(702) 229-6501

James Howard
Business & Finance Coordinator
Clark County School District
(702) 799-5452 ext. 310

James Start
State Audit Supervisor
Unclaimed Property Division
Treasurer's Office / State of Nevada
(702) 486-4041

ANDREW G. BURNS
1900 E. Flamingo, Ste. 180
Las Vegas, Nevada 89119

EDUCATION: University of Arizona, Tucson, AZ.
Degree: B.S., College of Engineering and Mines (1992)
Major: Hydrology

PROFESSIONAL EXPERIENCE:

1999 to Present; Southern Nevada Water Authority
Provide technical expertise related to water-resource investigations, groundwater and surface-water studies, streamflow routing, groundwater flow models, water resource management, Colorado River operations, and hydrologic field investigations. Specific responsibilities include the following:

- Lead hydrologist on SNWA's Three Lakes Valley Groundwater Development Project. Responsible for scientific aspects of the project, including conducting water-resource investigations and water-related effects analyses, interacting with stakeholders, and preparing for and participating in water-right hearings
- Lead hydrologist on SNWA's Clark, Lincoln, and White Pine Counties Groundwater Development Project. Responsible for writing work plans, directing technical studies, technical reporting, budget expenditures and scheduling, and interfacing with cooperating agencies
- Assist in the development and documentation of a conceptual model and 3-D numerical flow model of the White River and Meadow Valley Wash regional groundwater flow systems of eastern Nevada.
- Conduct hydrologic field investigations requiring various methods of data acquisition, including water-quality sampling, stream gaging, collection of well/spring data, and use of GPS.
- Prepare annual reports in support of LVVWD/SNWA water rights; review and prepare comments to reports related to proposed federal actions concerning LVVWD/SNWA water resources and the Colorado River.
- Conduct advanced analyses of the Colorado River system to evaluate proposed policy changes related to the development of criteria used to determine water resource availability and operation of system reservoirs and diversion works.
- Represent SNWA in various interstate/local technical forums, work groups, and meetings.

1998 to 1999; Colorado River Commission, Las Vegas, Nevada
Provided technical expertise related to hydrologic modeling applications, Colorado River operations, water resource management, and water-use accounting. Reviewed and prepared comments to proposed changes to Colorado River operations, permit applications, water-diversion contracts, and federal reports to ascertain impacts to the rights and interests of Nevada. Represented the Colorado River Commission (CRC) and the State of Nevada in interstate/local technical forums, work groups, and meetings. Specific responsibilities included the following:

- Maintained Colorado River water resources inventory by administering the Las Vegas Wash – Return Flow Credit Methodology. Administered CRC general permit for waters of the Las Vegas Wash.
- Conducted advanced hydraulic and hydrologic analyses related to the quantity and quality of water resources in the Colorado River Basin.
- Consulted with representatives of local water agencies to develop management strategies that will make more effective use of Nevada's Colorado River water resources.

1993 to 1998; IT Corporation, Las Vegas, Nevada

Provided technical support for project development, data acquisition, data analysis, and reporting in support of a regional groundwater characterization/monitoring program for the Underground Test Area Project of the Department of Energy's Environmental Restoration Division (DOE/ERD). Experience includes:

1997 to 1998; Task Manager - BULLION Forced-Gradient Tracer Experiment:

Responsible for planning, coordinating, scheduling, and staffing field operations; writing, reviewing, and implementing work plans and field instructions. Designed monitoring systems, automated data collection, and developed a data management and reporting system. Instrumental in the development and implementation of a sample management application to manage and store data and information resulting from the collection and analysis of over 850 water-quality samples over a four-month period. Successfully started the experiment on schedule and completed the experiment under budget, while meeting all technical objectives.

Commendations/Awards:

IT Corporation 1997 National Quality Award (1997)
Letter of Commendation: General Manager, IT Corporation, Las Vegas (1997)

1995 to 1997; Field Supervisor – Hydrologic Monitoring and Water-Quality Sampling:

Responsible for planning, coordinating, scheduling, and staffing field operations; writing, reviewing, and implementing work plans and field instructions; documenting field activities and reporting sample results. Conducted hydraulic tests to estimate the hydraulic properties of saturated-rock units penetrated by deep (greater than 3000 feet) boreholes.

- Thorough knowledge of the design and implementation of monitoring systems to automate hydrologic data collection and storage using dataloggers and various monitoring instrumentation.
- Experienced in the development, hydraulic testing, and sampling of wells in accordance with industry standards and protocols.

Commendations/Awards:

IT Corporation Health and Safety Award (1995)

1993 – 1998; Staff Hydrologist – Data Analysis/Reporting
Assisted in the development and documentation of a 3-D conceptual model of the hydrogeology of the Nevada Test Site and vicinity. Compiled data sets for inclusion into a regional groundwater flow and transport model using GIS and 3-D software applications (Environmental Resource Management Applications; Intergraph® Workstation).

- Instrumental in the design and population of a relational database consisting of a variety of hydrologic data and information from over 2,300 hydrologic sites in support of groundwater flow and transport modeling.
- Compiled, processed, and analyzed data collected during the drilling, development, and hydraulic-testing of clean and contaminated wells, to provide a basis for making decisions regarding waste management, fluid management, health and safety, and data quality.

Commendations/Awards:
IT Corporation Contribution to Quality Award (1996)
Letter of Appreciation: Director, DOE/ERD (1996)

PROFESSIONAL AFFILIATIONS:

Colorado River Water Users Association, Active
Nevada Water Resources Association, Active

PUBLICATIONS

IT Corporation. 1996a. Groundwater Recharge and Discharge Data Documentation Package (Phase I Data Analysis Documentation, Volume III). Prepared for the U.S. Department of Energy, Nevada Operations Office. Las Vegas, NV.

IT Corporation. 1996b. Hydrologic Parameter Data Documentation Package (Phase 1 Data Analysis Documentation, Volume IV). Prepared for the U.S. Department of Energy, Nevada Operations Office. Las Vegas, NV.

IT Corporation. 1996c. Potentiometric Data Documentation Package (Phase 1 Data Analysis Documentation, Volume II). Prepared for the U.S. Department of Energy, Nevada Operations Office. Las Vegas, NV.

IT Corporation. 1996d. Regional Geologic Model Data Documentation Package (Phase 1 Data Analysis Documentation, Volume I). Prepared for the U.S. Department of Energy, Nevada Operations Office. Las Vegas, NV.

IT Corporation. 1997. Bullion Forced-Gradient Experiment Implementation Plan, Part 1 of 2, ITLV/10972-195, DOE/NV-13-52. Las Vegas, NV.

PUBLICATIONS (continued)

IT Corporation. 1998a. Report and Analysis of the BULLION Forced-Gradient Experiment, ITLV/13052-042, DOE/NV-13-52. Las Vegas, NV.

Las Vegas Valley Water District, 2001, Water Resources and Ground-Water Modeling in the White River and Meadow Valley Flow System, Clark, Lincoln, Nye and White Pine Counties, Nevada: Las Vegas Valley Water District.

Smith, D. L., Johnson J., Burns, A., et al., 2004, Climate and Barometric Pressure Influences on Pederson Spring Discharge and the Carbonate Aquifer near the Muddy Springs, Southern Nevada: Journal of the Nevada Water Resources Association, Fall 2004, volume 1, number 1, p. 76-103.

Southern Nevada Water Resource Plan, 1999, 2002, and 2004 (participating author),

Southern Nevada Water Authority, 2005, Hydrogeologic Report in Support of Southern Nevada Water Authority's Proposed Groundwater Development Project in Three Lakes Valley South, Clark County, Nevada

U.S. Department of Energy, Nevada Operations Office. 1997. Regional Groundwater Flow and Tritium Transport Modeling and Risk Assessment of the Underground Test Area, Nevada Test Site, Nevada, DOE/NV--477. Las Vegas, NV.

Selected Abstracts and Presentations

Burns, A., 2005, Hydrologic and Geologic Studies in Support of Southern Nevada Water Authority's Proposed Clark, Lincoln, and White Pine Counties Groundwater Development Project, Nevada Water Resources Association, Abstracts of Technical Presentations

Burns, A., 2004, Hydrologic Monitoring Efforts in the Southern Portion of the White River Flow System, Nevada Water Resources Association, Abstracts of Technical Presentations

Burns, A., 2002, Forecasting Colorado River Water Supply Conditions, Nevada Water Resources Association, Abstracts of Technical Presentations

Burns, A., 2001, Interim Surplus Guidelines, Nevada Water Resources Association, Abstracts of Technical Presentations

Rebecca D. Shanahan

7429 Cochise Bend Ave. (702) 220-7987
Las Vegas, Nevada 89113 rebecca.shanahan@snwa.com

EDUCATION

- **Bachelor of Science in Forest Resources**, majored in Forest Environmental Resources with emphasis in Environmental Assessment, University of Georgia. Athens, Georgia, May, 1999. Senior thesis focused on a water quality assessment and monitoring plan for two perennial streams in the State Botanical Gardens of Georgia.
- The School for Field Studies, Boston University, Center for Coastal Studies, Bamfield, British Columbia, Canada, Summer 1998. As a summer student, explored the concept of ecosystem-based management through fieldwork exercises. Directed research project focused on the assessment of riparian vegetation and gravel bars along the Sarita River to develop ideas for salmon habitat restoration.

WORK HISTORY

Environmental Biologist I, Southern Nevada Water Authority (SNWA) (Jan. 2001 - present)
Contact: Mr. Zane Marshall, Senior Biologist, Las Vegas, Nevada (702) 862-3713

- Collect environmental/biological/hydrological data for scientific research projects that relate to SNWA water resource planning, including such activities as environmental assessments, threatened and endangered species surveys, environmental research and environmental monitoring studies. Specific activities have included:
  - Task lead on researching and conducting technical analysis for estimating evapotranspiration within hydrographic basins associated with water resource acquisition.
  - Contract administration and management with the University of Nevada System as well as with biological and hydrological consultants to the SNWA.
  - Oversee the assemblage of baseline data of the vegetation communities of spring systems in eastern Nevada in support of assessing impacts from groundwater pumping.
  - Coordination with federal and state agencies on rare and sensitive plant issues associated with water resource acquisition and construction of facilities for both the SNWA and the Las Vegas Valley Water District. Includes performing and/or overseeing biological surveys and inventories, preparation of restoration plans and implementing salvaging and restoration activities.
  - Participation in endangered species monitoring and mark-recapture studies on Mead and the Virgin River, and conservation activities along the Muddy River, such as bird surveys and fish counts
  - Participation in southwestern willow flycatcher, Yellow-billed cuckoo, and Yuma clapper rail surveys along the Las Vegas Wash.
  - Participation in desert tortoise surveys.
- Coordinate and cooperate with other agencies/entities through participation in field activities, Recovery Teams and Working Groups, and other meetings or conferences that relate to SNWA interests. Specific activities have included:
  - Representing the SNWA at technical meetings and conferences including preparation of oral presentations (Nevada Water Resources Association, the Rare Plant Working Group of the Clark County Multiple Species Habitat Conservation Plan, and the Southern Nevada Rare Plant Group).
  - Assisting the U.S. Fish and Wildlife Service and the Nevada Division of Wildlife with the Endangered Species program at Willow Beach National Fish Hatchery and with endangered species monitoring on Lakes Mead and Mohave.
  - Representing the SNWA on the Virgin River Recovery Team and the 100th Meridian Initiative Colorado River Basin Team (invasive species), and participate in the Relict Leopard Frog Working Group to develop a Conservation Agreement and Strategy.
  - Attending annual Colorado River Aquatic Biologists meeting and Desert Fishes Council meeting, as well as various workshops on the National Environmental Policy and Endangered Species Acts.

Environmental Scientist, Terracon (Aug. 1999 – Dec. 2000)
Contact: Mr. Kevin Pentony, Environmental Project Manager, Las Vegas, Nevada (702) 597-9393

- Major duties included performing Phase I site assessments, investigating site use history, report preparation, monitoring and sampling of groundwater, assisting in explorative soil boring, monitoring well installations as well as operation and maintenance of remediation systems.

Volunteer, Mississippi Sandhill Crane National Wildlife Refuge, Gautier, Mississippi (Summer 1998)

- Tracked Sandhill cranes using radio telemetry, searched for nests, and investigated the viability of eggs.

Intern, Alligator River National Wildlife Refuge (Summer 1997)
Contact: Bonnie Strawser, Wildlife Interpretist, Manteo, North Carolina

- Assisted in the Atlantic White Cedar restoration project, the Red Wolf reintroduction project, and the Loggerhead sea turtle program
- Gained experience using Trimble Global Positioning System (GPS)
- Participated in Red-cockaded woodpecker surveys and Southern Pine beetle eradication efforts
- Other duties included banding birds (terns and pelicans), guiding canoe tours in the Pamlico Sound, working in the Visitor Center, and general maintenance activities on the refuge.

PROFESSIONAL TRAINING and RELEVANT COURSEWORK

Exploring ENVI and Spectral Analysis with ENVI (RSI Educational Services, Jan. 2006)

Introduction to ArcGIS I and II (ESRI Educational Services, Oct. 2005)

Qualitative and Quantitative Methods (University of Nevada, Las Vegas- Spring 2005)

Western Water Policy (University of Nevada, Las Vegas- Fall 2004)

Spring Mountain Flora: Montane Island over the Eastern Mojave (Friends of the Jepson Herbarium of the University of California at Berkeley- June 2004)

Seminar in Fiscal Administration (University of Nevada, Las Vegas- Spring 2004)

Principles of Public Administration (University of Nevada, Las Vegas- Fall 2003)

Summer Annuals and Fall Blooming Shrubs of the Eastern Mojave Desert (Friends of Jepson Herbarium of the University of California at Berkeley, UC Granite Mountain Research Center- Sept. 2003)

Birds of Joshua Tree National Park (The Desert Institute of the Joshua Tree National Park Association- Apr. 2003)

Plants of Southern Nevada (University of Nevada, Las Vegas Cooperative Extension- Apr. 2002)

Endangered Species Act and the Integration of Law and Science (CLE International- 2002)

"Overview of the NEPA Process" and "Reviewing NEPA Documents" (The Shipley Group- 2001)

Desert Tortoise Training (Desert Tortoise Council- Nov. 2001)

Southern Sierra Research Station's Southwestern Willow Flycatchers Workshop (U.S. Fish and Wildlife Service- May 2001)

PROFESSIONAL POSTERS AND PRESENTATIONS

Shanahan, R.D. and Kistinger, G. (2006) Historical estimates of evapotranspiration in eastern Nevada and the variability in hydrologic parameters that influence evapotranspiration. Nevada Water Resources Association.

Shanahan, R.D., Wallen, M., and Katzer T. (2005) Estimating evapotranspiration using remote sensing and spectral indices in eastern and southern Nevada. Nevada Water Resources Association.

McArther, R.D. and Donovan, D.J. (2004) Ground-water discharge by evapotranspiration in Cave Valley, Lincoln and White Pine Counties, Nevada. Nevada Water Resources Association.

Warda Drici

1900 East Flamingo Road

Las Vegas, NV

Hydrologist

Experience Summary

Ms. Drici has more than 21 years of experience as a hydrologist in the governmental and commercial sectors. She is currently working with the Southern Nevada Water Authority on groundwater development projects, as a member of the Parsons team. She is involved in the analysis of groundwater data in support of water rights applications and water resource development. She served as an expert witness at the State's water-right hearings.

Previously, she worked on the Underground Testing Area Project (Nevada Test Site), a Department of Energy project for more than 10 years. She led the analysis of groundwater data and the preparation of numerous technical documents. Prior to joining the Underground Testing Area Project, Ms. Drici participated in the high-level nuclear waste site selection activities. For the Office of Nuclear Waste Isolation, she developed groundwater flow models for the salt domes of Mississippi and Cypress Fee and for the bedded salts of Deaf Smith County, Texas.

Her experience also includes water resource assessment and management, characterization of hazardous sites, design of dewatering and landfill leachate collection systems. She also has experience in optimal groundwater management; well test design and analysis, mapping, computer programming and various data analysis techniques. She has used several groundwater and surface water modeling codes including Modflow, MOC, Fracman, Sutra, Gram, Plasm, Help, QUAL2E, and Aqtsolve. She is also familiar with various other office applications. She authored and contributed to numerous technical documents.

Education

M.S. Petroleum Engineering, University of Kansas, 1987

M.S. Petroleum Management, University of Kansas, 1984 (Honors)

B.S. Mathematics, University of Algiers, 1977

Special Training

Introduction to ArcGIS I, ESRI, Las Vegas, NV, July 15 and 16, 2004

Fundamentals of Remote Sensing, Space Imaging, Las Vegas, NV June 22 and 23, 2004

FRACMAN Software Training, Golder Associates, Denver, CO, 2001

Myers Briggs Training, IT Corporation, Las Vegas, NV, 2001

Franklin Time Management, IT Corporation, Las Vegas, NV, 1997

Covey's Seven Habits of Highly Effective People, IT Corporation, Las Vegas, NV, 1996

Project Management Training, The Earth Technology Corporation, Long Beach, CA, 1989

Project Management Training, The Earth Technology Corp., Long Beach, CA, 1989

Marketing Course, Kay Lenz Marketing Management Associates, Long Beach, CA, 1988

Technical Writing Training Course, Shipley Associates, Long Beach, CA, 1988

AWARDS AND SPECIAL ACTIVITIES

- Qualified as an expert witness in Groundwater Hydrology, with emphasis on modeling at the Three Lakes Valley South Water Hearings held in Carson City, Nevada in November-December 2005.
- Member of the Quality Assessment Committee, Southern Nevada Water Authority.
- Member of the Steering Committee for two years, the Earth Technology Corporation.
- Recipient of the Key Employee Incentive Program Award in 1988, the Earth Technology Corporation
- Recipient of the Top Achiever Bonus Program in 1990, the Earth Technology Corporation
- Recipient of the Quality Award in 1996, IT Corporation.
- Recipient of the Quality Award in 2002 and 2003, Shaw Environmental

EXPERIENCE SUMMARY

May 2004 – Present. Parsons Corp., Las Vegas, NV, SNWA Hydrologist

2003 – 2004. INTERA Inc., Las Vegas, NV; Senior Hydrogeologist

2002 – 2003. Shaw Environmental Inc., Las Vegas, NV; Senior Hydrogeologist

1985 – 2002. International Technology Corporation, Las Vegas, NV; Senior Hydrogeologist

1984 – 1985. GeoTrans Inc., Las Vegas, NV; Senior Hydrogeologist

1992 – 1994. Professional Analysis, Inc., Las Vegas, NV; Environmental Engineer

1990 – 1992. The Earth Technology Corporation, Las Vegas, NV; Senior Hydrogeologist

1986 – 1992. The Earth Technology Corporation, Long Beach, CA Project Hydrogeologist

1985 – 1986. Kansas Geological Survey, Lawrence, KS Visiting Research Associate

1982 – 1985. Kansas Geological Survey, Lawrence, KS Research Assistant

1981 – 1983. Dept. of Chemical and Petroleum Engineering, University of Kansas, Lawrence, KS Teaching Assistant

1981– 1982. Supportive Educational Services, University of Kansas, Lawrence, KS Mathematics and French Tutor

REPRESENTATIVE EXPERIENCE

SITE CHARACTERIZATION

As a Senior Hydrogeologist with the Underground Test Area Project (UGTA), was involved in various site characterization activities of the underground test areas of the Nevada Test Site (NTS).

- Value of Information Analysis (VOIA) for the Pahute Mesa Underground Test Area. As the Task Manager, planned and led this task to successful completion. The purpose of the value-of-information analysis was to evaluate and compare data collection options for characterizing groundwater transport of contamination associated with the Pahute Mesa underground nuclear test area of the Nevada Test Site (NTS). Pahute Mesa is one of several areas of the NTS used for nuclear underground testing until 1992, with testing on Pahute Mesa starting in 1965. Most of the underground nuclear tests in Pahute Mesa were conducted within fractured rocks near or below the water table.

  The assessment approach includes stochastic simulations of contaminant transport. The inputs to the model(s) which include groundwater flow directions, hydrostratigraphic unit (HSU) geometry, HSU properties, radionuclide source, dispersivity, and sorption coefficients are treated as stochastic random variables with specified probability density functions PDFs).

Planned and conducted working meetings involving decision analysis specialists, modelers, and members of an expert panel.

- Data Quality Objectives (DQOs) Pahute Mesa and Yucca Flat Underground Test Areas. As the Task Manager, prepared Data Quality Objectives (U.S. EPA) including the selection of characterization activities based on the results of the VOIA. Planned and conducted working meetings including representatives from the Nevada Department of Environmental Protection and the U.S. Department of Energy.
- Corrective Action Investigation Plans for the Pahute Mesa, Frenchman Flat, and Yucca Flat underground test areas. As the Task Manager, planned and managed the execution of tasks including budget and schedule. Prepared sections of the plans, coordinated input from others and completed the integration and production of the plans.
- Well Testing Data Analysis for Well UE-10j and Well ER-30-1, Nevada Test Site. Interpreted constant-rate pump tests, borehole flow logs and geochemical samples to characterize formation hydraulic properties and groundwater composition. Prepared letter reports and documented analysis process and results.
- Pahute Mesa-Oasis Valley Area Investigation Wells. Analyzed numerous flow logs conducted in seven wells completed in the fractured volcanic rocks of the Pahute Mesa area of the Nevada Test Site. Documented analysis process and results for inclusion in final reports.
- ER-6-1 Tracer Test, Yucca Flat, Nevada Test Site, Nevada. Assisted in the design of a forced-gradient test at the ER-6-1 well site. Investigation objective was to determine the fracture interconnections and the hydraulic, dispersive, and sorptive properties of the rock mass. Derived hydraulic and transport parameters for use in radionuclide transport models. Ran various simulations of tracer transport using semi-analytical models. Prepared modeling report to support tracer test plan.

As a Senior Hydrogeologist with the Earth Technology Corporation, was involved in various site characterization activities.

- Well PM-3, Near Nevada Test Site, Nevada. Prepared groundwater level maps, isopach maps and structural contour maps of geologic units underlying the Pahute mesa area of the NTS. Evaluated aquifer-test data collected at Well PM3. Facilitated transfer of data from USGS and DRI and synthesized the data on behalf of DOE/NV. Contributed to the preparation of the completion report of well PM-3.

WATER RESOURCES

As a Hydrologist for the Southern Nevada Water Authority, currently participate in several hydrologic data analysis activities.

- Three-Lakes Valley South Project: Contribute to the effects analysis including the search for information, the data analysis, the modeling of effects, and the preparation of the report. Served as expert witness at water right hearings held by the Nevada State Engineer.
- In-state groundwater development project: Assist with recharge and hydraulic property data analysis activities. Contribute to the construction of the 3-D model mesh. Serve as an internal reviewer of the technical memoranda.

As a Senior Hydrogeologist with the Earth Technology Corporation, was involved in several water resource management projects including the following:

- TDS and Nitrogen Studies - Santa Ana Watershed Project Authority (SAWPA), Southern California. Responsible for the technical management of surface water quality modeling task for a nitrogen and TDS-loading study of the Santa Ana River.

Provided support in field sampling program design. Compiled, reduced and statistically analyzed data. Maintained field database.

MODELING

As a Hydrologist for the Southern Nevada Water Authority, currently participate in modeling activities.

- Evaluated effects of production wells proposed by SNWA using the Theis equation and the Death Valley Regional Flow System Model. Assisted in report preparation.
- Also evaluated the effects of groundwater pumping using the Death Valley Regional Flow System Model.

As a Senior Hydrogeologist with the Underground Test Area Project (UGTA), was involved in several modeling activities of the underground test areas of the Nevada Test Site (NTS).

- Regional Groundwater Flow and Tritium Transport Modeling, Nevada Test Site, Nevada. Task Manager for the reporting of regional groundwater flow and transport modeling of the Underground Test Area at the Nevada Test Site. Code used was Modflow.

As a Senior Hydrogeologist with the Earth Technology Corporation, was involved in various modeling projects.

- Water Right Applications. For the Las Vegas Valley Water District (LVVWD), developed and used four groundwater flow models of hydrographic basins in Southern Nevada including Three Lakes Valley on the Nellis Air Force Range. These 3-D models included the regional carbonate aquifer and alluvial basin aquifers and were used to simulate the long-term (50 and 100 years) impacts of large-scale groundwater withdrawals.
- River Water Quality Modeling. TDS and Nitrogen Studies Santa Ana Watershed Project Authority (SAWPA), Southern California responsible for technical management of surface water quality modeling task for a nitrogen and TDS-loading study of the Santa Ana river. Developed a stochastic model for the river using QUAL2E. Performed the deterministic calibration, verification and validation of the model. Performed stochastic calibration of model using Monte Carlo method. Evaluated system non-linearity.
- Fluid Flow Modeling For Seals Performance Assessment. Used the USGS code SUTRA to model fluid flow to analyze the performance of seals in high-level radioactive waste repository in bedded salts. Reviewed related codes and documents, and wrote activity plans for the project.

As a Research Assistant and Research Associate with the Kansas Geological Survey, was involved in several modeling projects including the following:

- Optimal Plume Management In The Equus Beds, Kansas U.S. Environmental Protection Agency. Developed a management model for the containment of an oil-brine plume in the Equus Beds Aquifer In Kansas. As a research assistant, performed flow and solute transport modeling using the USGS 2-D and 3-D groundwater flow modeling codes as well as a solute transport code (MOC). Assisted in the design of the Kansas geological groundwater management model and wrote part of the project report and two related papers submitted for publication.
- Optimal Groundwater Management Model Kansas Groundwater District # 4 Designed an optimal management model for the Kansas Ogallala Aquifer to stop and/or reverse the water level declines observed to occur at alarmingly high rates. As a research associate, performed groundwater flow modeling using the USGS 3-D groundwater flow modeling code and MADMOD (university of Arizona) and a KGS groundwater management model.

As a graduate student at Kansas University and for the Petroleum Management M.S. Thesis, developed Fortran a code to estimate gas reservoirs parameters. The code used gas flow time versus pressure data collected in the laboratory to calculate reservoir parameters including the Klinkenberg effect. The inverse solution was implemented using a modified Newton-Raphson method.

REMEDIATION

As a Senior Hydrogeologist with the Earth Technology Corporation, was involved in several remediation projects including:

- Hazard Ranking for the National Priority List, Nevada Test Site, Nevada. in support of the hazard ranking system scoring of the NTS, analyzed historic groundwater data relating to radionuclide concentrations collected as part of the long-term hydrologic monitoring program of the NTS. This effort included the development of a database for retrieval of the long-term records, graphical display of areal and temporal distributions of radionuclide concentrations, trend analysis for plutonium, cesium, strontium and other radionuclides. Performed statistical analyses to determine significant releases from source areas that could lead to exposure by worker population at the NTS.
- RI/FS remedial design, Norton Air Force Base. Developed specific design criteria and performed numerical simulations for a coupled groundwater extraction and injection system at Norton AFB for the remediation of a plume of tetrachloroethylene. Evaluations included the identification of capture zones, the design of aquifer testing protocols, the analysis of aquifer test data, and the development of a groundwater flow model to assess the long-term performance of the system and to assess the final well field layout.
- Hydrocarbon pollution studies Texaco USA Inglewood CA. Constructed a numerical contaminant transport model to assist in the identification of the sources of groundwater contamination.

RADIOACTIVE WASTE

As a Project Hydrogeologist with the Earth Technology Corporation, was involved in several projects dealing with radioactive waste.

- Brine Migration Studies U.S. Office of Nuclear Waste Isolation (ONWI) Deaf Smith County, Texas. As the lead analyst for the hydrologic performance of engineered systems surrounding a high-level waste package, performed a detailed literature survey on brine migration in salt including computer codes to model the process. Reviewed the computer code spectrom58 (RE/SPEC), one of the basic migration codes selected for possible use.
- Low-Level Nuclear Waste Studies, State of Illinois. Developed a numerical groundwater flow model using the USGS code SUTRA to assist in the design of a dewatering scheme. Constructed a rainfall-runoff infiltration model to support the design of the low level waste repository using HELP, a U.S. EPA code.
- Nuclear Waste Repository Studies U.S. Office of Nuclear Waste Isolation (ONWI) Louisiana and Mississippi. Developed a regional 3-D groundwater flow model of central and southern Mississippi to determine groundwater flow patterns in the vicinity of Richton Dome. Richton Dome is a salt dome, which was a former candidate repository location. Performed various simulations of groundwater flow using GRAM, a groundwater flow model developed by Earth Technology to support site characterization studies for a proposed high-level nuclear waste repository. Conducted the modeling in a NQA-1 environment.

CONSTRUCTION ENGINEERING

As a Senior Hydrogeologist with the Earth Technology Corporation, was involved in several projects dealing with construction engineering including:

- Rail Garrison Database Management. Assisted with database development and data integration for rail network data from throughout the conterminous united states. Supported U.S. Air Force study for the rail garrison missile deployment system.
- Tunnel Dewatering Modeling, Los Angeles Metro Rail System. Built and used semi-analytical models to design dewatering scheme in support of excavation of tunnels in the Los Angeles area.

PUBLICATIONS

Rehfeldt, K., **W. Drici**, D. Sloop, J. Watrus, T. Beard, M. Sully, C. Benedict, A. Wolfsbergand, P. Reimus. 2003. Contaminant Transport Parameters for the Groundwater Flow and Contaminant Transport Model of Corrective Action Units 101 and 102: Central and Western Pahute Mesa, Nye County, Nevada, Shaw/13052-201, Rev. 0. Las Vegas, NV: Shaw Environmental, Inc.

Rehfeldt, K., **W. Drici**, B. Lester, D. Sloop, J. Watrus, T. Beard, M. Sully, W. Fryer, and C. Benedict. 2003 (In Production). Hydrologic Data for the Groundwater Flow and Contaminant Transport Model of Corrective Action Units 101 and 102: Central and Western Pahute Mesa, Nye County, Nevada, Rev.0, Shaw/13052,-204. Las Vegas, NV: Shaw Environmental, Inc.

Coauthor of many reports and work plans produced for the Underground Project Area Project of the Nevada Test Site (U.S. Department of Energy) between 1996 and present. These include work Plans, Value of Information Analysis reports, well development and testing data analysis reports, data analysis and modeling reports, and presentations to the Department of Energy and State of Nevada.

Drici, O., Garey, C. and T.S Buqo, 1993, Hydrology and Steady-State Ground-Water Model Pahroc Valley, Lincoln and Nye Counties, Nevada: Las Vegas Valley Water District Cooperative Water Project, Series Report No. 10.

Buqo, T.S., **O. Drici** and D.B. Goings, 1992, Hydrology and Steady-State Ground-Water Model Coyote Spring Valley, Clark and Lincoln Counties, Nevada: Las Vegas Valley Water District Cooperative Water Project, Series Report No. 3.

Buqo, T.S., **O. Drici** and D.B. Goings, 1992, Hydrology and Steady-State Ground-Water Model of Three-Lakes Valley South, Clark County, Nevada: Las Vegas Valley Water District Cooperative Water Project, Series Report No. 4.

Garey, C., **Drici, O.** and T.S. Buqo, February 1991, "Cooperative Water Project: Water for Nevada's Future - Pahranagat Valley", Draft Report prepared by The Earth Technology Corporation for The Las Vegas Valley Water District.

Heidari, M., J. Sadeghipour, and **O. Drici**, "Velocity Control as a Tool for Optimal Plume Containment in the Equus Beds Aquifer, Kansas." Water Resources Bulletin, April 1987, Vol. 23, No. 2

Drici, O., and S. Vossoughi, "Catalytic Effects of Heavy Metal Oxides on Crude Oil Combustion." Presented at the 92nd National AICHE meeting, Houston, TX, March 1985; published in Journal of Petroleum Technology, November, 1987.

Drici. O., M. Heidari, and J. Sadeghipour, "Application of a Groundwater Quality Management Model to the Equus Beds Aquifer in Kansas." An unpublished paper presented at the Sixth National Symposium and Exposition on Aquifer Restoration and Groundwater Monitoring Conference (NWWA Conference).

Heidari, M., **O. Drici**, and J. Sadeghipour, "Optimal Strategy for Management of an Oil-Brine Polluted Aquifer near Wichita, Kansas." Kansas Geological Survey Report, 1986.

Drici, O., and S. Vossoughi, "Study of the Surface Area Effect on Crude Oil Combustion by Thermal Analysis Techniques." Journal of Petroleum Technology, April, 1985.

Drici, O., and S. Vossoughi, "Study of the Surface Area Effect on Crude Oil Combustion by Thermal Analysis Techniques." Proceedings of the 13th North American Thermal Society Conference, Philadelphia, PA Sept., 1984.

James M. Watrus

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Education

M.S. Geochemistry, New Mexico Institute of Mining and Technology, 1998
B.S. Geology, University of Idaho, 1994

Professional Experience

2004 to present — **Parsons** — Las Vegas, Nevada
SR GEOLOGIST

Employed as a Sr. Geologist with Parsons on a groundwater resource contract for the Southern Nevada Water Authority. Experience includes data analysis, data integration, GIS analysis, surface water sampling, water-level measurement, water quality sampling, database development, site characterization, and report preparation.

2003 to 2004 — **INTERA, Inc.** — Las Vegas, Nevada
GEOLOGIST/GEOCHEMIST

Employed as a geologist/geochemist with INTERA, Inc. on a multi-contractor environmental team to assist the National Nuclear Security Administration in investigating the contamination resulting from the Underground Nuclear Tests conducted at the Nevada Test Site. Experience includes data analysis, data integration, web development, GIS analysis, groundwater sampling, well drilling activities, and report preparation.

1998-2003 — **Science Applications International Corporation,** — Las Vegas, Nevada
GEOLOGIST/GEOCHEMIST

Same contract as described above with INTERA, Inc.

1997-1998 — **New Mexico Bureau of Mines and Mineral Resources,** — Socorro, New Mexico
GEOGRAPHIC INFORMATION SYSTEMS TECHNICIAN

Worked for the Petroleum Department using the ArcView Geographic Information System to develop digital maps of the petroleum resources within the state of New Mexico. The results of the work were originally published on the New Mexico Bureau of Mines and Mineral Resources ArcIMS Petroleum Web Page. Also worked on a mineral resource assessment project for the McGregor Range located in southern New Mexico.

Technical Activity Work Summary

- Prepared databases for the central storage of well construction, hydrologic, geologic, and geochemical information.
- Performed data analysis tasks including compilation, qualification, and interpretation of various geologic, geochemical, and hydrologic data associated with a large-scale groundwater modeling program.
- Assisted in the preparation of technical reports.

- Implemented HTML front-end delivery system for Underground Test Area (UGTA) data analysis reports on CD-ROM and modeling web pages.
- Established a Borehole Index for the purpose of unifying well names and coordinates between the multiple contractors and organizations involved at the Nevada Test Site.
- Developed the UGTA Groundwater Modeling Web Site for the purpose of enhancing information exchange between UGTA data analysis and modeling participants.
- Assisted in the conversion of the UGTA Modeling Web from a collection of static pages to a dynamic database driven application that allows for more timely information exchange.
- Employed ArcGIS technology for the preparation of maps as well as data analysis activities.

Field Activity Work Summary

- Performed groundwater and surface water field investigations including water-level measurement, and stream and spring discharge measurements in remote Central Nevada locations.
- Participated as a team member and team leader on multi-contractor groundwater sampling events to establish regional and local groundwater chemistry.
- Performed initial well site water-quality monitoring.
- Collected geologic sample media during well drilling operations.
- Authored Site Specific Health and Safety Plans.
- Authored Technical Field Instructions and Work Packages for groundwater sampling events at the Nevada Test Site.
- Authored Letter's of Accomplishment for sampling activities and Completion Reports for well drilling activities.
- Participated in ITLV Sampler's Training to demonstrate proper sampling procedures to junior level staff.

Project Management Summary

- Managed Source Term Screening Project to develop a geodatabase to assist Lawrence Livermore National Laboratory in the categorization of underground nuclear tests on the Nevada Test Site.
- Prepared annual task plans for UGTA projects.

References

Rehfeldt, K., W. Drici, D. Sloop, **J. Watrus**, T. Beard, M. Sully, C. Benedict, A. Wolfsbergand, P. Reimus. 2003. Contaminant Transport Parameters for the Groundwater Flow and Contaminant Transport Model of Corrective Action Units 101 and 102: Central and Western Pahute Mesa, Nye County, Nevada, Shaw/13052-201, Rev. 0. Las Vegas, NV: Shaw Environmental, Inc.

Rehfeldt, K., W. Drici, B. Lester, D. Sloop, **J. Watrus**, T. Beard, M. Sully, W. Fryer, and C. Benedict. 2003. Hydrologic Data for the Groundwater Flow and Contaminant Transport Model of Corrective Action Units 101 and 102: Central and Western Pahute Mesa, Nye County, Nevada, Rev.0, Shaw/13052,-204. Las Vegas, NV: Shaw Environmental, Inc.

Read, A., R. Broadhead, A. Lopez, E. Fleming, and **J. Watrus**. 2000. New Mexico Oil and Gas Pools. New Mexico Bureau of Geology and Mineral Resources Circular 209. Soccoro, NM.

Watrus, J. 1999. A Regional Geochemical Atlas for Part of Soccoro County, New Mexico. New Mexico Bureau of Geology and Mineral Resources Open File Report 445. Soccoro, NM.

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Timothy J. Durbin

Principal Groundwater and Surface-Water Hydrologist

Education	Master of Science in Civil Engineering, 1971 Stanford University, Stanford, California Bachelor of Science in Civil Engineering, 1967 Stanford University, Stanford, California
Licenses	Civil Engineer, California Civil Engineer, Oregon Civil Engineer, Texas
Professional Societies	American Society of Civil Engineers American Geophysical Union International Association of Hydrogeologist National Ground Water Association

Professional Experience

February 1999 to Present

Timothy J. Durbin, Inc., Fair Oaks, California, Principal. Directs projects relating to groundwater and surface-water hydrology. Areas of expertise include design of multidisciplinary investigations, design of large-scale programs for the collection and interpretation of hydrologic data, and application of mathematical modeling to the analysis of problems in groundwater and surface-water hydrology. Examples of such projects include:

- Seaside Groundwater Basin, California. The Seaside groundwater basin was adjudicated to balance the threat of seawater intrusion against the need for groundwater production to supply water to communities overlying the basin and within the Monterey Peninsula area. Developed a groundwater model to assess the relation between groundwater production and seawater intrusion. Work was done in support of litigation related to the adjudication.

- Carbonate Aquifer System, Eastern Nevada. Analyzed the water-related impacts of groundwater development within the regional Carbonate Aquifer System that underlies central and eastern Nevada. The Southern Nevada Water Authority, which delivers water to Las Vegas and neighboring communities, is considering a project to import of groundwater from the Carbonate Aquifer. The analysis is focused on the possible impacts of the project on springs and phreatophytes. The work includes developing a groundwater model of the Carbonate Aquifer System. The model extends over an area covering 20,000 square miles. The work was done in support of hearings before the Nevada State Engineer on water-right applications by the Authority. The work was done also in support of the environmental compliance for the project.

- North Platte River, Wyoming and Nebraska. Analyzed the impacts of water-resource development and reservoir operations on water supply, streamflows, regional economics, and wildlife resources within the North Platte River Basin, Nebraska and Wyoming. Designed and directed a multi-disciplinary investigation involving agricultural engineers, groundwater hydrologists, surface-water hydrologists, agricultural economists, and environmental scientists in six different consulting firms. Work was done in support of litigation before the U.S. Supreme Court between the states of Nebraska and Wyoming.

- Santa Monica Groundwater Basin, California. Analyzed the occurrence of MTBE in the Santa Monica groundwater basin, California. MTBE contamination from multiple sites has resulted in abandonment of public-supply wells. An analysis of the sources and fate of MTBE within the Santa Monica groundwater basin is being conducted. Work was done within the context of State and Federal regulatory proceedings and litigation.

- Special Master, California. Assigned as Special Master in a technical dispute between City of San Bernardino, California and the Regional Water Quality Control Board. The issue is the cause of a wastewater discharge to the Santa Ana River. The work was being done within the context of a State regulatory proceeding.

May 1998 to January 1999

Bookman-Edmonston Engineering, Inc., Sacramento, California. Vice President. Directed projects related to groundwater and surface-water hydrology. Directed a staff of about 30 engineers, hydrologists, biologists, and geologists. Examples of such projects include:

- Flooding, Arizona. Analyzed the causes of flooding near Phoenix, Arizona. Residential and commercial areas were flooded during a summer storm. The analysis involved assessing the effect of irrigation ditches and other facilities on the depth of flooding. The work was done in support of litigation.

- Pipeline Break, California. Analyzed the impact of floodflows on the failure of a stream pipeline crossing within Thousand Oaks, California. A large sewer line failed owing to channel erosion during an extreme flood event. The recurrence interval of the erosion event was analyzed. The work was done within the context of a State regulatory proceeding.

March 1989 to May 1998

Hydrologic Consultants, Inc., Sacramento, California. President. Directed projects related to groundwater and surface-water hydrology. Directed a staff of about 10 hydrologists, geologists, and engineers. Examples of such projects include:

- Lake Tahoe, California and Nevada. Analyzed the impacts of urban development on the water quality of Lake Tahoe, California. Work involved the analysis of sediment and nutrient transport in streams tributary to the lake and nutrient cycling within the lake. Work was done for litigation.

- Streamflow Temperature, California. Analyzed streamflow temperature within the Owens River, Owens Valley, California. Work was done to evaluate the hydrologic feasibility of reestablishing a fishery within the Owens River.

- Groundwater Salinity, California. Analyzed the source and management of surface-water and groundwater salinity within the Lompoc groundwater basin. Work involved developing groundwater and surface-water models of the Santa Ynez River basin, including salinity models. Work was done in support of litigation.

- Agricultural Drainage, California. Analyzed the causes and management of drainage water discharges from the Firebaugh and Central California Water District to natural watercourses and the San Joaquin River. Work was done in support of litigation.

- FERC Re-licensing, California. Developed a model for the optimal use of ground water and surface water within the Turlock and Modesto Irrigation Districts for the benefit of water supply and environmental resources. Work was done in support of the FERC re-licensing of New Don Pedro Reservoir.

- Seawater Intrusion, California. Analyzed seawater intrusion in the Salinas Valley. Analyzed the impacts of groundwater pumping on seawater intrusion. Analyzed the impacts of reservoir operations on streamflow recharge and seawater intrusion. Work was done in support of litigation.

- Petroleum Contamination, California. Analyzed the source of soil and groundwater contamination by petroleum hydrocarbons at Santa Barbara, California. Work was done in support of litigation. Analyzed the source of soil and groundwater contamination by petroleum hydrocarbons at Oxnard, California. Work was done in support of litigation.

- San Bernardino Groundwater Basin, California. Analyzed the occurrence of high groundwater levels in the San Bernardino Valley, California using surface-water and groundwater models. High groundwater levels resulted from excess artificial recharge and other factors. Work was done in support of litigation.

- Arkansas River, Colorado and Kansas. Analyzed the effects of groundwater pumping and other factors in the depletion of streamflow in the Arkansas River at the Colorado-Kansas state line using surface-water, groundwater, and institutional models. Work was done in support of litigation in the U.S. Supreme Court between the states of Kansas and Colorado.

- Geothermal Development, California. Analyzed the effects of geothermal development on thermal-spring discharges in the Mammoth Lakes area, California using groundwater and heat-transport models. Work was done in support of litigation.

October 1985 to March 1989

S.S. Papadopulos & Associates, Inc., Davis, California. Vice President, and Manager of Davis office. Directed and conducted investigations of numerous aspects of groundwater hydrology. Examples of such projects include:

- Love Canal, New York. Analyzed the migration of groundwater contaminants at the Love Canal hazardous waste site in Niagara Falls, New York using a groundwater model. The Love Canal site is a Superfund Site. Work was done in support of litigation.

- Groundwater Contamination, New Jersey. Analyzed the migration of groundwater contaminants at the Lone Pine landfill near Freehold,

New Jersey. The Lone Pine landfill is a Superfund site. Work was done as part of a remedial investigation.

- Modeling Code. Developed a computer program for the simulation of soil-water movement within and near a land-disposal facility. Work was done for the U.S. Environmental Protection Agency in support of the preparation regulations relating to the design of cover, liner, and leak-detection systems for land-disposal facilities.

- Sediment Transport, California. Analyzed the impacts of urban development on flooding and sediment transport for streams in Orange County, California. Work was done to support the permitting of a large residential and commercial development project.

July 1984 to October 1985

Williamson and Schmid, Hydrotec Division, Davis, California. Manager of Davis office. Directed and conducted investigations for evaluation of groundwater resources, management of regional groundwater systems, and evaluation of hazardous waste sites. Studies involved identification of essential hydrologic issues, collection of hydrologic data, and application of quantitative methods to evaluate alternatives and to select an optimal solution. Examples of such projects include:

- Groundwater Contamination, California. Developed a three-dimensional groundwater model of a physical barrier at a hazardous waste landfill in order to evaluate performance of the existing barrier and proposed modifications. Work was done for regulatory compliance.

- Isotope Geochemistry, California. Analyzed a hazardous waste site using isotope geochemistry and groundwater models as investigative tools. Work was done for regulatory compliance.

- Groundwater Salinity, Nevada. Analyzed the utilization of fresh water body overlying saline water using surface geophysical techniques and a density-dependent groundwater flow model.

August 1982 to July 1984

U.S. Geological Survey, Water Resources Division, California District. District Chief (GS-15). Managed California District (350 persons in 14 offices) with annual budget of $25 million (in 1995 dollars) for hydrologic investigations. Responsible for developing plans for hydrologic investigations and ensuring plans were implemented. Provided organizational and technical input to

development of large scale, multi-agency investigations. Examples of such projects include:

- Agricultural Drainage, California. Investigation of water quality related to agricultural drainage from the west side of San Joaquin Valley, California.

- San Francisco Bay, California. Investigation of hydrodynamics of San Francisco Bay and Sacramento-San Joaquin, California Delta hydrologic systems.

- Groundwater Exports, California. Investigation of the effects of exporting water from Owens Valley groundwater basin, California, including both hydrologic and biological impacts.

- Central Valley Groundwater, California. Assessment of the groundwater resources of the Central Valley, California. Work was part of the Central Valley Regional Aquifer System Analysis (RASA).

- Modeling Code. Development of numerical finite element codes (now used within the U.S. Geological Survey) for simulation of two- and three-dimensional groundwater flow and solute transport.

July 1977 to August 1982

U.S. Geological Survey, Water Resources Division, Nevada District. District Chief (GS-14) from 1/80 to 8/82 and Assistant District Chief (GS-13) from 7/77 to 1/80. Managed Nevada District (80 persons in three offices) with annual budget of $10 million (in 1995 dollars) for hydrologic investigations. Projects included:

- Truckee River, Nevada. Design and organization of Truckee-Carson River Quality Assessment and Great Basin Regional Aquifer System Analysis (RASA).

- Groundwater Management, Nevada. Development of groundwater and solute transport models for Washoe Valley, Galena Creek, Eagle Valley, and Carson Valley groundwater basins in Nevada.

- Geothermal Development, Nevada. Design and organization of regional geothermal investigations of areas throughout Nevada including Dixie Valley, Ruby Valley, Black Rock Desert, and Carson Desert.

July 1972 to July 1977

U.S. Geological Survey, Water Resources Division, California District. Hydrologist (GS-13; 12/75 to 7/77), Hydrologist (GS-12; 10/74 to 12/75), Hydrologist (GS-11; 9/73 to 10/74), and Hydrologist (GS-9; 7/72 to 9/73). Served as Project Chief for numerous groundwater projects involving hydrogeologic and geophysical investigations and groundwater modeling. Conducted research in development of finite-element models for simulation of groundwater flow and mass transport. Applied results of research to solution of management problems and provided assistance to hydrologists within USGS and other public agencies in use of these models.

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Publications

Durbin, T.J., 1974, Digital simulation of the effects of urbanization on runoff in the upper Santa Ana Valley, California: U.S. Geological Survey Water-Resources Investigations 41-73, 44 p.

Durbin, T.J., and Hardt, W.F., 1974, Hydrologic analysis of the Mojave River, California, using a mathematical model: U.S. Geological Survey Water-Resources Investigation 17-74, 50 p.

Durbin, T.J., 1975, Selected effects of suburban development on runoff in south-coastal California: in Proceedings of Second National Symposium on Urban Hydrology and Sediment Control, Lexington, Kentucky, p. 209-217.

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CORDILLERAN HYDROLOGY, INC.

TERRY KATZER, *HYDROGEOLOGIST*

EDUCATION

B.S. in Geology - Mackay School of Mines - University of Nevada, Reno, 1953-1958
Twelve units of graduate hydrogeology - University of Nevada, Reno, 1964-1966
Many technical and administrative short courses

Professional Affiliations

Geological Society of America *(Hydrology Division, Program Manager, 1984)*, Inactive
Colorado River Water Users Association, Inactive
National Water Well Association, Inactive
American Water Works Association (*Water Management Committee member, 1987-90, Co-chair 1989-1990*), Inactive
American Water Resources Association, Inactive
Nevada Water Resources Association, Active
Sewage and Waste Water Committee, Advisory to the Board of Commissioners, Clark County, Nevada *(member 1986-1990, Chairman 1988)*, Retired

EXPERIENCE

Cordilleran Hydrology, Inc.
1995-Present

SUMMARY

Consulting Hydrogeologist in the western states with emphasis in Nevada.
Terry Katzer: I am the founder and principal-in-charge of Cordilleran Hydrology, Inc. As a consulting hydrogeologist, I work throughout the western United States, with an emphasis in Nevada and specialize in hydrogeologic evaluations, problem definition, project oversight, quality assurance, and all phases of report preparation. Major effort has been directed to the hydrogeology of numerous ground- and surface-water systems. I have been qualified as an Expert Witness in water-right hearings over 20 times before the Nevada State Engineer, the majority of times testifying on behalf of the State. Completed projects are listed by publication in the bibliography section. Prior to forming my own company I was with the Las Vegas Valley Water District where I oversaw a major hydrologic investigation of ground-water basins in eastern and southern Nevada. Between 1966 and 1985 I was with the U. S. Geological Survey.

I am currently (2006) involved in three major water-resource studies in: eastern and southern Nevada, northwestern Nevada, and the Walker River Basin. Additionally I am an advisor to a university in Australia evaluating the potential for artificial recharge.

Las Vegas Valley
Water District
1985-1995

Director of Research for the Las Vegas Valley Water District in Las Vegas, Nevada. Evaluated artificial recharge through deep well injection as a means of reducing subsidence and providing a measure of drought and peak demand storage. The project has proven quite successful and the District now has the largest recharge project of this type in the world.

Launched a major hydrologic investigation of ground-water basins in eastern and southern Nevada including the lower Virgin River Basin. The purpose of this multi-discipline investigation is to explore the potential for a water resource development project as a source option for southern Nevada. As a follow-up to the Virgin River project I served for the Southern Nevada Water Authority on a technical committee with the Arizona and Utah Departments of Water Resources.

Directed a large well drilling program in Las Vegas Valley and other nearby valleys where the District operates rural water systems, established a ground-water quality monitoring network in Las Vegas Valley designed to provide an early warning for the principal public supply aquifer.

U.S. Geological Survey
1966-1985

Project member/leader in all disciplines. The work included streamgaging throughout Alaska and Nevada, ground-water hydraulics on Amchika Island in the Bearing Sea, aquifer characterization in Las Vegas Valley, and water-resource evaluations of select valleys in Nevada. In 1979, I became the Assistant District Chief of the Nevada District and Acting District Chief followed by State Office Chief in 1981. Duties included direct responsibility for program development and planning, budgeting, administration, and technical assurance of ongoing programs.

Federal Watermaster
1964-1966

Assistant Federal Watermaster: Responsible for determining and adjusting surface-water diversions of the Truckee-Carson River System, western Nevada.

Carson Water Sub-
Conservancy District
1962-1964

Secretary-Manager: Responsible for liaison between U. S. Bureau of Reclamation and the agricultural community for a potential reclamation project (*Watasheamu Division of the Washoe Project)*, western Nevada.

Standard Slag Co.
1960-1962

Exploration Geologist: Mineral exploration in Western U. S., Canada, and Alaska.

U. S. Army
1958-1960

Signal Corps Officer: Executive Officer and Company Commander of Signal Corps School Companies.

The technical aspects of my career are fairly well represented in the following bibliography that is divided into four categories, ground water, surface water, ground and surface water, and other technical and administrative publications.

GROUND WATER

Katzer, T. L., 1977, **Water-level changes associated with ground-water development in Las Vegas Valley, Nevada, March 1976 to March 1977**: Nevada Division of Water Resources Information Report 27, 35 p.

Katzer, T. L., 1980, **General ground-water map of the Carson City Quadrangle, Nevada**: Nevada Bureau of Mines and Geology, Environmental Series 7 1/2° Quadrangle Map 1AF.

Harrill, J. R., and Katzer, T. L., 1980, **General ground-water map of the Las Vegas SE Quadrangle, Nevada**: Nevada Bureau of Mines and Geology, Environmental Series, 7 1/2° Quadrangle Map No. 3AF.

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Brothers, Kay, and Katzer, Terry, 1988, **Ground-water chemistry changes resulting from stressed aquifer systems in the Las Vegas Valley, Clark County, Nevada**: Nevada Department of Conservation and Natural Resources, Division of Environmental Protection, 66 p.

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Brothers, Kay, and Katzer, Terry, 1990, **Water banking through artificial recharge, Las Vegas Valley, Clark County, Nevada**: Journal of Hydrology, 115, p. 77-103.

Katzer, Terry, and Brothers, Kay, 1990, **Moving toward the millennium**: American Society of Civil Engineers, International Symposium; Hydraulics/Hydrology of Arid Lands, p. 124-130.

Morros, Peter G., and Katzer, Terry, 1990, **Overdrafting ground-water basins -- mining or managing?:** American Institute of Hydrology, Proceedings of Symposium; Minimizing the Risk to the Environment, Alexander Zaporozce, Editor, Kendall/Hunt Publishing Company, Dubuque, Iowa, p. 161-168

Katzer, T., Brothers, K., Johnson, M., Morris, T., and Bernholtz, A., 1991, **Design and evaluation of joint-use wells for water supply and artificial recharge in Las Vegas Valley, Clark County, Nevada**: American Water Works Association, Proceedings of Annual Conference, p. 527-540.

Bernholtz, A. Brothers, K., and Katzer, T., 1991, **Analyses of aquifer responses due to continued artificial recharge of treated Colorado River water, Las Vegas Valley, Clark County, Nevada**: Arizona Hydrological Society, Proceedings of Fourth Annual Meeting, p. 110-118.

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Bernholtz, Alan, Brothers, Kay, and Katzer, Terry, 1994, **Artificial recharge in Las Vegas Valley, Clark County, Nevada -- storing today, treating tomorrow?:** American Society of Civil Engineers, Proceedings of Second International Symposium; Artificial Recharge of Ground Water, Orlando, Florida.

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Ranch areas, Washoe County, Nevada: Cordilleran Hydrology, Inc., consultant's report, 29 p.

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Shanahan, Rebecca D., Wallen, Michael, and Katzer, Terry, 2005, **Estimating evapotranspiration using remote sensing and spectral indices in eastern and southern Nevada:** Annual Nevada Water Resources Association, Abstract and Poster Session in Conference Proceedings.

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Katzer, T. L., Surface water in Harrill, J. R., 1971, **Water-resources appraisal of the Granite Springs Valley area, Pershing, Churchill, and Lyon Counties, Nevada**: Nevada Department of Conservation and Natural Resources Reconnaissance Series, Report 55, 36 p.

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Glancy, P. A., and Katzer, T. L., 1975, **Fluvial sediment transport and its relation to urbanization at Incline Village, Lake Tahoe, Nevada**: Association of Engineering Geologist, 18th Annual Meeting, Program with Abstracts, 23 p.

Katzer, T. L., Glancy, P. A., and Harmsen, Lynn, 1976, **A brief hydrologic appraisal of the July 3-4, 1975 flash flood in Las Vegas Valley, Nevada:** U. S. Geological Survey Open-File Report 76-100, 40 p.

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Mojib, Reza, and Katzer, Terry, 1996, **The determination of sediment loads in the lower Virgin River, Clark County, Nevada:** Sixth Federal Interagency Sedimentation Conference Proceedings, March. 1996, Las Vegas, Nevada.

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Cole, Erin and Katzer, Terry, 2000, **Analysis of gains and losses in Virgin River flow between Bloomington, Utah and Littlefield, Arizona:** Southern Nevada Water Authority, Las Vegas, Nevada, 57 p.

Cole, Erin, and Katzer, Terry, 2000, **Gains and losses in the lower Virgin River, Utah and Arizona:** Southern Nevada Water Authority, Las Vegas Nevada, 9 p.

Katzer, Terry, Cole, Erin, and Dixon, Gary, 2000, **Geologic control solves hydrologic questions of gains and losses in the Virgin River in southwestern Utah:** Geological Society of America, Abstracts with program.

GROUND AND SURFACE WATER

Rush, F. E., and Katzer, T. L., 1973, **Water-resources appraisal of Fish lake Valley, Nevada and California**: Nevada Division of Water Resources Reconnaissance Report 58, 61 p.

Glancy, P. A., and Katzer, T. L., 1975, **Water-resources appraisal of the Carson River Basin, western Nevada:** Nevada Division of Water Resources Reconnaissance Report 59, 126 p.

Katzer, Terry, Durbin, T. J., and Maurer, D. C., 1984, **Water-resources appraisal of the Galena Creek Basin, Washoe County, Nevada**: U.S. Geological Survey Open- File Report 84-433, 59 p.

Bell, John W., and Katzer, Terry, 1984, **Quaternary tectonic history of the IXL Canyon Quadrangle, Dixie Valley, Nevada**: Geological Society of America, Abstracts with program, V. 16, No. 6., p. 442.

Bell, John W., and Katzer, Terry, 1987, **Surficial geology, hydrology, and Quaternary tectonic history of the IXL Canyon area, Nevada**: Nevada Bureau of Mines and Geology, Bulletin 102, 52 p.

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American Water Resources Association and the Hydrology Section, Arizona Nevada Academy of Science, Proceedings of Symposium; Hydrology and water resources in Arizona and the Southwest, V. 19, p. 7-18.

Brothers, K., Tracy, J., Katzer, T., Stock, M., Bentley, C., Zdon, A., and Kepper, J., 1992, **Hydrology and interactive computer modeling of ground and surface water in the lower Virgin River Valley, primarily in Clark County, Nevada:** Las Vegas Valley Water District, Cooperative Water Project, Series Report No. 1, 90 p.

Brothers, K., Katzer, T., Mojib, R. M., Grinnell, G., Bernholtz, A., and Johnson, M., 1993, **Addendum to hydrology and interactive computer modeling of ground and surface water in the lower Virgin River Valley, primarily in Clark County, Nevada**: Las Vegas Valley Water District, Cooperative Water Project, Series Report No. 1-A, 35 p.

Katzer, Terry, and Brothers, Kay, 1995, **To capture a river - water supply development of the Virgin River, Clark County, Nevada**: American Water Resources Association, Proceedings of Symposium; Water in the 21st Century, Conservation, Demand, and Supply, Salt Lake City, Utah, p. 35 - 45.

Smith, Dwight, and Katzer, Terry, 1998, **Proposed development of a supplemental water supply for the North Valleys Area of Reno, Nevada**: Nevada Water Resources Association Annual Meeting, Abstract.

Katzer, T., Leising J., Brothers, K., and Ball, George, 1998, **Hydrogeological evaluation and ground-water model of the Wadsworth-Dodge Flat area, Washoe County, Nevada:** Wateresource Consulting Engineers, Inc., Report prepared for the Town of Fernley, Nevada.

Katzer, Terry, Brothers, Kay, Cole, Erin, Donovan, David, and Johnson, Michael, 1998, **A cost-benefit analysis of artificial recharge in the Las Vegas Valley ground-water system, Clark County, Nevada**: Southern Nevada Water Authority, Las Vegas, Nevada, 39 p.

Smith, Dwight, and Katzer, Terry, 2000, **Hydrogeology of Dry Valley, Washoe County, Nevada**: Consultants report prepared for Intermountain Pipeline, LTD., Reno, Nevada, 27 p.

Katzer, T., in Las Vegas Valley Water District, 2001, **Water resources and ground-water modeling in the White River and Meadow Valley Flow Systems, Clark, Lincoln, Nye, and White Pine Counties, Nevada**: Las Vegas Valley Water District, Las Vegas, Nevada, 254 p.

Dixon, Gary and Katzer, Terry, 2002, **Geology and hydrology of the lower Virgin River Valley in Nevada, Arizona, and Utah**: Virgin Valley Water District, Mesquite, Nevada, Report VVWD-01, 126 p.

Katzer, Terry, Dixon, Gary, and Johnson Michael, 2002, **Impact analysis of water-resource development in Tule Desert, Lincoln County, Nevada on the water resources of the lower Virgin River Valley, Clark County, Nevada:** Virgin valley Water District, Report VVWD-02, 51 p.

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OTHER TECHNICAL AND ADMINISTRATIVE REPORTS

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END

February 2006

RESUME

PETER D. ROWLEY, Ph.D.

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Business Products Offered:
Geologic studies and project management relevant to real-world applications, done by a senior scientist
Reports done at deadline, written at the highest professional standards, relevant and useful to the problem at hand, and understandable whether read by the professional or the layman
Geologic mapping, any scale, Western U.S.A.
Geologic framework of ground-water flow systems and siting of production well fields
Hazard assessments, seismic potential of building sites, and pollution mitigation
Mineral-resource and geothermal-energy-resource exploration and assessment, all types
Environmental studies and assessments to satisfy Federal/State compliance requirements (NEPA, CEQA)
Technical reviews of geologic documents

Senior-Scientist Expertise:
Expert on the geology of southwestern Utah and southern Nevada
Broad regional knowledge of the geology of the western U.S.A., notably the Great Basin and other parts of the Basin and Range, as well as the Colorado Plateau and Rocky Mountains
Application of geologic knowledge to solving practical problems and questions
Structural geology, especially faults and their geophysical interpretation
Metallic and nonmetallic mineral deposits
Volcanic rocks and other igneous rocks
Ground-water flow systems and water resources
Present-day (Quaternary) sediments and landforms, including engineering implications, geomorphology of archeological sites, and potential impact of building sites by seismicity and other geologic hazards
Geologic mapping experience in Utah, Nevada, Colorado, California, Wyoming, Mount St. Helens, Antarctica, and Saudi Arabia
Dealing with the TV, radio, and print media, based on handling press conferences during the 1980 eruptions of Mount St. Helens and on other work with reporters

Education:
Ph.D. in geology (6/1968)—University of Texas at Austin (9/1964-6/1968). Dissertation: "Geology of the southern Sevier Plateau, Utah;" advisor J. Hoover Mackin
B.A. in geology (6/1964)—Carleton College, Northfield, Minnesota (9/1960-6/1964)

Current Employment:
Consulting Geologist
Geologic Mapping, Inc. (this is an S Corporation of which I am the President)
From 5/2001 to present

Work in progress—
(A) Subcontractor to Southwest Geology, Inc., Blackfoot, ID, to analyze ground-water flow, prepare a 1:250,000-scale geologic map, cross sections, structure sections, and geologic report, and to provide expert-witness testimony to provide the geologic framework for a regional ground-water flow model of, and help site production well fields in, the northern White River regional ground-water flow

system, Nevada and Utah, under funding provided by the Southern Nevada Water Authority/Las Vegas Valley Water District (1/03-present).

(B) Geologist for Robert E. McDonald, Beaver, UT, on retainer to assist with geologic mapping of the Adamsville and Cave Canyon 7.5' quadrangles (1:24,000 scale), UT and to help prepare them as digital maps for publication with the Utah Geological Survey (1/02-present).

(C) Contractor to the Utah Geological Survey, Salt Lake City, UT, to geologically map the Goldstrike and east half of the Docs Pass quadrangle (1:24,000 scale), Utah, and to assist with the geologic mapping of the St. George 30' x 60' quadrangle (1:100,000 scale), Utah, and to prepare the digital maps and text for publication with them (2-year project, 7/05-present).

(D) Subcontractor to Southwest Geology, Inc., Blackfoot, ID, to map (1:100,000 scale) the geology of the Smoke Creek Desert and parts of adjacent ranges, Nevada, for publication by the Nevada Bureau of Mines and Geology, to use the digital map and cross sections to aid hydrologists with a ground-water flow model of the basin, and to help hydrologists site a production water well field for a water-cooled power plant to be constructed there. (5/04-present).

(E) Contractor to The EXAFS Company (Farrel Lytle), Pioche, NV, to provide geological and geomorphological expertise on his project to date desert varnish and rock art by x-ray fluorescence, under funding from the Bureau of Land Management and Bureau of Reclamation (11/03-present).

(F) Hydrogeologist (expert witness) for the Mountain Valley Water Protection Association, Cedar City, UT (Carl Palmer, President; Mabey & Wright of Salt Lake City), to defend ranchers in water-poor, landslid areas of Cedar Mountain/Kolob Plateau east of Cedar City against commercial development (11/04 to present).

(G) Contractor to Ross LeBaron of Cedar City to provide advice and testimony concerning water-rights issues and well locations in the Elephant Butte area southeast of Zion National Park (9/05 to present).

Jobs completed—

(A) Contractor to the Washington County Water Conservancy District (WCWCD), St. George, Utah, to (1) provided hydrogeologic analysis, wrote 3 reports, and scheduled to do expert-witness testimony for a lawsuit by Pah Tempe Hot Springs Resort, near Hurricane, UT; settled out of court (8/05 to 1/2006); (2) in collaboration with Southwest Geology, Inc., and Terraspectra Geomatics, Las Vegas, NV, made a 1:75,000-scale digital geologic map and wrote a geological/engineering report of the 120-mile route of a possible water pipeline to bring culinary water from Lake Powell to Sand Hollow Reservoir and well field southwest of Hurricane, Utah (4/04–2/05); (3) in collaboration with Southwest Geology, Inc., Earth Knowledge LLC, Tucson, Arizona, and Terraspectra Geomatics, made 1:12,000-scale digital geologic map and potentiometric-surface maps of a 35-square-mile area and wrote a 14-p. report to site new wells at the Sand Hollow Reservoir and well field southwest of Hurricane, Utah (5-12/04); (4) analyzed and wrote a report on the reason for falling production in the town well field of Rockville, Utah, and what might be done to achieve a sustainable water supply (9/04); (5) analyzed and wrote a report on the reason for falling water tables in the rapidly growing community of Apple Valley, east of Hurricane, Utah (6-7/03); (6) analyzed and wrote a report on Sullivan's well near Leeds, Utah, a production water well drilled by WCWCD that is flowing under artesian pressure and producing more water than they had originally predicted (6-11/02); (7) provided geohydrology expertise and wrote the hydrology chapter of the Environmental Assessment for the Santa Clara Pipeline (BLM, 2002, 98 p. + appendices) from the Gunlock well field (5-11/02); and (8) analyzed the effects on Pah Tempe Hot Springs, Inc. of a WCWCD pipeline that diverts the Virgin River around the highly saline water of these hot springs (2-10/02).

(B) Contractor to the Utah Geological Survey, Salt Lake City, Utah, to (1) geologically map the Beaver 30' x 60' quadrangle (1:100,000-scale), Utah, and to prepare the digital map and text for publication with them (6/03-5/05): and (2) geologically map the Cedar City 30' x 60' quadrangle (1:100,000-scale), Utah, and to prepare the digital map and text for publication with them (6/02-5/03). Maps are being revised following technical review.

(C) Contractor to Kevin McLaws and associates to site three wells on their ranch along the North Fork of the Virgin River, just east of Zion National Park (10/05-1/06).

(D) Contractor to Trip Long and associates of Dallas concerning siting an oil well north of Enterprise, Utah. We visited it and I advised against it because it was in a volcanic vent area (2/05).

(E) Subcontractor to Kleinfelder Engineering, Park City, Utah, to site water wells for Brian Head Ski Resort (12/04). Several wells were successfully drilled.

(F) Contractor to the town of New Harmony, Utah, to write the Environmental Assessment for 40 acres of BLM land, disposed to the town (7/02-9/04). The EA was published (BLM, 2004, 55 p. + appendices), and the town has its land.

(G) Subcontractor to Southwest Geology, Inc., Blackfoot, Idaho, to analyze ground-water flow and help prepare a 1:250,000-scale digital geologic map and cross sections of the southern White River regional ground-water flow system, Nevada, Utah, and Arizona for publication by the Nevada Bureau of Mines and Geology, and to use these to help construct regional ground-water flow models, under funding provided by the Las Vegas Valley Water District/Southern Nevada Water Authority, National Park Service, and Fish and Wildlife Service (7/02-8/03). The map is in press.

(H) Subcontractor to Bullock Brothers Engineering, Cedar City, Utah, to site a production water well for a 3-square-mile housing development west of Kanarraville, Utah, where others had been unable to find sufficient water (6-9/03). The well is producing about 150 gpm, and another well was sited (but not yet drilled) in case it is needed later.

(I) Subcontractor to Anteon Inc., San Diego, on a grant from BLM to provide geohydrology advice and prepare a report on the hydrologic controls of two endangered plants in Carson Slough, near Death Valley Junction, Amargosa Desert, Nevada-California (1/02-7/03). A 65-p report was produced, and I am now looking for a publisher.

(J) Contractor to the Ely office of BLM to provide geohydrology expertise and advice for BLM staff and to provide technical review of the Environmental Impact Statement (by CH2M Hill) for the proposed Toquop Power plant, Tule Desert (NW of Mesquite), Lincoln County, Nevada (7/01-1/03). The EIS was published (BLM, 2003, 345 p. + appendices) but not enough water was granted by the Nevada State Engineer for the plant to be water cooled, so the project is in limbo.

(K) Contractor to the Colorado Geological Survey, Denver, Colorado, to geologically map about half the Cascade 7.5' quadrangle, Colorado, and to help prepare the digital map and text for publication with them (6/02-6/03). The map was published 7/04.

(L) Small contractor (Purchase Order) to the Ely office of BLM to prepare a report on the geologic controls on a newly found obsidian source for implements that was mined by Indians for thousands of years in Lincoln County, Nevada. Prepared 8-p. report (10/1-3/02).

(M) Small contractor (Purchase Order) to the Ely office of the Bureau of Land Management (BLM) to do a geomorphology assessment of archeological sites found as part of the BLM inventory of a 7200-acre congressionally-mandated sale of BLM land in Lincoln County, Nevada (Lincoln County Land Act, north of Mesquite) scheduled for disposal on 10/2001. Prepared 6-p. report (7-9/01).

(N) Contractor to Peter Levenson, New Jersey, to provide advice on ground-water availability of 40 acres that he anticipated buying as a home site just east of Cedar City. His property is on a huge landslide, so the work evolved also into geologic advice. Prepared a 7-p. report (4-6/02).

(O) Temporary employee (Physical Science Researcher III), Colorado Geological Survey, Denver, Colorado, on a 6-month detail to geologically map the Cheyenne Mountain 7.5' quadrangle, Colorado, and to prepare the digital map and text for publication with them (7-12/01). Map was published 7/04.

(P) Subcontractor to Southwest Geology, Inc., Blackfoot, Idaho, to draw cross sections for a report on the geohydrology of the White River ground-water flow system, central to southeastern Nevada, for the Las Vegas Valley Water District (5-7/01).

(Q) Subcontractor to Simon-Bymaster, Inc, Bountiful, Utah, and Gerhart Consultants, Inc., Sandy, Utah, to assist in detailed geologic mapping of the dam site of the Piute Reservoir, Piute Co., Utah. The dam is old, is cut by an active fault, and is to be relocated (5-8/01).

Previous Employment:

(1) Geology professor (full-time, temporary)
Dept. of Physical Science, Southern Utah University, Cedar City, UT
From 8/2000 to 5/2001
Courses taught: Natural Hazards, Environmental Geology, Mineralogy, Field trips to Marysvale volcanic field UT and Caliente caldera complex NV, Optical Mineralogy, Igneous Petrology

(2) Geologist
U.S. Geological Survey, Denver, CO (1970-1997), Las Vegas, NV (1997-1999), Southern Utah University, Cedar City, UT (1999-2000)
From 8/1970-8/2000. Highest grade attained, GS-15 (1981-2000)
Thirty years of experience in research, leadership, and management, mostly in four areas: (A) Co-

Project Chief (management and leadership; with G.L. Dixon), Nevada Test Site/Las Vegas Urban Corridor Project (1995-2000), a large (about 30 employees), mostly outside-funded (we built it up to about $3 million/year) project dealing both with the contamination of the Death Valley ground-water flow system by about 800 underground nuclear tests and with geology and hydrology of the fastest growing area (Las Vegas) in the country; (B) Project Chief (research and leadership) of geologic studies in many areas and mining districts in Utah and Nevada (1970-1995), including the Caliente caldera complex, NV, Delamar, Pennsylvania, Easter, and Chief mining districts, NV, Marysvale volcanic field, UT, Iron Springs mining district, UT, eastern Uinta Mountains and Uinta Basin, UT-CO, and the Black Mountains and Mineral Mountains, UT; (C) several roles dealing with the results of the 1980 eruptions of Mount St. Helens, WA, including USGS Spokesman (June 9-22, August 7, 1980) and Project Chief of research on the 1980 pyroclastic flows and other topics (1980-1982); and (D) second-in-charge (1970-71) then Field Party Leader and Project Chief (research and leadership; 1972-73, 1977-78, 1984-85, 1986-87) of remote expeditions to Antarctica (the last unexplored mountainous parts of the Earth's land surface) in which we geologically mapped about 50,000 mi^2 and then did stateside research and writing.

(3) Assistant Professor (full time, temporary)
Dept. of Geology, Carleton College, Northfield, MN
From 9/1969-7/1970
Courses taught: Mineralogy, Environmental Geology, Igneous and Metamorphic Petrology, and Structural Geology

(4) Temporary Instructor (full time, temporary)
Dept. of Geology, Kent State University, Kent, OH
From 9/1968-6/1969
Courses taught: Volcanology, Geomorphology, and Physical Geology

Other Current Affiliations and Licenses:
Emeritus Geologist, Geologic Division, USGS, Menlo Park, CA
Adjunct Professor, Southern Utah University, Cedar City, UT
State of Utah Professional Geologist License 5244263-2250 (1/02/2003-present)

Honors and Awards:
1999: Distinguished Achievement Award, for career accomplishments, Carleton Alumni Association, Carleton College, Northfield, MN
1995: Dibblee Medal, Dibblee Geological Foundation, for career accomplishments in geologic mapping and field geology (a national medal, given annually)
1972-1987: Principal Investigator of 6 National Science Foundation grants to the USGS, totaling $519,000, for field and stateside research in Antarctica
1986: Meritorius Service Award, Department of the Interior
1986: Named geographic feature: Rowley Massif, in the Black Coast of the Antarctic Peninsula
1985, 1980: Named fossils, Otazamites rowleyi (a cycad leaf), Retroceramus rowleyi (a pelecypod)
1990-present: In Who's Who in America, Who's Who in the West, Who's Who in America (Science and Engineering), International Leaders in Achievement, Men of Achievement, Who's Who in Technology, American Men and Women of Science, Dictionary of International Biography, etc.

Membership in Professional Societies
Geological Society of America (1963-present), Fellow (1979)
Colorado Scientific Society (1970-1998); Membership Chairman, 1975-77
Utah Geological Association (1973-1978, 1999-present)
Rocky Mountain Association of Geologists (1974-1998)
American Geological Institute (1970-present)
Society of Economic Geologists (1977-present)
The Antarctican Society (1978-present)
Explorers Club (1979-1985), Fellow (1979)
American Geophysical Union (1988-present)
Geological Society of Nevada (1992-present)
Association of Engineering Geologists (1997-present)

Dixie Geological Society (1999-present) (President in 2002)

Funding Agencies for Which I (or Employees I Managed) Wrote Major Reports:
U.S. Geological Survey
U.S. Department of Energy
National Park Service
Bureau of Land Management
Las Vegas Valley Water District/Southern Nevada Water Authority
Washington County Water Conservancy District
Virgin Valley Water District
Nye County, NV
Lincoln Co, NV
Nevada Bureau of Mines and Geology
Utah Geological Survey
Colorado Geological Survey
Fish and Wildlife Service

Other Contributions to the Advancement of Science:
President, Dixie Geological Society, 2002
I give many talks and lead field trips at various times to professional and avocational groups
Preparation of the geologic maps of the Brian Head and Navajo Lake, Utah 7.5' quadrangles for the National Park Service and for publication by the Utah Geological Survey
Field-trip Chairman and member of Organizing Committee, Rocky Mountain Section of the Geological Society of America Meeting in Cedar City, Utah, May 2002
Member of Organizing Committee and Co-Editor of published volume, Mackin Conference (Utah Geological Association), Cedar City, Utah, October 2001
Research on dating desert varnish with Farrel Lytle of the EXAFS Co., Pioche, NV, who with Nick Pingitore of UTEP is developing a nondestructive x-ray fluorescence method using a portable machine. His timeline needs calibration, which requires work with Quaternary geologists and cosmogenic and other dating specialists. The method would allow dating of landforms, for use in determining ages of young faults, other geologic hazards, and petroglyphs. We are working with archeologists of BLM, etc and with geologists of the Utah Geological Survey, USGS, etc. I applied for a research grant for over $450,000 from the National Science Foundation in 2001 when I was with SUU, but it was rejected. Small grants from BLM and the Bureau of Reclamation have helped Farrel and Nick so far, and we are looking into other funding sources.

Overall Publications:
I have been senior or junior author of more than 200 published refereed geologic reports and maps and more than 50 published abstracts. Publications and other details about my career before my USGS retirement in mid-2000 are given in my USGS "Research Scientist Record," which is available in hard copy or as a digital attachment upon request. It lists 177 published reports and 43 published abstracts up until January 2000, when it was last updated. Some of the more noteworthy of these are given below. My most recent publications are given in the next section.

1. Rowley, P.D., Cunningham, C.G., Steven, T.A., Workman, J.B., Anderson, J.J., and Theissen, K.M., 2002, Geologic map of the central Marysvale volcanic field, southwestern Utah: U.S. Geological Survey Geologic Investigation Series Map I-2645-A, scale 1:100,000.
2. Rowley, P.D., and Dixon, G.L., 2001, The Cenozoic evolution of the Great Basin area, U.S.A.—New interpretations based on regional geologic mapping, *in* Erskine, M.C., Faulds, J.E., Bartley, J.M., and Rowley, P.D., eds., The geologic transition, High Plateaus to Great Basin—A symposium and field guide (The Mackin Volume): Utah Geological Association Publication no. 30 and Pacific Section of the American Association of Petroleum Geologists Guidebook GB 78, p. 169-188.
3. Erskine, M.C., Faulds, J.E., Bartley, J.M., and Rowley, P.D., eds., 2001, The geologic transition, High Plateaus to Great Basin—A symposium and field guide (The Mackin Volume): Utah Geological Association Publication no. 30 and Pacific Section of the American Association of Petroleum Geologists Guidebook GB 78, 430 pp.

4. Hatfield, S.C., Rowley, P.D., Sable, E.G., Maxwell, D.J., Cox, B.V., McKell, M.D., and Kiel, D.E., 2000, Geology of Cedar Breaks National Monument, Utah, in Sprinkel, D.A., Chidsey, T.C., Jr., and Anderson, P.B., eds., Geology of Utah's parks and monuments: Utah Geological Association Publication 28, p. 139-154.
5. Slate, J.L., Berry, M.E., Rowley, P.D., Fridrich, C.J., Williams, V.S., Morgan, K.S., Workman, J.B., Young, O.D., Dixon, G.L., Swadley, W C, McKee, E.H., Ponce, D.A., Hildenbrand, T.G., Ekren, E.B., Warren, R.G., Cole, J.C., Fleck, R.J., Lanphere, M.A., Lundstrom, S.C., Grunwald, D.J., Laczniak, R.J., Menges, C.M., Yount, J.C., and Jayko, A.S., 1999, Digital geologic map of the Nevada Test Site and vicinity, Nye, Lincoln, and Clark Counties, Nevada, and Inyo County, California: U.S. Geological Survey Open-File Report 99-554-A, CD-ROM, scale 1:100,000.
6. Rowley, P.D., 1998, Cenozoic transverse zones and igneous belts in the Great Basin, western United States--Their tectonic and economic implications, *in* Faulds, J.E., and Stewart, J.H., eds., Accommodation zones and transfer zones--The regional segmentation of the Basin and Range province: Geological Society of America Special Paper 323, p. 195-228.
7. Rowley, P.D., Cunningham, C.G., Steven, T.A., Mehnert, H.H., and Naeser, C.W., 1998, Cenozoic igneous and tectonic setting of the Marysvale volcanic field and its relation to other igneous centers in Utah and Nevada, *in* Friedman, J.D., and Huffman, A.C., Jr., eds., Laccolith complexes of southeastern Utah--Time of emplacement and tectonic setting—Workshop proceedings: U.S. Geological Survey Bulletin 2158, p. 167-202.
8. Rowley, P.D., Dixon, G.L., and Steven, T.A., 1997, The value to the country of geologic mapping, in Letters: GSA Today, v. 7, no. 10, p. 17-19.
9. Rowley, P.D., Nealey, L.D., Unruh, D.M., Snee, L.W., Mehnert, H.H., Anderson, R.E., and Gromme, C.S., 1995, Stratigraphy of Miocene ash-flow tuffs in and near the Caliente caldera complex, southeastern Nevada and southwestern Utah, *in* Scott, R.B., and Swadley, WC, eds., Geologic studies in the Basin and Range-Colorado Plateau transition, southeastern Nevada, southwestern Utah, and northwestern Arizona: U.S. Geological Survey Bulletin 2056-B, p. 43-88.
10. Stout, D.L., 1995, Peter D. Rowley receives 1995 Dibblee Medal: GSA Today, v. 5, no. 8, p. 157-159.
11. Rowley, P.D., Shroba, R.R., Simonds, F.W., Burke, K.J., Axen, G.L., and Olmore, S.D., 1994, Geologic map of the Chief Mountain quadrangle, Lincoln County, Nevada: U.S. Geological Survey Geologic Quadrangle Map GQ-1731, scale 1:24,000.
12. Rowley, P.D., Kellogg, K.S., Williams, P.L., Willan, C.F.H., and Thomson, J.W., 1992, Geological map, southern Palmer Land and eastern Ellsworth Land: British Antarctic Survey Series BAS 500G, sheet 6, scale 1:500,000.
13. Rowley, P.D., Williams, P.L., and Pride, D.E., 1991, Metallic and non-metallic mineral resources of Antarctica, Chapter 18, *in* Tingey, R.J., ed., The Geology of Antarctica, Oxford monographs on geology and geophysics no. 17: Oxford, Clarendon Press, p. 617-651, 3 figs.
14. Steven, T.A., Morris, H.T., and Rowley, P.D., 1990, Geologic map of the Richfield 1° x 2° quadrangle, west-central Utah: U.S. Geological Survey Miscellaneous Investigations Series Map I-1901, scale 1:250,000.
15. Rowley, P.D., and Vennum, W.R., eds., 1988, Studies of the geology and mineral resources of the southern Antarctic Peninsula and eastern Ellsworth Land, Antarctica: U.S. Geological Survey Professional Paper 1351, 49 p.
16. Rowley, P.D., Miller, D.M., and Miller, F.K., compilers, 1986, An overview of geologic mapping needs in the United States: U.S. Geological Survey Open-File Report 86-572, 82 p.
17. Rowley, P.D., Hait, M.H., Jr., Russell-Robinson, S.L., Buchanan-Banks, J.M., and Cashman, K.V., 1986, The role of the U.S. Geological Survey in providing information to news media about the 1980 eruptions of Mount St. Helens: U.S. Geological Survey Open-File Report 86-509, 15 p.
18. Schmidt, D.L., and Rowley, P.D., 1986, Continental rifting and transform faulting along the Jurassic Transantarctic rift, Antarctica: Tectonics, V. 5, p. 279-291.
19. Rowley, P.D., MacLeod, N.S., Kuntz, M.A., and Kaplan, A.M., 1985, Proximal bedded deposits related to pyroclastic flows of May 18, 1980, Mount St. Helens, Washington: Geological Society of America Bulletin, v. 96, p. 1373-1383.
20. Rowley, P.D., Hansen, W.R., Tweto, Ogden, and Carrara, P.E., 1985, Geologic map of the Vernal 1° x 2° quadrangle, Colorado, Utah, and Wyoming: U.S. Geological Survey Miscellaneous Investigations Series Map I-1526, scale 1:250,000.

21. Steven, T.A., Rowley, P.D., and Cunningham, C.G., 1984, Calderas of the Marysvale volcanic field, west-central Utah: Journal of Geophysical Research, v. 89, no. B10, p. 8751-8764.
22. Rowley, P.D., 1983, Developments in Antarctic geology during the past half century, *in* Boardman, S.J., ed., Revolution in the earth sciences—Advances in the past half century: Dubuque, Iowa, Kendall/Hunt Publishing Co., p. 414-419.
23. Rowley, P.D., Williams, P.L., and Pride, D.E., 1983, Mineral occurrences of Antarctica, *in* Behrendt, J.C., ed., Petroleum and mineral resources of Antarctica: U.S. Geological Survey Circular 909, p. 25-49.
24. Hansen, W.R., Rowley, P.D., and Carrara, P.E., 1983, Geologic map of Dinosaur National Monument and vicinity, Utah and Colorado: U.S. Geological Survey Miscellaneous Investigations Series Map I-1407, scale 1:50,000.
25. Rowley, P.D., Kuntz, M.A., and MacLeod, N.S., 1981, Pyroclastic-flow deposits, *in* Lipman, P.W., and Mullineaux, D.R., eds., The 1980 eruptions of Mount St. Helens, Washington: U.S. Geological Survey Professional Paper 1250, p. 489-512.
26. Rowley, P.D., Steven, T.A., and Mehnert, H.H., 1981, Origin and structural implications of upper Miocene rhyolites in Kingston Canyon, Piute County, Utah: Geological Society of America Bulletin, pt. 1, v. 92, p. 590-602.
27. Rowley, P.D., Kinney, D.M., and Hansen, W.R., 1979, Geologic map of the Dinosaur Quarry quadrangle, Uintah County, Utah: U.S. Geological Survey Geologic Quadrangle Map GQ-1513, scale 1:24,000.
28. Rowley, P.D., Steven, T.A., Anderson, J.J., and Cunningham, C.G., 1979, Cenozoic stratigraphic and structural framework of southwestern Utah: U.S. Geological Survey Professional Paper 1149, 22 p.
29. Rowley, P.D., and Barker, D.S., 1978, Geology of the Iron Springs mining district, Utah, *in* Shawe, D.R., and Rowley, P.D., eds., Utah Geological Association Publication 7, p. 49-58.
30. Rowley, P.D., Lipman, P.W., Mehnert, H.H., Lindsey, D.A., and Anderson, J.J., 1978, Blue Ribbon lineament, an east-trending structural zone within the Pioche mineral belt of southwestern Utah and eastern Nevada: U.S. Geological Survey Journal of Research, v. 6, p. 175-192.
31. Lipman, P.W., Rowley, P.D., Mehnert, H.H., Evans, S.H., Jr., Nash, W.P., and Brown, F.H., 1978, Pleistocene rhyolite of the Mineral Mountains, Utah—Geothermal and archeological significance: U.S. Geological Survey Journal of Research, v. 6, p. 133-147.
32. Rowley, P.D., Williams, P.L., and Schmidt, D.L., 1977, Geology of an Upper Cretaceous copper deposit in the Andean province, Lassiter Coast, Antarctic Peninsula: U.S. Geological Survey Professional Paper 984, 36 p.
33. Anderson, J.J., Rowley, P.D., Fleck, R.J., and Nairn, A.E.M., eds., 1975, Cenozoic geology of southwestern High Plateaus of Utah: Geological Society of America Special Paper 160, 88 p.

All Publications Since 1998:

In Press

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SOUTHWEST GEOLOGY, INC.

GARY L. DIXON, Geologist

EDUCATION

B.A. in Geology – Western State College, Gunnison, Colorado, 1964-1969. Numerous courses in technical and scientific fields such as geophysical exploration, geophysical logging techniques and many administrative short courses.

MEMBERSHIP IN PROFESSIONAL SOCIETIES

Geological Society of America (1972-1997)
American Geophysical Union (1980)
Colorado Scientific Society (1970-1981)
Geological Society of Nevada (1998)
Nevada Water Resources Association (1999-present)
Nevada Geological Society (1990-present)

EXPERIENCE

United States Geological Survey
1999 – present

Scientist Emeritus: Geologic Division Regional Geologist Office, Menlo Park California. Provides scientific and technical leadership and guidance to USGS scientists and staff as needed.

Southwest Geology, Inc.
1999 – present

Consulting geologist in the southwest United States. Founder of Southwest Geology, Inc. Focus is primarily in the desert southwest specializing in geologic framework studies related to geologic hazards, the potential of ground-water resources, geologic mapping, geophysical investigations as applied to solving aforementioned framework studies, and working closely with other geosciences in solving modern urban problems. Prior to forming his own company he worked for 33 years with the United States Geological Survey. Provides consulting services to:

--Virgin Valley Water District as expert witness for the protestant in the Tule Desert water right hearings. Provides geologic and hydrogeologic expertise to the VVWD as needed.

--Southern Nevada Water Authority as an expert witness for the Three Lakes/Tikaboo water rights hearings.

--Southern Nevada Water Authority in matters of geology, geophysics, and hydrogeology as needed. Currently working on the geologic framework of the White River Flow System.

United States Geological Survey
1965-1999

Geologist: Project Chief, National Cooperative Geologic Mapping Program, Las Vegas Urban corridor Project. Coordinated 15 project scientists in the geologic mapping (1:100,000-scale geologic mapping) in the Las Vegas and Lake Mead quadrangles. The purpose of the mapping was to record the geologic, geophysical, and hydrologic history of the quadrangles before urbanization destroyed the record. The study resulted in over 50 publications, which was concluded in 1999 with the publications of the two maps. Worked closely with the Las Vegas Valley Water District, Southern Nevada Water Authority, Virgin Valley Water District, National Park Service-Lake Mead National Recreation Area, and Nevada Bureau of Mines and Geology - Las Vegas, Nevada.

Geologist: Coordinator/liaison for EPA sponsored projects in the southwest for the Geologic Division of the USGS - Las Vegas, Nevada.

Geologist: Coordinated the Geologic Division efforts in the Nevada Carbonate Aquifer Program. Principal program responsibility included providing scientific, technical, and administrative leadership to the Program participants: Water Resources Division, U.S. Bureau of Reclamation, Las Vegas Valley Water District, Nevada Bureau of Mines and Geology – Las Vegas, Nevada.

Geologist: Program Manager, Radioactive Waste Disposal at the Nevada Test Site, and assistant Branch Chief, Engineering Geology Branch, USGS – Denver, Colorado. Managed and coordinated over 40 employees that had scientific and investigative responsibilities to the Waste Disposal Program at the Nevada Test Site. Represented the USGS in interfacing with the DOE.

Geologist: Acting Branch Chief, Special Projects Branch. Supervised over 50 employees while the Branch was being disbanded and dispersed into other branches in the USGS – Denver, Colorado.

Geologist: Special Projects Branch geologist working at the Nevada Test Site starting research to identify storage sites for radioactive wastes and siting underground nuclear tests. Included geologic mapping at the Nevada Test Site and detailed geologic mapping

in Central Nevada. While in Central Nevada, supervised deep drilling (>6,000') program and bore hole geophysics in support of the drilling. Over 20 holes were drilled and logged.

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EDUCATION

Colorado School of Mines, Golden, CO

1991-1994 **Doctor of Philosophy**, Geological Engineering
Emphasis: Hydrogeology, Ground-water Modeling, and GIS
Minor: Environmental Sciences / Ecology
Thesis: *Using Geoscientific Information Systems for Three-Dimensional Modeling of Regional Ground-water Flow Systems, Death Valley Region, Nevada and California*

1989-1991 **Master of Engineering**, Geological Engineering
Emphasis: Engineering Geology and Applied Geomorphology
Thesis: *A Regional Aggregate Evaluation of Surficial Materials using a GIS*

1985-1989 **Bachelor of Science**, Geological Engineering
Emphasis: Geology and Engineering Science
Minor: Environmental Science

CONTINUING EDUCATION

Market Advantage Technologies, Inc., Durango, CO

Ongoing **Team Leadership and Business Strategy**
Coach: John Cundiff
- Over 400 hours of coaching and counseling in team leadership, business strategy, human interactions, performative speaking, negotiation, conflict management, business alliances, and market presence.

U.S. Geological Survey, Water Resources Division, Lakewood, CO

Fall 1995 **Advanced Modeling of Ground-water Flow**
Coordinator: Stan Leake (U.S. Geological Survey)
- Survey of expanded capabilities of MODFLOW; Particle tracking using MODPATH; Stream-flow routing; Rewetting of model cells; Transient leakage from confining units; Low-permeability barriers to horizontal flow; Issues of parameter estimation techniques.

Winter 1995 **Parameter Estimation for the Modular Ground-water Flow Model**
Instructor: Mary Hill (U.S. Geological Survey)
- Capabilities of MODFLOWP; Parameter estimation using non-linear regression; Least-squares estimation; Error analysis for regression solution; Analysis of residuals; Predictive uncertainty; Field examples.

PROFESSIONAL EXPERIENCE

2003-present **Principal**

Earth Knowledge, Inc., Tucson AZ

Founder and Co-owner of private consulting practice specializing in knowledge integration and decision management for the earth and environmental sciences.

Strategic Planning and Decision Management:

- Develop or review technical objectives and make recommendations for achieving scientific defensibility and organizational efficiency in earth-science based projects.
- Develop formal processes so that more responsive, confident, and reliable decisions can be made to support organizational objectives and to achieve strategic targets.
- Develop technical program strategies based on client organizational core competencies by engaging technical staff and management.

Knowledge Integration:

- Provide interdisciplinary solutions through effective and efficient integration of available data, information, and knowledge.
- Develop innovative methods to facilitate interdisciplinary collaboration and communication.
- Improve and formalize collaborative techniques for information management, analysis, and predictive simulation.
- Evaluate and implement appropriate information technology that enables access and sharing of resources that support technical investigations.

Technical Evaluation:

- Conduct technical evaluations or audits on previous or on-ongoing earth and environmental science programs.
- Determine quality and scientific defensibility of scientific programs.
- Make recommendations describing steps necessary for reaching required quality and defensibility levels.

Scientific Advising:

- Advise managers and technical staff on the most appropriate methods for multidisciplinary scientific analyses that support a comprehensive investigation or characterization program.

2001-2003 **Hydrologist**

U.S. Geological Survey, Water Resources Division, Arizona District, Tucson AZ

Project Chief, Hydrogeologic Framework of Aquifer Systems in the Desert southwestern U.S.

- Coordinated and/or supervised USGS staff and collaborating research, academic and private consulting contractors totaling over 75 interdisciplinary scientists located throughout the United States conducting geologic, hydrologic, geophysical, geomorphologic, and ecological investigations.
- Proposed, planned, organized and monitored project progress and budget.
- Coordinated integration of multidisciplinary data and interpretations for development of surface and subsurface representation of the regional 3D hydrogeologic framework of ground-water basins in the southwestern United States.
- Developed and coordinated international strategy for development of a hydrogeologic analysis and modeling enterprise.

PROFESSIONAL EXPERIENCE
(Continued)

1' `-2003 **Hydrologist**

U.S. Geological Survey, Water Resources Division, Arizona District, Tucson AZ
Principal Investigator and Technical Lead, Death Valley Regional Ground-water Flow System (DVRFS) Project

Supervisory/Management Responsibilities include:

- Coordinate and/or supervise USGS DVRFS project staff including over 50 interdisciplinary scientists located throughout the western United States conducting geologic, hydrologic, geophysical, geomorphologic, and ecological investigations.
- Propose, plan, organize and monitor project progress and budget.
- Supervise development and maintenance of 3D GIS data base for DVRFS project.
- Organize and supervise data base documentation and distribution to public through multi-media outlets.
- Coordinate inter-Divisional geologic and geophysical investigations contributing to improved understanding of geologic framework of Death Valley region.
- Coordinate integration of multidisciplinary data and interpretations for development of surface and subsurface representation of the regional 3D hydrogeologic framework.
- Design, coordinate and monitor progress of regional hydrologic investigations, including land-water-atmosphere modeling of ground-water recharge, evapotranspiration delineation and monitoring, assessment of ground-water withdrawals, and hydrochemical sampling and analysis.

Technical/Research Responsibilities include:

- Develop 3D conceptual/numerical models of ground-water flow in the Death Valley region.
- Conduct calibration, sensitivity analyses, and predictive simulations of complex 3D numerical model using inverse, parameter estimation techniques.
- Apply advanced computer visualization techniques to aid in the construction and interpretation of 3D hydrogeologic framework models.
- Present ongoing results and conclusions at international and national organizational and programmatic review meetings.
- Assist and consult with other participating scientists from national laboratories on the adaptation of the results of the 3D regional ground-water flow model for incorporation into the site saturated zone flow model for Yucca Mountain.
- Provide expert technical advice and guidance to other principal investigators for the USGS and other participants, such as Lawrence Berkeley National Laboratory, Los Alamos National Laboratory, Sandia National Laboratory, and the Nuclear Regulatory Commission on regional ground-water modeling studies.

Program Development/Outreach/Technology Transfer Responsibilities include:

- Participate in technology transfer activities, such as conducting workshops, guest lecturing, and writing proposals for and conducting collaborative investigations with other research and academic institutions, utilizing hydrogeologic framework and fluid flow modeling techniques to evaluate ground-water flow in complex geologic basins.
- Coordinate efforts with USGS Geologic Division staff to develop programs directed at evaluating Hydrogeologic Framework of the Desert Southwest of the United States on a regional and sub-regional basis.

PROFESSIONAL EXPERIENCE
(Continued)

1990-1998 **Hydrologist**

U.S. Geological Survey, Water Resources Division, Yucca Mountain Project, Denver, CO
Project Chief, Three-Dimensional (3D) Regional Hydrologic Modeling Studies

Responsibilities included:

- Developed 3D conceptual and numerical models of ground-water flow for the Death Valley flow system.
- Conducted calibration, sensitivity analyses, and predictive simulations of complex 3D numerical model using inverse, parameter estimation techniques.
- Evaluated ground-water flow path hypotheses using hydrologic and hydrochemical testing.
- Developed regional vegetation map of study area using remote sensing and GIS techniques and utilized results for quantifying regional ground-water recharge and discharge.
- Applied advanced computer visualization techniques to aid in the construction and interpretation of 3D hydrogeologic framework models.
- Conducted beta-testing and developed alternative applications techniques for GIS and geologic modeling software for various commercial vendors including Intergraph Corporation, Huntsville, Alabama; Schlumberger-GeoQuest, Houston, Texas; and Landmark Graphics, Austin, Texas; and frequently interacted with software development teams to improve software for use in hydrogeologic, geophysical and environmental applications.
- Organized and developed 3D GIS data base for regional hydrogeologic assessment including all surface and subsurface data types (geology, geomorphology, soils, vegetation, well data, climate, geophysics).
- Conducted field mapping of geology, soils, and vegetation to assess accuracy of integrated GIS data.
- Organized and conducted field work for paleohydrology and geochemistry studies, including water chemistry, isotope and micro- and macro-fauna sampling of wells, springs, and playas.
- Identified sources of data, developed data base, and documented GIS data for public use.
- Compiled and integrated USGS Digital Cartographic Data Series (DEM, DLG, land-use/land cover) data.
- Managed scanning and digitizing of manuscript maps by technician and student staff.
- Assisted and consulted with others on the adaptation of the results of the 3D regional ground-water flow model for incorporation into the site saturated zone flow model for Yucca Mountain.
- Engaged in technology transfer activities such as workshops and training courses to communicate utility of 3D ground-water modeling techniques.
- Presented ongoing results and conclusions at organizational and programmatic review meetings.
- Planned and monitored monthly project progress and budget.
- Supervised project technician staff.

PROFESSIONAL EXPERIENCE
(Continued)

S ner 1989 **Physical Science Technician (Engineering Geologist)**
U.S. Forest Service, San Juan National Forest, Engineering, Durango, CO
- Evaluated the distribution, quality and potential volume of gravel aggregate reserves and developed an engineering method of evaluation to be used in a forest-wide inventory.
- Assessed aggregate quality, engineering costs (operative scale and road networking), and environmental impacts (visual impact, reclamation potential, land-use suitability, and hillslope-failure potential) of aggregate development on special-use areas (wilderness, big-game winter-range, grazing, timber production, recreation, and private lands).
- Conducted soil survey analysis, air photo-interpretation, field geologic mapping and sampling, and evaluation of geotechnical properties of deposits.

1988-1989 **Hydrologic Technician**
U.S. Geological Survey, Water Resources Division, Denver, CO
- Assisted laboratory manager in the procurement, construction and calibration of prototype instrumentation used in unsaturated zone-rock infiltration testing.
- Prepared fractured-rock samples, collected and analyzed infiltration test and modeling data.

TEACHING EXPERIENCE

Aug 2003 **Lecturer, Geoscience Knowledge Integration**
General Training on Methodologies for Geologic Waste Disposal in North America
International Atomic Energy Agency Network of Centers of Excellence, Berkeley, CA
- Presented 4 hour lecture on approaches and tools for enabling geoscience knowledge integrations.

Feb 1997 **Guest Lecturer, Advanced Ground-water Modeling (HWR584)**
University of Arizona, Department of Hydrology and Water Resources, Tucson, AZ
- Presented lecture on parameter estimation and inverse modeling techniques.

Feb 1997 **Guest Lecturer, Parameter Estimation for the Modular Ground-water Flow Model**
U.S. Geological Survey, National Training Center, Lakewood, CO
- Presented lecture on development of MODFLOWP ground-water flow models using 3D hydrogeologic characterization packages, calibration of models, and assessment of uncertainty.

1996-1998 **Guest Lecturer, Engineering Geomorphology**
Colorado School of Mines, Department of Geology and Geological Engineering, Golden, CO
- Assisted faculty member in development of Environmental Processes and Engineering Geomorphology course, including lectures and lab exercises.
- Lectured on applied geomorphology for selected dates throughout semester.

1989-1991 **Teaching Assistant**
Colorado School of Mines, Department of Geology and Geological Engineering, Golden, CO
- Prepared and conducted lab exercises and field trips for undergraduate Physical Geology and Applied Geomorphology.
- Developed and presented senior-level engineering design problems for course in Water Well Design and Construction.

PROFESSIONAL AND STUDENT AFFILIATIONS

Tau Beta Pi, National Engineering Honor Society
Kappa Mu Epsilon, Mathematics Honor Society
CSM Association of Geoscience Students,
- Founder and President (1987-1989)
- "To further undergraduate participation in the geology and geological engineering program"
- Proposed and created new course directed at informing students of potential careers in geology and geological engineering

Association of Engineering Geologists
- Secretary-Treasurer, CSM Student Chapter (1989-1990)
- Organized annual Student Night Dinner for Rocky Mtn Chapter (1990)

Geological Society of America (1990-present)
American Geophysical Union (1994-present)

HONORS

USGS Ten-Years-of-Service Award, October 1999
USGS Quality Step-Increase, October 1996
USGS Special Achievement Award, January 1996
USGS Superior Performance Award, May 1995
USGS Special Achievement Award, June 1994
USGS Superior Performance Award, September 1993
Outstanding Graduating Senior-Geological Engineering, Colorado School of Mines, May 1989
Colorado Engineering Council Silver Medal-Colorado School of Mines, Graduation May 1989
Sun Exploration and Production Co. Scholarship, Colorado School of Mines, 1986; 1987
T.W. Nelson Scholarship, Mobil Oil Corporation, 1985
Colorado School of Mines President's Scholarship, 1985

COMPUTER INFORMATION TECHNOLOGY SKILLS

Geographic Information Systems: IDRISI, ArcGIS, and Intergraph's MGE.
Three-Dimensional Geoscientific Information Systems: Intergraph's MGVA (Voxel Analyst), Landmark's Stratamodel SGM (Stratigraphic Geocellular Modeling), and Lynx Geosystem's GMS (Geological Modeling System), Dynamic Graphics' Earthvision
Ground-water Modeling: MODFLOW, MODPATH, MODFLOWP and RANDOM WALK
Graphics, Gridding, and Contouring Packages: AUTOCAD, Microstation, SURFER and Schlumberger-GeoQuest's CPS-3.
Digital Image Processing: ILWIS, TerraMar MICROIMAGE, and Intergraph's Imagestation Imager

COMMITTEES, WORKSHOPS, SYMPOSIA ORGANIZED/CHAIRED

Co-organized a one-week workshop on "Hydrogeology of the Desert Southwest" for the USGS National Cooperative Geologic Mapping Program and USGS National Ground-water Resources Program, April 2002.

Co-organized a one-day workshop on "Integrating Geologic Data for use in Ground-water models" for the USGS National Ground-water Meeting, sponsored by the USGS, Water Resources Division, Office of Groundwater, Nov. 1-5, 1999.

Served as member of the USGS National Cooperative Geologic Mapping Program Advisory Committee to evaluate annual research proposals for Fiscal Years 2001 and 2000, August 1999 and 2000.

Co-organized and co-chaired theme session entitled "The Death Valley Hydrogeologic System", Geological Society of America 1996 Annual Meeting, Denver, Colorado, October 1996.

Co-organized Workshop on "New Research Frontiers: Three-Dimensional Subsurface Characterization" for the Third International Conference/Workshop on Integrating Geographic Information Systems and Environmental Modeling, sponsored by the National Center for Geographic and Information Analysis, at Santa Fe, New Mexico, January 21-25, 1996.

Co-organized and co-chaired theme session entitled "Leading Edge Techniques in Three-Dimensional Geologic Modeling", Geological Society of America 1994 Annual Meeting, Seattle, Washington.

PRESENTATIONS

DVRFS: The Once and Future Model, Devil's Hole Workshop, Death Valley National Park Headquarters, Death Valley, California, May 2003.

Steps Toward Global Geoscience Knowledge Integration, Briefing to the Secretary, UNESCO International Hydrological Programme and Director, UNESCO Earth Sciences Division, Paris, France, September 2002.

Development of a Universal Geoscience Business Process, Lecture to the UNESCO-IHE Institute for Water Education, Delft, The Netherlands, September 2002.

Knowledge integration and transfer, USGS Workshop on the Hydrogeology of the Desert Southwest, April 2002, Tucson, Arizona.

Uncertainty, parameter estimation, calibration of models, and managing uncertainty in subsurface characterization, European Science Foundation Conference on New Paradigms for the Prediction of Subsurface Conditions, Characterization of the Shallow Subsurface: Implications for Urban Infrastructure and Environmental Assessment, Sol Cress Conference Center, Spa, Belgium, July 7 – 12, 2001. **(INVITED KEYNOTE)**.

nal geo-data requirements – a North American perspective, European Science Foundation Conference on New Paradigms for the Prediction of Subsurface Conditions, Characterization of the Shallow Subsurface: Implications for Urban Infrastructure and Environmental Assessment, Sol Cress Conference Center, Spa, Belgium, July 7 – 12, 2001. **(INVITED)**.

PRESENTATIONS
(Continued)

Characterizing complex hydrogeologic basins in desert regions of the southwestern U.S.: Past successe present limitations, and future needs, Lecture to the British Geological Survey, Keyworth, U.K., March 2001.

Scientific challenges for hydrogeologic investigations in the Great Basin, U.S.A., Lecture to the International Institute for Geo-Information Science and Earth Observation (ITC), Enschede, The Netherlands, March 2001.

A work plan for hydrogeologic investigations in the southwestern United States, Briefing to Netherlands Institute of Applied Geoscience TNO – National Geological Survey, Delft, The Netherlands, March 2001.

Modeling of complex hydrogeologic systems, Lecture to University Hydrogeology Class, Technical University, Delft, The Netherlands, March 2001. **(INVITED)**.

Three-dimensional modeling of complex hydrogeologic systems in the desert southwestern United States, Modeling for Management, Symposium, Technical University, Delft, The Netherlands, May 2000. **(INVITED)**.

Status of investigations for the Death Valley regional ground-water flow system (DVRFS) project, DVRFS Stakeholders Technical Exchange Workshop, Beatty, Nevada, November 16-18, 1999.

Use of inverse modeling for calibrating complex geologically-based ground-water flow models, Paramete estimation techniques workshop at the USGS National Ground-water Meeting, sponsored by the USGS, Water Resources Division, Office of Groundwater, Nov. 1-5, 1999 **(INVITED)**.

Status of investigations for the Death Valley regional ground-water flow system (DVRFS) project, DVRFS Stakeholders Technical Exchange Workshop, Amargosa Valley, Nevada, May 24-26, 1999.

An integrated ground-water modeling program for the Death Valley region, Nevada and California, Water in the Deserts: Past, Present and Future, Southern California Academy of Science Symposium, Fullerton, California, April 30, 1999 **(INVITED)**.

Death Valley ground-water model: calibration vs. geologic conceptual model testing, Status of Geologic Research and Mapping in Death Valley National Park, Las Vegas, Nevada, April 9-11, 1999 **(INVITED KEYNOTE)**.

Requirements for reducing uncertainty in the DOE regional ground-water flow models of the Death Valley region, Nevada and California, Nevada Test Site Community Advisory Board Meeting, October 1998 **(INVITED)**.

A regional ground-water model as a water-resource management tool, Devil's Hole Workshop, Stateline, Nevada, March 1998.

Comparison of the Yucca Mountain and Nevada Test Site Underground Testing Areas regional ground-wate flow models, Yucca Mountain Site Characterization Senior Staff Meeting, Office of Civilian Radioactive Waste Management, Las Vegas, Nevada, October 1997 **(INVITED)**.

PRESENTATIONS
(Continued)

L h Valley regional flow model calibration using optimal parameter estimation methods and geoscientific information systems, University of Arizona, Department of Hydrology and Water Resources Weekly Hydrology Seminar Series, August 27, 1997.

Limitations in regional saturated-zone ground-water modeling, Yucca Mountain Saturated-Zone Expert Elicitation Panel Program Review, Las Vegas, Nevada, August 21, 1997.

Utilizing the Death Valley regional ground-water flow model to assess uncertainty in our knowledge of the system, Devil's Hole Workshop, Stateline, Nevada, April 7-8,1997 **(INVITED)**.

Use of commercial products for developing hydrogeologic framework and numerical ground-water flow models, USGS Ground-water Modeling Workshop, Denver, Colorado, March 18-20, 1997.

Use of hydrogeologic framework modeling techniques and optimal parameter estimation methods for modeling of complex ground-water flow systems, USGS District Ground-water Specialists Meetings, Northeast and Southeast Regions: Orlando, Florida, January 28-30, 1997; Central and Western Regions: Menlo Park, California, February 11-13, 1997.

Regional 3D ground-water flow model of the Death Valley basin, Nuclear Waste Technical Review Board Meeting, January 20-21, 1997 **(INVITED)**.

Results of the USGS Death Valley 3D regional ground-water flow model, Devil's Hole Workshop, Death Valley National Park Headquarters, Death Valley, California, May 8-9, 1996 **(INVITED).**

A progress report on modeling the Death Valley regional ground-water flow system, Devil's Hole Workshop participants, Desert Research Institute, Las Vegas, Nevada, April 24, 1995 **(INVITED).**

Considerations for 3D regional hydrological modeling using geoscientific information systems, TNO, Delft, The Netherlands, June 1992.

Design and development of a 3D data base for regional hydrogeological modeling, Time-Space Modeling of Bounded Natural Domains workshop, sponsored by the European Science Foundation at Lucca, Italy, June 1992.

PUBLICATIONS

Journal Articles /Book Chapters:

Tiedeman, C.R., Hill, M.C., **D'Agnese, F.A.**, and Faunt, C.C., in press, Methods for using ground-water model predictions to guide hydrogeologic data collection, with application to the Death Valley regional ground-water flow system: Water Resources Research.

D'Agnese, F.A. and O'Brien, G.M., 2003. Impact of geoinformatics on the emerging Geoscience Knowledge Integration Paradigm. In: Rosenbaum, M.S. and Turner, A.K. (Eds.) Characterisation of the Shallow Subsurface: Implications for Urban Infrastructure and Environmental Assessment. Springer-Verlag, Düsseldorf. 000-000. **(INVITED)**.

D'Agnese, F.A., Faunt, C.C., Hill, M.C., and Turner, A.K., 1999, Death Valley regional ground-water flow model calibration using optimal parameter estimation methods and geoscientific information systems: Advances in Water Resources, Vol. 22, No. 8, pp. 777-790, **(INVITED)**.

D'Agnese, F.A., Faunt, C.C., and Turner, A.K., (USGS approved), An assessment of vegetation distributions in the Death Valley region, Nevada and California, using remote sensing and GIS techniques: (outlet pending).

Leavesley, G.H., Turner, A.K., **D'Agnese, F.A.**, and McKnight, D., 1997, Regional delineation of North America for the assessment of freshwater ecosystems and climate change: Hydrologic Processes, Vol. 11, pp.819-824.

D'Agnese, F.A., Turner, A.K., and Faunt, C.C., 1996, Using geoscientific information systems for three-dimensional regional ground-water flow modeling in the Death Valley Region, Nevada and California: *in* GIS and Environmental Modeling: Progress and Research Issues (M. F. Goodchild, L.T. Steyaert, and B.O. Parks, eds), GIS World Books, Fort Collins, Colorado, pp. 265-270.

U.S. Geological Survey Reports:

D'Agnese, F.A., O'Brien, G.M., Faunt, C.C., Belcher, W.R., and San Juan, C.A., 2002, A three-dimensional numerical ground-water flow model of predevelopment conditions in the Death Valley regional ground-water flow system, Nevada and California: U.S. Geological Survey Water Resources Investigations Report 02-4102.

Belcher, W.R., Faunt, C.C., and **D'Agnese, F.A.**, 2002, Three-dimensional hydrogeologic framework model for use with a steady-state numerical ground-water flow model of the Death Valley regional flow system, Nevada and California: U.S. Geological Survey Water Resources Investigations Report 01-4254, 97 p.

Hill, M.C , Ely, D.M. , Tiedeman, C.R., O'Brien G.M., **D'Agnese, F.A.**, and Faunt, C.C., 2000, Preliminary evaluation of the importance of existing hydraulic-head observation locations to advective transport predictions, Death Valley Regional Flow System, California and Nevada: U.S. Geological survey Water-Resources Investigations Report 00-4282, 62 p.

D'Agnese, F.A., and Faunt, C.C., 1999, The Death Valley regional ground-water flow system (DVRFS) model - Calibration versus hydrogeologic model testing in Slate, J.L., ed., Proceedings of Conference on Status of Geologic Research and Mapping in Death Valley National Park, Las Vegas, Nevada, April 9-11, 1999: U.S. Geological Survey Open-File Report 99-153, p. 52.

Faunt, C.C., W.R. Belcher, and **F.A. D'Agnese**, 1999, Using geologic data for a three-dimensional hydrogeologic framework model of the Death Valley region, in Slate, J.L., ed., Proceedings of Conference on Status of Geologic Research and Mapping in Death Valley National Park, Las Vegas, Nevada, April 9-11, 1999: U.S. Geological Survey Open-File Report 99-153, pp. 59-60.

D'Agnese, F.A., O'Brien, G.M., Faunt, C.C., and San Juan, C.A., 1999, Simulated effects of climate change on the Deat' Valley regional ground-water flow system, Nevada and California: U.S. Geological Survey Water Resources Investigations Report 98-4041.

PUBLICATIONS
(Continued)

I ,nese, F.A., Faunt, C.C., and Turner, A.K., 1998, An estimated potentiometric-surface of the Death Valley region, Nevada and California, developed using geographic information system and automated interpolation techniques: U.S. Geological Survey Water Resources Investigations Report 97-4052.

D'Agnese, F.A., Faunt, C.C., Turner, A.K., and Hill, M.C., 1997, Hydrogeologic evaluation and numerical simulation of the Death Valley regional ground-water flow system, Nevada and California: U.S. Geological Survey Water Resources Investigations Report 96-4300.

Faunt, C.C., **D'Agnese, F.A.,** and Turner, A.K., 1997, A hydrogeologic map of the Death Valley region, Nevada and California, developed using GIS techniques: U.S. Geological Survey Water Resources Investigations Report 95-4016.

Luckey, Richard R., Tucci, Patrick, Faunt, Claudia C., Ervin, Elisabeth M., Steinkampf, William C., **D'Agnese, Frank A.,** Patterson, Gary L., 1996, Status of understanding of the saturated-zone ground-water flow system at Yucca Mountain, Nevada, as of 1995: U.S. Geological Survey Water Resources Investigations Report 96-4077, p. 71.

Turner, A.K, **D'Agnese, F.A.,** and Faunt, C.C., 1996, Digital elevation model (DEM) file of the topographic elevations for the Death Valley region of the southern Nevada and southeastern California processed from U.S. Geological Survey 1-degree Digital Elevation Model files: U.S. Geological Survey Open-File Report 95-287 (A).

Turner, A.K, **D'Agnese, F.A.,** and Faunt, C.C., 1996, Digital hydrographic (DLG), land-use cover, and hydrologic unit code files for the Death Valley region, southern Nevada and southeastern California processed from U.S. Geological Survey 1:100,000- and 1:250,000-scale digital data files: U.S. Geological Survey Open-File Report 95-287 (B).

D'Agnese, F.A., Faunt, C.C., and Turner, A.K., 1995, Preliminary digital geologic maps of the Mariposa, Kingman, Trona, and Death Valley Sheets, California: U.S. Geological Survey Open-File Report 94-318, 29 p.

Conference Proceedings:

Tiedeman, C.R., Hill, M.C., **D'Agnese, F.A.,** and Faunt, C.C., 2001, Using ground-water model predictions to guide hydrogeologic data collection: MODFLOW-2001 and other modeling odysseys Conference Proceedings, eds. H.S. Seo, E. Poeter, C. Zheng, and O. Poeter, p. 195-201.

Hill, M.C., **D'Agnese, F.A.,** and Faunt, C.C., 1999, Guidelines for model calibration and application to simulation of flow in the Death Valley regional ground-water system: *in* Fritz Stauffer, Wolfgang Kinzelbach, Karel Kovar, and E. Hoehn, eds, Proceedings of the 1999 Model CARE Conference, Zurich, Switzerland, September, 1999, volume I, p.179-188 **(INVITED)**.

D'Agnese, F.A., Faunt, C.C., Hill, M.C., and Turner, A.K., 1996, Death Valley regional ground-water flow model calibration using optimal parameter estimation methods and geoscientific information systems: Calibration and Reliability in Ground-water Modelling, Proceedings of the ModelCARE 96 Conference held at Golden, Colorado, September 1996, IAHS Publication no. 237, 1996.

D'Agnese, F.A., Faunt, C.C., and Turner, A.K., 1996, Using remote sensing and GIS techniques to estimate discharge and recharge fluxes for the Death Valley regional ground-water flow system, Nevada and California, USA: HydroGIS '96: Application of Geographic Information Systems in Hydrology and Water Resources Management, Proceedings of the Vienna Conference, April 1996, IAHS Publication no. 235, 1996.

PUBLICATIONS
(Continued)

D'Agnese, F.A., Turner, A.K., and Faunt, C.C., 1996, Using geoscientific information systems for three-dimension. regional ground-water flow modeling in the Death Valley Region, Nevada and California: Proceedings International Conference/Workshop on Integrating Geographic Information Systems and Environmental Modeling, September 26-30, 1993, Breckenridge, Colorado.

Turner, A. Keith, **D'Agnese, Frank A.**, Faunt, Claudia C., 1994, Use of three dimensional geoscientific information systems for data integration and visualization in support of regional hydrogeological studies: *in* 5th international conference on geoscience information, June 20-23, 1994, (Hruska, J., editor), Geofond of the Czech Republic, Prague, Czech Republic, Vol. 5, p. 47.

Faunt, C.C., **D'Agnese, F.A.**, Downey, J.S., and Turner, A.K., 1993, Characterizing the hydrogeologic framework of the Death Valley Region, southern Nevada-California, USA: High-Level Radioactive Waste Management, Proceedings of the Fourth Annual International Conference, Las Vegas, Nevada, April 1993, pp. 1194-1199.

Faunt, C.C., **D'Agnese, F.A.**, and Turner, A.K., 1993, Development of three-dimensional hydrogeologic framework model for the Death Valley Region, southern Nevada-California, USA: HydroGIS '93: Application of Geographic Information Systems in Hydrology and Water Resources, Proceedings of the Vienna Conference, April 1993, IAHS Publication No. 211, pp. 227-234.

Faunt, C.C., **D'Agnese, F.A.**, Downey, J.S., and Turner, A.K., 1993, Geoscientific information systems and 3D hydrogeologic models for the Yucca Mountain area, southern Nevada-California, USA: Waste Management '93, Proceedings of the Symposium on Waste Management at Tucson, Arizona, February 28 - March 4, 1993, pp.1317-1320.

Abstracts:

D'Agnese, F.A. and O'Brien, G.M., 2002, Impact of geoinformatics on the integration of geoscience knowledge: Geological Society of America Abstracts with Programs, vol. 34, no. 6, October 2002, p. 224. **(INVITED)**.

O'Brien, G.M., **D'Agnese, F.A.**, and Nasser, K.H., 2002, An infrastructure and protocols to enable geoscience knowledge integration: Geological Society of America Abstracts with Programs, vol. 34, no. 6, October 2002, p. 224.

Lagueux, F., Nasser, K.H., O'Brien, G.M., and **D'Agnese, F.A.**, 2002, An enterprise system to enable geoscience knowledge integration: Geological Society of America Abstracts with Programs, vol. 34, no. 6, October 2002, p. 225.

Anning, D.W., **D'Agnese, F.A.**, Konieczki, A.D., Leake, S.A., Monical, J.E., O'Brien, G.M., and Rees, J.A.H., 2002, Hydrogeologic classification of basins in the Basin and Range physiographic province of the western United States: Geological Society of America Abstracts with Programs, vol. 34, no. 6, October 2002, p. 392-393.

O'Brien, G.M., **D'Agnese, F.A.**, Turner, A.K., Nasser, K.H., 2002, Role of geoinformatics in the geoscience-business process: Proceedings of the International Association of Mathematical Geology, Annual Meeting 2002, Berlin Germany.

Belcher, W.R., Faunt, C.C., **D'Agnese, F.A.**, 2002, Three-dimensional hydrogeologic framework for use with a steady-state numeric ground-water flow model of the Death Valley regional flow system, Nevada and California, Abstracts of Technical Presentations, Nevada Water Resources Association Annual Conference, February 27 – 28, 2002, Las Vegas, Nevada, p. 20.

O'Brien, G.M., **D'Agnese, F.A.**, Faunt, C.C., and Belcher, W.R., 2000, Effective model calibration for the geologicall' complex Death Valley regional ground-water flow system, Nevada and California (abs.): EOS, Transactions, American Geophysical Union, 2000 Fall Meeting, San Francisco, California, Vol. 81, No. 48, November 28, 2000, p.426.

PUBLICATIONS
(Continued)

I ;nese, F.A., 2000, The Death Valley regional ground-water flow system (DVRFS): increasingly complex problems, increasingly complex models, (abs.): Geological Society of America Abstracts with Programs, Vol. 32, No. 7, 2000 Annual Meeting, Reno, Nevada, p. 337. (**INVITED**).

Belcher, W.R., Faunt, C.C., **D'Agnese, F.A.**, and Sweetkind, D.S., 2000, Integration, management, and processing of hydrogeologic data using a digital three-dimensional hydrogeologic framework model of the Death Valley regional ground-water flow system, (abs.): Geological Society of America Abstracts with Programs, Vol. 32, No. 7, 2000 Annual Meeting, Reno, Nevada, p. 338.

O'Brien, G.M., **D'Agnese, F.A.**, Faunt, C.C., and Belcher, W.R., 2000, Hydrogeologic data, parameter estimation, and the Death Valley regional ground-water flow model (abs.): Geological Society of America Abstracts with Programs, Vol. 32, No.7, 2000 Annual Meeting, Reno, Nevada, p. 338.

D'Agnese, F.A., 2000, Hydrogeology in the Great Basin: merging ideas with emerging technologies, (abs.): Geological Society of America Abstracts with Programs, Vol. 32, No. 7, 2000 Annual Meeting, Reno, Nevada, p. 503. (**INVITED**).

Tiedeman, C.R. Hill, M.C., **D'Agnese, F.A.**, and Faunt, C.C., 1999, Assessment of uncertainty in advective travel paths predicted by the Death Valley regional ground-water flow model, Nevada and California: American Geophysical Union EOS Transactions, vol. 80, no. 46, p. F317.

Faunt, C.C., and **D'Agnese, Frank A.**, 1999, Hydrogeologic-framework and ground-water flow models of the Death Valley region, Nevada and California, (abs.): Geological Society of America Abstracts with Programs, Vol. 31, No. 7, 1999 Annual Meeting, Denver, Colorado, p. 86. (**INVITED**).

Hc.esi, Joseph A., Flint, Alan L., Flint, Lorraine E., **D'Agnese, Frank A.**, and Faunt, C.C., 1999, Application of watershed modeling for estimation of spatially and temporally distributed recharge, (abs.): Geological Society of America Abstracts with Programs, Vol. 31, No. 7, 1999 Annual Meeting, Denver, Colorado, p. 87.

Sweetkind, D.S., Faunt, C.C., Belcher, W., **D'Agnese, Frank A.**, and Potter, C.J., 1999, Complex geology and hydrology demand a complex flow model: the Death Valley regional flow system (DVRFS), Nevada and California, (abs.): Geological Society of America Abstracts with Programs, Vol. 31, No. 7, 1999 Annual Meeting, Denver, Colorado, p. 288.

Faunt, C.C., Belcher, W., **D'Agnese, Frank A.**, Sweetkind, D.S., Hill, M.C., and Potter, C.J., 1999, Geologic detail appropriate for modeling the Death Valley regional ground-water flow system (DVRFS), Nevada and California, (abs.): Geological Society of America Abstracts with Programs, Vol. 31, No. 7, 1999 Annual Meeting, Denver, Colorado, p. 288.

D'Agnese, Frank A., Faunt, C.C., Belcher, W., Sweetkind, D.S., Hill, M.C., and Potter, C.J., 1999, Complexity in the Death Valley regional flow system (DVRFS) model: justifying the geology, (abs.): Geological Society of America Abstracts with Programs, Vol. 31, No. 7, 1999 Annual Meeting, Denver, Colorado, pp. 288-289.

Belcher, W., Faunt, C.C., **D'Agnese, Frank A.**, and Sweetkind, D.S., 1999, Using geologic data for constructing a digital three-dimensional hydrogeologic framework model of the Death Valley region, Nevada and California, (abs.): Geological Society of America Abstracts with Programs, Vol. 31, No. 7, 1999 Annual Meeting, Denver, Colorado, pp. 346-347.

C en, G.M., Jones, M.L., and **D'Agnese, Frank A.**, 1999, An assessment of water-level observation accuracy for use in calibration of the Death Valley regional flow system (DVRFS) model, Nevada and California, (abs.): Geological Society of America Abstracts with Programs, Vol. 31, No. 7, 1999 Annual Meeting, Denver, Colorado, p. 289.

PUBLICATIONS
(Continued)

D'Agnese, F.A., and Faunt, C.C., 1999, Evaluating the significance of hydrogeologic complexity in the Death Valle region, Nevada and California, (abs.): EOS, Transactions, American Geophysical Union, 1999 Fall Meeting, San Francisco, California, Vol. 80, No. 46, December 13-17, 1999, p.317 **(INVITED)**.

Tiedeman, C.R., Hill, M.C., **D'Agnese, F.A.**, and Faunt, C.C., 1999, Assessment of uncertainty in advective travel paths predicted by the Death Valley regional ground-water flow model, Nevada and California, (abs.): EOS, Transactions, American Geophysical Union, 1999 Fall Meeting, San Francisco, California, Vol. 80, No. 46, December 13-17, 1999, p.317.

D'Agnese, F.A., Faunt, C.C., and Hill, M.C., 1997, Conceptual model testing and calibration of a regional ground-water flow model for the Death Valley region, Nevada and California, (abs.): EOS, Transactions, American Geophysical Union, 1997 Fall Meeting, San Francisco, California.

Hill, Mary C., **D'Agnese, Frank A.**, Barlebo, Heidi C., 1996, Physics, geology, hydrology, and effective-value inverse modeling of complex ground-water systems, (abs.): EOS, Transactions, American Geophysical Union, 1996 Fall Meeting, San Francisco, California, Vol. 77, No. 46, December 15-19, 1996, p. 221.

Hill, Mary C., **D'Agnese, Frank A.**, Barlebo, Heidi Christiansen, 1996, Physics, geology, hydrology, and effective-value inverse modeling of complex ground-water systems, (abs.): Geological Society of America Abstracts with Programs, Vol. 28, No. 7, 1996 Annual Meeting, Denver, Colorado, p. 388.

D'Agnese, F.A., Faunt, C.C., and Turner, A.K., 1994, Development of a regional potentiometric-surface map using interactive gridding and geographic information system techniques, Death Valley, California and Nevada (abs.): Geological Society of America Abstracts with Programs, Vol. 26, No. 7, 1994, Annual Meeting, Seattle Washington, p. 80.

Faunt, C.C., **D'Agnese, F.A.**, and Turner, A.K., 1994, Characterization of the three-dimensional hydrogeologic framework of the Death Valley region, Nevada and California (abs.): Geological Society of America Abstracts with Programs, Vol. 26, No. 7, 1994, Annual Meeting, Seattle, Washington, p. 81.

Turner, A. Keith, Faunt, Claudia C., **D'Agnese, Frank A.**, 1994, Developing a three-dimensional hydrogeologic model: *in* U.S. Geological Survey scientific visualization workshop; New Orleans, Louisiana, April 11-12, 1994; program and abstracts (Lebing, Gerry, Brown, Diana C., MacDonald, Richard A., eds): U.S. Geological Survey Open-File Report 94-0001, p. 26-28.

Faunt, C.C., **D'Agnese, F.A.**, Downey, J.S., and Turner, A.K., 1992, Development of three-dimensional hydrogeologic framework model for the Death Valley Region, southern Nevada-California, (abs.): EOS, Transactions, American Geophysical Union, 1992 Fall Meeting, San Francisco, California, Vol. 73, No. 43, October 27, 1992, p 189.

D'Agnese, F.A., and Kolm, K.E., 1991, A regional aggregate evaluation of surficial materials using a geographic information system (abs): Geological Society of America, Abstracts with Programs, Vol. 23, No. 5, 1991 Annual Meeting, San Diego, California, p A40.

Dwight L. Smith, P.E., R.G.

Principal Hydrogeologist

Education

M.S. - Hydrogeology, University of Nevada, Reno, 1996
B.S. - Geological Engineering, Colorado School of Mines, 1988

Professional Registration

P.E. - Professional Geological Engineer in Nevada, PE No. 11906
H.G. - Certified Hydrogeologist in California, HG No. 194
R.G. - Registered Geologist in California and Arizona, RG No. 5974 and 28482
W.R.S. -Water Right Surveyor in Nevada, WRS No. 1045
Formerly Registered as a C.E.M. (Certified Environmental Manager) in Nevada

Employment Summary

2002-Present:	Principal Hydrogeologist, InterFlow Hydrology, Inc., Truckee, CA
2001-2002:	Senior Associate, Kennedy/Jenks Consultants, Reno, Nevada
1998-2001:	Associate Hydrogeologist, Stantec Consulting, Inc., Reno, Nevada
1995-1998:	Senior Hydrogeologist, Stantec Consulting, Inc. (formerly SEA, Inc.)
1990-1995:	Hydrogeologist, SEA, Inc, Reno, Nevada
1988-1990:	Hydrogeologist, Ron Barto & Associates, Big Bear Lake, CA

Professional Summary

Mr. Smith has 18 years of experience as a consulting hydrogeologist, specializing in ground water resources evaluations in the Western U.S., primarily in Nevada and California.

His professional experience includes: water resources development feasibility, groundwater resources management, regional aquifer and watershed assessments, groundwater recharge and sustainability evaluations, well design and pumping assessments, water rights surveying and research, design of dewatering systems, geochemical evaluations to assess sources of water, computer-aided groundwater flow modeling, stream flow gaging, stream and groundwater interaction studies, spring evaluations, water quality management plans, and environmental impact evaluations.

Mr. Smith has consulted to a wide range of clients, including municipalities, city, county, state and federal agencies, regional water authorities, private industries including power, mining and manufacturing, resort and recreational developments, commercial and residential establishments, private land trusts, and to other civil, geotechnical, and environmental engineering firms.

Professional Affiliations

- **International Association of Hydrogeologists**
- **National Ground Water Association – Association of Groundwater Scientists and Engineers**
- **American Water Works Association**
- **Association of Engineering Geologists** – *Former National Board of Directors, Section Board of Directors, and Great Basin Section Chair.*
- **Nevada Water Resources Association** – *Former Annual Conference Committees, and Well Construction Seminar Chairman.*
- **Consulting Engineers Council of Nevada** – *Former Participant and Environmental Subcommittee Chair.*

Publications

Smith, D.L., Johnson, J., Kistinger, G., and Donovan, D., Burns, A., 2004, "**Climate and Barometric Pressure Influences on Pederson Spring Discharge and the Carbonate Aquifer near the Muddy Springs, Southern Nevada".** Journal of the Nevada Water Resources Association, Fall 2004, Vol. 1, No. 1, pp. 76 – 103.

Smith, D.L., Johnson, J., Kistinger, G., and Donovan, D., 2004, "**Implications of Barometric Pressure and EH-5B Water Levels to Discharge of Pederson Spring, Clark County, Nevada**". Abstract and presentation at the 2004 NWRA Nevada Water Conference.

Smith, D.L., Albright, C.A., and Smitherman, J., 2003, "**Availability of Decreed Truckee River Water Rights and Projections of Future Water Demands in the Truckee Meadows Area, Southern Washoe County, Nevada**". Abstract and presentation for the 2003 NWRA Nevada Water Conference.

Johnson, J., Smith, D.L., and Katzer T., 2002, "**Regional Carbonate Aquifer - A Hypothesis of Terminal Ground Water Outflow to the Colorado River**". Abstract and presentation made at the 2002 NWRA Annual Nevada Water Conference.

Smith, D.L. and Guitjens, J.C., 1999, "**Characterization of Urban Surfacing Ground Water in Northwest Henderson, Clark County, Nevada**". Environmental and Engineering Geosciences, Joint Publication of Association of Engineering Geologist and Geological Society of America (Winter 1998-1999).

Smith, D.L. and Katzer, T., 1998, "**Lemmon Valley Water Resources Project - Marshall Ranch Alternative, Proposed Development of a Supplemental Water Supply for the North Valleys Area of Reno**". Abstract and presentation made at the 1998 NWRA Nevada Water Conference.

Smith, D.L. and Guitjens, J.C., 1996, "**Shallow and Surfacing Ground water in an Arid Urban Environment**". Proceedings of the ASCE North American Water and Water Environment Congress of 1996.

A representative portion of Mr. Smith's professional experience is presented below.

Basin-Scale Hydrogeologic Studies

- *Basin-fill and Regional Potentiometric Water-Level Assessment for over 30 Hydrographic Basins in Eastern and Central Nevada and Western Utah - Southern Nevada Water Authority*
- *Smoke Creek Desert, Washoe County - Ground Water and Surface Water Resource Evaluations, Exploration Drilling, Regional Aquifer Testing, Basin Water Balance, Aqueous Chemistry, and Numeric Flow Modeling, Northwestern Nevada – Sempra Power Generation*
- *Hydrogeologic Evaluations of Tikaboo and Three Lakes Valley - Southern Nevada Water Authority*
- *Hydrologic Evaluations of Muddy Springs and Regional Carbonate Aquifer, South-central Nevada - Southern Nevada Water Authority*
- *Martis Valley Ground Water Recharge and Perennial Yield Assessment, Placer and Nevada Counties, California*
- *Shallow and Surfacing Ground Water Evaluations, Regional Monitoring Well Network, and Aqueous Geochemistry Assessments – City of Henderson, Nevada*
- *Coyote Spring Valley and Associated Regional Carbonate Aquifer Interpretations, Southern Nevada, Coyote Springs Investments*
- *Hydrogeology of the Dry Valley, Washoe County, Nevada*
- *Hydrogeology of the Bedell Flat, Washoe County, Nevada*
- *Hydrogeology of the Cabazon Basin, Southern California*
- *Sierra Highlands Water Resources Development Potential, Portola, California*
- *Multi-Basin Water Supply Feasibility Review, Northeastern Nevada - Coastal Power Company*
- *Potential for Land Subsidence from Water Level Declines, Wickenberg, Arizona - Toyota Testing Facility*
- *Hydrogeologic Evaluation and Test Well Program for Hamilton Ranch, California*

Surface Water Studies

- *Martis Valley Surface Water & Ground Water Interaction Study, Tributaries to the Upper Truckee River, Placer and Nevada Counties, California*
- *Ophir Lake Project, Surface Water Resources and Potential for Artificial Recharge, Washoe Valley, Nevada*
- *Warm Spring Creek, Spring and Stream Gaging, and Feasibility of Artificial Recharge, Washoe County, Nevada*
- *Hamilton Canyon Dam Feasibility, Sonoma County, California*
- *Galena Creek Surface Water Diversion – Infiltration Collector, Montreux Development, Washoe County, Nevada*
- *Infiltration Gallery Assessment near the Truckee River, Kal Kan Foods, Storey County, Nevada*
- *Duck Lake Valley, Reconnaissance Surface Water Resources Assessment, Washoe County, Nevada*

Numeric Groundwater Flow Modeling

- *MODFLOW Numeric Flow Modeling of the Lower Virgin River Aquifer System - Southern Nevada Water Authority*
- *MODFLOW Numeric Ground-Water Flow Modeling of Bedell Flat, Washoe County, Nevada - Intermountain Water Supply, LTD*
- *MODFLOW Numeric Flow Modeling of Dry Valley, Washoe County, Nevada - Intermountain Water Supply, LTD*
- *MODFLOW Numeric Modeling and Design of Temporary Dewatering Facilities, Pioneer Meadows, Sparks, Nevada*
- *Herlong Utility Coop, Honey Lake Valley, California - Professional Peer Review of a MODFLOW Ground Water Model*
- *MODFLOW Simulation of the Effects of Artificial Recharge in Warm Springs Valley, Washoe County, Nevada, - Intermountain Water Supply, LTD*
- *Hassayampa Wash Sub-Basin, Arizona, Professional Peer Review of a MODFLOW Model*
- *MODFLOW Aggregate Pit Dewatering Model, Lower Truckee River, Washoe County, Nevada*
- *Stampmill Estates MODFLOW Modeling for Water Quality Management, Wadsworth, Nevada*
- *Steamboat Creek Drop Structure Seepage and Hydrostatic Uplift Analysis (SEEP2D) - Washoe County Regional Transportation Commission*

Well Drilling, Design and Testing

- *Dry Valley Test Well Program, Washoe County, Nevada*
- *Smoke Creek Desert Exploration Drilling and Test Well Program, Washoe County, Nevada*
- *Mt. Rose Ski Area Well Development Program, Lake Tahoe, Nevada*
- *Alpine Springs County Water District, Evaluation of Horizontal Wells, Placer County, California*
- *Pine Ridge Exploration and Production Well Drilling and Testing, Portola, California*
- *Gold Mountain Well Performance Evaluations, Portola, California*
- *Incline Village General Improvement District, Exploration Well Program, Lake Tahoe, Nevada*
- *Community of Coto de Caza, California, Ground Water Development, Well Fields, and Aquifer Testing*
- *Kaiser Micromill Well Construction and Aquifer Testing, Storey County, Nevada*
- *Kal Kan Dry Food Well Construction and Aquifer Testing, Washoe County, Nevada*
- *City of Fallon, Nevada, Municipal Well No. 4*
- *Ancil Hoffman Golf Course Water Supply - Sacramento County Parks & Recreation*
- *Deule Vocation Facility Well Evaluation - California Department of Corrections*
- *Shadow Creek Golf Course Well Field Development, Las Vegas, Nevada*
- *Bellagio Resort and Casino Production Wells, Las Vegas, Nevada*

- *Las Vegas Water Pollution Control Facility Dewatering System – Clark County Sanitation District*
- *Washoe Lake Wetlands Well, Washoe County, Nevada – Nevada Department of Transportation*
- *Glenshire Mutual Water Company Well Design and Standard Specifications, Truckee, California*
- *City of Corona, California, Municipal Well Design and Testing*
- *City of Simi Valle, California, Municipal Well Construction Oversight*
- *Community of Imlay, Nevada, Ground Water Development Evaluation, Municipal Well*
- *Pyramid Lake Paiute Tribe, Nevada, High School Irrigation Well*
- *University of Nevada, Carlin Fire Training Academy Wells*

Nevada Water Rights

- *Research of Water Rights in 10 Basins in Eastern Nevada - Southern Nevada Water Authority*
- *Truckee River Water Rights Availability - Washoe County Regional Water Planning Commission*
- *Truckee River Water Rights Recovery Program - Truckee Meadows Water Authority*
- *University of Nevada, Reno, Main Station Farm and Valley Road Farm Water Rights Surveying and Consulting*
- *Kiley Ranch, Reno, Water Rights Research, Surveying and TMWA Banking*
- *MGM & Mirage Resorts, Las Vegas - Water Rights Development, Management, and Proofs - Shadow Creek Golf Course and Bellagio Casino*
- *Operating Engineers JAC, Wadsworth, Nevada - Water Rights Management and Proofs*
- *Midas Joint Venture, Water Rights Research, Northern Nevada*
- *Marshall Ranch, Washoe County, Nevada, Water Rights Appropriations, Vested Claims, Artificial Recharge, and Proof of Beneficial Use*

Environmental Evaluations

- *High Salinity Agricultural Irrigation Evaluation as a Groundwater Mitigation Alternative - Buffalo Valley & Lower Reese River, Nevada*
- *Warm Springs Valley Ground Water Quality Management Plan, Washoe County, Nevada*
- *Mining Site Soil and Groundwater Contamination Characterization and Monitoring Network - Northeastern Nevada*
- *Environmental Characterization of Soil and Groundwater Contamination at the Mountain Warfare Training Center, California – US Department of Defense*
- *Environmental Remediation of Fuel Contaminants in Soil and Groundwater - Lassen Union High School, Susanville, California*
- *Silver Lake Landfill Remediation, Reno, Nevada*
- *Solid Waste Assessment Testing (SWAT) Evaluations and Ground Water Quality Monitoring Networks at Approximately 12 Landfill Facilities, Riverside and San Bernardino Counties, California*

Name and Title: Dale A. Devitt, Professor of Soil & Water

Address: Department of Environmental & Resource Science, University of Nevada Reno
Department of Biological Sciences, University of Nevada Las Vegas (Adjunct)

Education: B.S. Environmental science. 1972, University of California Riverside
M.S. Soil Science. 1975. University of California Riverside
Ph.D. Soil Science. 1983. University of California Riverside

Professional Experience:

2005-Present	Full Professor. Dept. Biological Sciences, UNLV
1998-2005	Full Professor, Dept. Environmental & Resource Sciences, UNR
1990-1998	Associate Professor, Dept. Environmental & Resource Sciences University of Nevada Reno
1984-1990	Assistant Professor, Dept. of Range Wildlife and Forestry University of Nevada Reno
1976-1984	Staff Research Associate 4, Dept of Soil &Environmental Sci. University of California Riverside
1975-1976	Staff Research Associate 2, Dept. of Soil & Environmental Sci. University of California Riverside
1972-1975	Staff Research Associate 1, Dept. of Soil & Environmental Sci. University of California Riverside

Recent Grants and Awards

Las Vega Valley Water District. Monitoring golf course transition to reuse water. 2000-2005. $750,000.

Clark County Sanitation District. Foliar damage associated with sprinkler irrigation of sewage effluent. 1998-2003. $228,000.

TORO Corporation. Using spectral data to assess nitrogen and water stress in turfgrass. 2001-2003. $90,000.

DOE. Using plants as sentinels of detection of radioactive leakage from low level waste sites. 2000-2006. $600,000.

Southern Nevada Water Authority. Assessing Evapotranspiration in Northern Nevada Basins. 2004-2005. $840,000

Southern Nevada Water Authority. Quantifying water savings in the urban landscape with satellite ET controllers. 2004-2005. $180,000

Publications

1. Devitt, D. J. Letey, L.J. Lund and J.W. Blair. 1976. Nitrate-nitrogen movement through soil as affected by soil profile characteristics. j. Environ. Qual. Vol. 5 No. 3 283-288pp.

2. Letey, J., J.W. Blair, D.Devitt, L.S. Lund and P. Nash. 1977. Nitrate-nitrogen in effluent from agricultural tile drains in California. Hilgardia Vol 45, No. 9 289-319 pp.

3. Jury, W.A. , H. Frenkel, H. Fluhler, D.Devitt and L.H. Stolzy. 1978. Use of saline irrigation waters and minimal leaching for crop production. Hilgardia. Vol 46, No. 5, 169-192 pp.

4. Jury, W.A., H. Frenkel, D. Devitt, and L.H. Stolzy. 1978. Transient changes in the soil-water system from irrigation with saline water: II. Analysis of experimental data. SSSAP, vol 42 No. 4, 585-590 pp.

5. Jury, W.A., W.M. Jarrel and D.Devitt. 1979. Reclamation of saline-sodic soils by leaching. SSSAP, Vol. 43, No. 6 1100-1106 pp.

6. Devitt, D., W.M. Jarrel and K.L. Stevens. 1981. Sodium-potassium ratios in soil solution and plant response under saline conditions. SSSAP Vol. 45 No. 1 80-86 pp.

7. Devitt, D., W. A. Jury, P. Sternberg and L.H. Stolzy. 1983. Comparison of methods used to estimate evapotranspiration for leaching control. Irrig. Sci. 4: 59-69.

8. Devitt, D. W.M. Jarrell, W.A. Jury, O.R. Lunt and L.H. Stolzy. 1984. Wheat response to sodium uptake under zonal saline-sodic conditions. SSSAP. vol 48 No. 1 86-92 pp.

9. Devitt, D. L.H. Stolzy and W. M. Jarrell. 1984. Response of sorghum and wheat to different K/Na ratios at varying osmotic potentials. Agron. J. July-August.

10. Devitt D.A. , L.H. Stolzy, W.A. Jury and G. Lopatynski. 1986. Response of sorghum to a water gradient and potassium variable. Plant and Soil 93, 67-77 pp.

11. Embleton, T.W., M. Matsumura, LH. Stolzy, and D.A. Devitt. 1986. Citrus nitrogen fertilizer management, groundwater pollution, soil salinity, and nitrogen balance. Applic. Agric. Res. Vol. 1 57-64 pp.

12. Devitt, D.A. and L.H. Stolzy. 1986. Plant response to Na, K and K/Na ratios under saline conditions. Univ. Calif. Agric. Expt. Station. Special publication 3315.

13. Devitt, D.A. and R.L. Morris. 1987. Morphological response of annual flowers to salinity. J. Am. Soc. Hort. Sc. 112(6) : 951-955 pp.

14. Devitt, D.A., L.H. Stolzy and C.K. Lababauskas. 1987. Impact of potassium, sodium and salinity on the protein and free amino acid content of wheat grain. Plant and Soil 103, 101-109 pp.

15. Devitt, D.A. and R.L. Morris. 1989. Response of bermudagrass to plant growth regulators under varying nitrogen fertility. Jour. of Environ. Hort. 7(1):1-8.

16. Devitt, D.A. and W.W. Miller. 1988. Subsurface drip irrigation of bermudagrass with saline water. Appl. Agric. res. Vol. 3 No. 3 133-143 pp.

17. Devitt, D.A., L.H. Stolzy, W.W. Miller, J.E. Campana and P. Sternberg. 1989. Influence of salinity, leaching fraction, and soil type on ODR measurements and electrode "poisoning". Soil Science 145 (5):327-335.

18. Devitt, D.A. 1989. Response of bermudagrass to varied leaching fractions, irrigation, salinity and soil types. Agronomy J. 81:893-901.

19. Devitt D.A. and R.L. Morris. 1990. Effects of irrigation frequency, salinity of irrigation water and soil type on growth and response of bermudagrass. Arid Soil Res. and Rehab.

20. Devitt D.A., R.L. Morris and D.C. Bowman. 1990. Response of tall fescue to composted sewage sludge used as a soil amendment. J. Plant Nutrition 13(9) 1115-1139.

21. Devitt D.A., R.L. Morris and D.C. Bowman. 1991. Response of periwinkle to composted sewage sludge used as a soil amendment. J. Environmental Hort.

22. Devitt D.A., R.L. Morris and D.C. Bowman. 1992. Evapotranspiration, crop coefficients, and leaching fractions of irrigated desert turfgrass systems. Agronomy Journal 84:717-723.

23. Devitt D.A., M. Berkowitz,P.J. Schulte and R.L. Morris. 1993. Estimating transpiration for three woody ornamental tree species using stem-flow gauges and lysimetry. Hortscience 28(4):320-322

24. Devitt D.A., D.C. Bowman and P.J. Schulte. 1993. Response of Cynodon dactylon to prolonged water deficits under saline conditions. Plant and Soil 148:239-251.

25. Devitt D.A., R.L. Morris and D.S. Neuman. 1994. Evapotranspiration and growth response of three woody ornamental species placed under varying irrigation regimes. J. Amer. Soc. Hort. Sci. 119(3):452-457

26. Devitt D.A., D.S. Neuman, D.C. Bowman and R.L. Morris. 1995. Comparative water use of turfgrasses and ornamental trees in an arid environment. J. Turfgrass Management 1:47-63.

27. Devitt D.A., D. Kopec, M.J. Robey, R.L. Morris, P. Brown, V.A. Gibeault and D.C. Bowman.1995. Climatic assessment of the arid southwestern United States for use in predicting evapotranspiration of turfgrass. J. Turfgrass Management 1:65-81.

28. Devitt D.A., D.S. Neuman, D.C. Bowman and R.L. Morris. 1995. Water use of landscape plants grown in an arid environment. J. Aboriculture 21(5)239-245

29. Sala A., D.A. Devitt and S.D. Smith. 1996. Water use by Tamarix ramosissima and associated phreatophytes in a Mojave desert floodplain. J. Applied Ecology 6:888-898

30. Dean D.E., D.A. Devitt, L.S. Verchick and R.L. Morris. 1996. Turfgrass quality, growth and water-use as a function of salinity and water deficit induced stress. Agronomy J. 88:844-849

.

31. Smith S.D. A. Sala, D.A. Devitt and J.R. Cleverly. 1996 Evapotranspiration from a saltcedar-dominated desert floodplain: a scaling approach. 1996 . In: Barrow, J.R., E.D. McArthur, E.D. Sosebee, R.E. Tausch and R.J. Comps. Proceedings: Symposium on shrubland ecosystem in a changing climate. May 1995 Las Cruces New Mexico.

32. Morris R.L. D.A. Devitt and T.Katzer. 1996.Historical use of water in the Las Vegas Valley. Journal of Water Resources Planning and Mgmt. 123:189-196

33. Devitt D.A., A. Sala K.A. Mace and S.D. Smith. 1997. The effect of applied water on the water use of tamarix ramosissma during summer in a desert riparian environment. J. Hydrology 192:233-246.

34. Devitt D.A., S.D. Smith and D.S. Neuman. 1997. Carbon isotope discrimination in three landscape species growing in an arid environment. J. Arid Environments 36:249-257.

35. Fenstermaker-Shaulis L.K., A. Leskys and D.A. Devitt. 1997. Utilization of remotely sensed data to monitor a turfgrass irrigation study. J. Turfgrass Management. 2:65-81

36. Devitt D.A., J.M. Piorkowski, S.D. Smith, J.R. Cleverly and A. Sala. 1997. Plant water relations of tamarix ramosissima in response to the imposition and alleviation of soil moisture stress. J. Arid Environment. 36:527-540.

37. Cleverly J.R., S.D. Smith, A. Sala and D.A. Devitt. 1997. Comparative ecophysiology of the exotic tamarix ramosissima and three native Mojave desert phreatophytes in response to summer drought. Oecologia 111:12-18.

38. Dean D.E., D.A. Devitt, L.S. Verchick and R.L. Morris. 1998. Physiological response of two turfgrass species to varying ratios of soil matric and osmotic potentials. Crop Science 38:175-181

39. Devitt D.A., A. Sala, S.D. Smith, J. Cleverly, L.K. Shaulis and R. Hammett. 1998. Bowen Ratio Estimates of Evapotranspiration for Tamarix ramosissima Stands on the Virgin River in Southern Nevada. Water Resources Res. 34:2407-2414

40.Bowman, D.C., D.A. Devitt, M.C. Engelke, and T.W. Rufty, Jr. 1998. Root Architecture Affects Nitrate Leaching from Bentgrass Turf. Crop Sci. 38:1633-1639.

41. Bowman, D.C., D.A. Devitt, D.R.Huff and W.W. Miller. 1998. Comparative evapotranspiration of seventeen buffalograss (Buchloe dactyloides (Nutt.) Engelm) genotypes. J. Turfgrass Management. Vol 2 pp 1-10.

42.Neuman D.S., B.A. Smit, D.A. Devitt and M. Obersteiner. Leaf area production-affects of restricted root growth. 1998 Plant Cell and Environment (In Press).

43. Smith SD, Devitt DA, Sala A, Cleverly JR, Busch DE (1998) Water relations of riparian plants from warm desert regions. Wetlands18:687-696.

44. Leskys A., D.A. Devitt, R.L. Morris and L.S. Verchick. 1999. Response of tall fescue to saline water as influenced by leaching fractions and irrigation uniformity distributions. Agronomy 91:409-416.

45. Bowman D.C., D.A. Devitt and W.W. Miller. 1999. The effect of salinity on nitrate leaching from tall fescue turfgrass. In: Fate and management of turgrass chemicals. Chapter 10 p164-179. ACS symposium series #743. J.M.Clark and M.P. Kenna (eds).

46. Jordan L.A., Devitt D.A., Morris R.L. and Neumann D.S. 2001. Foliar damage to ornamental trees sprinkler-irrigated with reuse water. Irrigation Science 21:17-25.

47. Carlos, W.J., W.W. Miller, D.A. Devitt, and G.C.J. Fernandez. 2001. Water conservation using satellite technology for irrigation scheduling [On-line Proceedings]. Faye Anderson, David W. Moody, Patricia K. Wouters (eds) International Specialty Conference "Globalisation and Water Resources: The Changing Value of Water, Session 7 - Using Information Technology to Support Water Management. American Water Resources Association/International Water Law Research Institute, University of Dundee, Dundee, Scotland. Available at http://www.awra.org/proceedings/dundee01/Documents/MillerandCarlos.pdf

48. Devitt D.A. and S.D. Smith. 2002. Water and Tracer Movement Associated With The Presence of Root Channel Macropores of *Larrea tridentata*. Journal of Arid Environment 50:99-108.

49. Devitt D.A., D.J. Donovan, T. Katzer, and M.Johnson. 2002. A reevaluation of the ground water budget for Las Vegas Valley Nevada, with emphasis on ground water discharge. J. Amer. Water Resour. Assoc. 38:1735-1751.

50. Schaan C.M. D.A. Devitt, R.L. Morris and L.Clark. 2003. Cyclic irrigation of turfgrass using a shallow saline aquifer. Agron. J. 95:660-667.

51. Borden G.W., D.A. Devitt, R.L. Morris, M.L. Robinson and J. Lopez. 2003. Residential assessment and perception toward biosolid compost use in the urban setting of Las Vegas Nevada. Compost Science and Utilization. (In press).

52. Devitt D.A. R.L. Morris and D.S. Neuman. 2003. Impact of water treatment on foliar damage of landscape trees sprinkle irrigated with reuse water. Journal of Environmental Horticulture 21(2):82-88.

53. Brown C., D.A. Devitt and R.L. Morris. 2004. Water use and physiological response of tall fescue turf to water deficit irrigation in an arid environment. HortScience (In Press).

54. Bowman D.C., D.A. Devitt and W.W. Miller. 2004. The effect of salinity on nitrate leaching from bermudagrass turf. J. Amer. Soc. Hort. Sci. (In Press).

55. Devitt D.A., R.L. Morris, D. Kopec and M. Henry. Golf Course superintendents attitudes and perceptions toward using reuse water for irrigation in the southwestern United States. HortTechnology 14(4):1-7.

56. Devitt D.A., R.L. Morris and L.K. Fenstermaker. Foliar damage, spectral reflectance and tissue ion analysis of trees sprinkle irrigated with waters of similar salinity but different chemical composition. Hort Science (In Press).

57 Devitt D.A. R.L. Morris, M. Baghzouz, M.Lockett. Water quality changes in golf course irrigation ponds transitioning to reuse water. Hort Science (In Press).

58 Devitt D.A. R.L. Morris, L.K, Fenstermaker, M. Baghzouz and D.S. Neuman. Foliar damage and flower production of landscape plants sprinkle irrigated with reuse water. Hort Science (In Press).

59 Bowman D.C., D.A. Devitt and G. Cramer 2006.Effect of salinity and N status on N uptake by tall fescue (Festuca arundinacea Schreb) turf. J. Plant Nutrition. (accepted for 2006)

60. D.C. Bowman, D.A. Devitt and G.Cramer. 2006.Effect of N status on salinity tolerance of tall fescue (Festuca arundinacea Schreb) turf Journal of Plant Nutrition. (accepted for 2006)

61. D.C. Bowman, D.A. Devitt and W.Miller. 2006. The Effect of Moderate Salinity on Nitrate Leaching from Bermudagrass Turf. Soil, Air and Water Pollution. (accepted for 2006).

Books

Devitt, D.A., R.B. Evans, W.A. Jury, and T.H. Starks. 1987. Soil gas sensing for detection and mapping of volatile organics. National Water Well Assoc., Dublin, Ohio.

DOUGLAS BENNETT

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VEGASBENNETTS@GMAIL.COM

PERSONAL INFORMATION

Date of Birth	26 November 1962
Birthplace	Marquette, MI (KI Sawyer AFB)
Citizenship	United States
Gender	Male
Marital Status	Married

EMPLOYMENT HISTORY

SOUTHERN NEVADA WATER AUTHORITY, LAS VEGAS, NEVADA
Conservation Manager, April 2000 to present

Strategic Responsibilities

- Develop and implement conservation strategies, policies and programming for a community of 1.8 million people in the Mojave Desert with a primary focus on consumptive demand management.
- Key team member in the development of water resource, demand management and drought response plans. Implementation of the drought response plan resulted in a 13 percent reduction in per capita water use over a two-year period without negative economic impact.
- Represent the agency before political boards, professional conferences and media. Conduct approximately 50 media interviews for radio, print and television annually.
- Coordinate with up to eight jurisdictional agencies to assure consistency of messaging and continuity of services. Prepare coordinated community outreach efforts and provide jurisdictional reports for regional programs.
- Participate in and lead development of national conservation policy through interaction with other agencies. Initiated the Smart Water Application Technologies (SWAT) initiative, a national collaborative of water agencies and the irrigation industry to facilitate and accelerate marketplace transformation for efficient landscape irrigation technologies.

Operational Responsibilities

- Developed and manage an annual O&M budget of $32 million. Led development of a unified financial accountability and data management system for conservation programs.
- Supervise a staff of up to 37 personnel conducting educational, enforcement and incentive programs.

Programmatic Responsibilities

- Developed the nation's largest xeriscape program, providing incentives for the conversion of 70 million square feet of landscape over a five year period. Operations include the use of aerial photography and GIS systems to measure and document converted areas. Implemented use of mobile tablet PC's and GPS systems to maximize productivity of field operations.
- Developed and operate innovative private/public partnerships to promote conservation, including programs with the restaurant, landscape, car wash and homebuilding industries. Developed and sponsored industry trade shows for the exhibition of water efficient products to developers and contractors. Initiated the nation's first large scale voluntary program to construct and build water efficient homes, including a partnership with the region's largest homebuilder.
- Implementing multi-spectral imagery to assess quantity and type of irrigated landscape over a 320 square mile urban area to establish benchmarks and monitor change in existing and new development.
- Participate in the development of public information programs, including print and video educational materials and mass media campaigns.
- Collaborate with other agencies in the development and execution of regional and national research programs. Research initiatives include measuring the resource impact of various ornamental landscape styles, measuring the influence of sub-metering in multi-family dwellings and the evaluation of automated, demand based irrigation controllers. Currently collaborating on a national initiative to determine the impact of using a suite of products and techniques to maximize efficiency of newly-constructed single-family homes. Projects have included collaboration with accredited universities, the U.S. Bureau of Reclamation and the U.S. Environmental Protection Agency.

CITY OF ALBUQUERQUE PUBLIC WORKS DEPARTMENT, ALBUQUERQUE, NEW MEXICO

Irrigation Conservation Manager, June 1995 to April 2000

- Participated in development and implementation of conservation strategies, policies and programming for a community of 472,000 people in the Chihuahuan Desert.
- Developed programs related to landscape irrigation efficiency, xeriscaping, rainwater harvesting and other sustainable concepts.
- Responsible for the development and operation of a water waste enforcement program believed to be the first public water utility to assess violation fees to customer water bills. Implemented the use of mobile computers and video documentation of violations.
- Oversaw contract projects to install large meters in existing city parks to improve metering accountability and reduce unaccounted for water.
- Oversaw a water auditing program for single family and multi-family dwellings.
- Conducted an analysis of water use data and policies for the use of portable hydrant meters used in construction and maintenance activities. Developed and implemented new policies to reduce unaccounted water and water theft.
- Supervised a team of five personnel conducting educational, enforcement and incentive programs.
- Managed professional service contracts and capital programs of up to $350,000, including large metering programs and residential water auditing programs.
- Represented the City in administrative hearings and court proceedings related to water policy violations.
- Represented the agency before political boards, professional conferences and media.
- Performed water use and cost analyses for industrial, commercial and institutional customers.
- Participated in the development of public information programs, including print and video educational materials and mass media campaigns.

NM STATE UNIVERSITY COOPERATIVE EXTENSION SERVICE
.sistant Professor, February 1987 to June 1995

- Developed and implemented community-based programs in urban horticulture, youth development and community development.
- Managed community-based programs with up to 900 members and 125 volunteers. Responsible for developing and delivering a variety of educational programs in agriculture, horticulture, animal science and technology.
- Developed and operated successful Master Gardener programs in two counties. These structured programs trained volunteers in horticultural practices, including xeriscape, and developed into self-sustaining, community-based volunteer organizations.
- Developed a community farmers' market for local growers. Required the passage of a city ordinance to accommodate transient vendors on public land and development of a self-supporting organization.
- Utilized mass media to deliver educational programming, including authoring an award-winning newspaper column and community horticultural newsletter.
- Authored technical publications in horticulture and landscape irrigation for statewide distribution.

EDUCATION

COLLEGE OF BUSINESS, NEW MEXICO STATE UNIVERSITY, LAS CRUCES, NM
Master of Arts, Business and Personnel Management, May 1992

- Emphasis on strategic business development and personnel management.

COLLEGE OF AGRICULTURE, NEW MEXICO STATE UNIVERSITY, LAS CRUCES, NM
Bachelor of Science, Agricultural Pest Management, December 1986

- Emphasis on plant pathology, entomology and horticulture.

TECHNICAL CREDENTIALS

IRRIGATION ASSOCIATION
Certified Landscape Irrigation Auditor, August 1995 to present

CA-NV SECTION, AMERICAN WATER WORKS ASSOCIATION
Certified Conservation Practitioner, April 2005 to present

AWARDS & DISTINCTIONS

Personal Awards

Distinguished Service Award
New Mexico Association of 4-H Agents
1994

First Place National Award
Turfgrass/Horticulture – Category 1
National Association of County Agricultural Agents
1994

First Place, Western Region
Personal Column
National Association of County Agricultural Agents
1990

First Place State Award, New Mexico
Public Relations In Daily Efforts
National Association of County Agricultural Agents
1990

2nd Place National Award
Turfgrass/Horticulture Communications
National Association of County Agricultural Agents
1989

Team Awards

Pinnacle Best of Show – Public Relations Program
Water Smart: Drought Communications Campaign
Public Relations Society of America
2005

Pinnacle Award of Excellence – Video
Detecting and Silencing Leaks
Public Relations Society of America
2004

Pinnacle Award of Excellence – Direct mail
SNWA Drought Watering Schedule
Public Relations Society of America
2003

PUBLICATIONS & ARTICLES

Selected Publications and Articles

Sovocool, K.A., M. Morgan and D. Bennett. (2006). An in-depth investigation of Xeriscape as a water conservation measure. Journal AWWA, 98:2.

Frank, L. and D. Bennett. (1999). Low Volume Irrigation Design and Installation Guide. City of Albuquerque, NM. 22 p.

Bennett, D. (1999). Albuquerque reduces water consumption by twenty-four percent, *Irrigation Business and Technology*, 7(6), pp. 22-28.

Bennett, D. and L.E. Doxon. (1994). Tree Pruning Techniques. New Mexico State University, Las Cruces, New Mexico. Guide H-156. 4 p.

Selected Publications and Articles – continued

Bennett, D.B., L. Doxon and E.K. Grubaugh. 1990. I can dig it: A guide to installing a home sprinkler system. New Mexico State University, Las Cruces, New Mexico. Guide M-303. 8 p.

Porzig C. and Bennett D. (1997). Key sites of irrigation on the Internet, *Journal of Applied Irrigation Science*, 32(1).

Porzig C. and Bennett D. (1997). Cyberspace station: Surfing the supercanal, *Irrigation Business and Technology*, 5(1). p 22.

Selected Publications Reviewed

Wilson, T. 2004. Site Water Management Planning: A Handbook for landscape, water conservation, golf and irrigation professionals. Bilhah Publishing. 291 p.

Schultz, R.D. 1998. The Complete How-To Guide to Xeriscaping. City of Albuquerque, NM. 46 p.

SELECTED PROFESSIONAL AND TECHNICAL PRESENTATIONS

3rd Annual New Mexico Drought Conference. Albuquerque, NM. October 6, 2005.

Arizona Hydrological Society. 18th Annual symposium. Flagstaff, AZ. September 21, 2005

American Society for Horticultural Science. Las Vegas, NV. July 18, 2005

U.S. State Department, Embassy, Gabarone, Botswana. April 21, 2005.

Rain Bird Corporation Irrigation Advisory Council. San Diego, CA. September 15-17, 2004.

New Mexico State University Community Water Conference. Albuquerque, NM. September 2, 2004.

Western Coalition of Arid States Legislative Conference. Las Vegas, NV. February 18, 2004.

Golf Course Superintendents Association of America. San Diego, CA. February 11, 2004.

New Mexico Xeriscape Conference. Albuquerque, NM. October 17, 2003.

American Water Works Association Annual Conference. Anaheim, CA. June 17, 2003.

American Society of Irrigation Consultants. Asheville, NC. May 5, 2003

AFFILIATIONS & MEMBERSHIPS

Irrigation Water Management Society. Cheney, WA. Advisory Committee member. 2005 – current.

American Water Works Association. Denver, CO. Member. 2000-current

Irrigation Association. Falls Church, VA. Member. 1995-current.

New Mexico Irrigation Association. Secretary. 1993-1995.

New Mexico Association of Extension 4-H Agents. President. 1993.

R. Michael Turnipseed, PE
President, Turnipseed Engineering Ltd.
Carson City, Nevada

Education
BS, Civil Engineering, Utah State University, 1972

Registrations
Professional Engineer, Nevada #5638, Utah #4635
Water Rights Surveyor, Nevada #612

Organizations
American Water Resources Association - Past State Chapter President
National Society Professional Engineers - Past Member
American Society of Civil Engineers - Member

Experience
President, Turnipseed Engineering Ltd.
July 2004 - Present

Director, Department of Conservation and Natural Resources
August 2000- July 2004

Nevada State Engineer, Division of Water Resources
February 1990 - August 2000

Chief, Surface Water and Adjudication, Division of Water Resources
1985 - 1990

Utah Division of Water Rights
1972 - 1985

Idaho Department of Water Resources
1971 - 1972

DAVID J. DONOVAN

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Las Vegas, NV 89119
(702) 862-3733
david.donovan@lvvwd.com

EXPERIENCE:

SOUTHERN NEVADA WATER AUTHORITY/ LVVWD ***September 1991 – present***

HYDROLOGIST II, December 1994 – present

Current projects: Technical support for integrated hydrogeologic studies eastern Nevada Carbonate Terrain. Specific areas of investigation include; geologic framework, and basin hydrologic budgets.

Previous projects: Principal investigator for Las Vegas Valley ground-water flow (MODFLOW) model, re-evaluated subsurface stratigraphy, natural recharge, natural discharge, historical ground-water production, spring flow, perennial and ephemeral wash flow, and waste water discharges. Technical assistance to the Las Vegas Valley Ground-Water Management Program. Creation of water level maps and hydrographs to document annual changes in water level. Evaluation of latest hydrologic and geologic investigations. Creation of explanative text and graphics for the education of the general public and decision-makers about ground-water issues. Organization of monthly water level measurements in about 125 production, artificial recharge and monitor wells; Geochemical and isotopic sampling of ground water; Aquifer testing of municipal supply wells; Sub-surface mapping of aquifers; Measurement of water levels in wells and surface flows of creeks in eastern Nevada.

LAS VEGAS VALLEY WATER DISTRICT

HYDROLOGIC/RESEARCH INTERN, 9/91 – 12/94: Responsible for generation of AutoCAD graphics used in professional and internal reports and presentations, and developed computer programs and procedures to interface MODFLOW numerical output to AutoCAD graphics.

NEWMONT EXPLORATION LTD. ***August 1987 – August 1991***

MINE GEOLOGIST/GEOLOGICAL ASSISTANT/GEOLOGICAL TECHNICIAN: Progressively responsible experience exploring for and developing large gold ore bodies in northern Nevada's Carlin Trend. Major responsibilities included: Ore control, Core and rock chip lithologic and geotechnical descriptions (logs), and Geologic mapping used for; exploration of new and existing ore bodies, Hydrology and Slope stability.

SUMMERS AND WORK DURING SCHOOL YEARS ***1983-1987***

Seismic Technician, National Park Ranger, Pipefitters Apprentice, Historical Researcher/Assistant Curator, Baker

EDUCATION:

MASTERS OF SCIENCE; *August 1996,* **Geoscience with emphasis in Hydrogeology,**
University of Nevada, Las Vegas

Graduate coursework in Ground and Surface-water Hydrology, Environmental Law, Geochemistry, Quaternary Geology, and Sandstone Petrology.
Thesis Title: ***Hydrostratigraphy and allostratigraphy of the Cenozoic alluvium in the northwestern part of Las Vegas Valley, Clark County, Nevada***

BACHELOR OF SCIENCE; *July 1987,* **Geology Extended – with emphasis in Hydrology, Engineering Geology, and Environmental Geology**, Northern Arizona University

Graduate coursework in Hydrology.
Independent research on formation and degradation processes on cinder cones in northern Arizona.

Continuing Education; *1989-1990,* Northern Nevada Community College (now, Great Basin College); Course work in: Geology of Nevada, Ore Deposits, Mining Law, Lotus, and dBase.

PROFESSIONAL ASSOCIATIONS AND INTERESTS

Qualified As Expert Witness Before Nevada State Engineer March 2004
Theme Session Chairman, Nevada Water Resources Annual 2004 Conference
William R. Boggess Award (Best Paper 2002, Journal of the AWRA)
Theme Session Chairman, Geological Society of America Annual 2000 Conference
Memberships:
American Water Resources Association (2000-2006)
National Ground Water Association (1991-2006)
Geological Society of America (1987-2006)
General Interests:
Photography, Western History

Publications and Presentations

Hines, W. G., Cole, E. D., and Donovan, D. J., 1993, **Ground-water quality in the Las Vegas Valley, Clark County, Nevada: An update and analysis of trends,** Las Vegas Valley Water District prepared in cooperation with the Nevada Division of Environmental Protection, Carson City, Nevada, 50p.

Donovan, D. J., 1993, **Hydrogeochemistry of the principal alluvial aquifers in the northwest part of Las Vegas Valley;** Arizona-Nevada Academy of Science 37th annual meeting.

Donovan, D. J., 1994, **Geologic controls on aquifer permeability in west central Las Vegas Valley;** Nevada Water Resources Association Conference.

Donovan, D. J., 1994, **Allostratigraphic units in northwest Las Vegas Valley;** Rocky Mountain Ground-Water Conference.

Donovan, D. J. and Seaber, P.R., 1994, **Hydrostratigraphic and Allostratigraphic Units, Northwest Las Vegas Valley, Clark County, Nevada;** Geologic Society of America, Abstracts with Programs, 1994 Annual Meeting.

Donovan, D. J., 1996, **Hydrostratigraphy and allostratigraphy of the Cenozoic alluvium in the northwestern part of Las Vegas Valley, Clark County, Nevada**: M.S. Thesis, University of Nevada, Las Vegas, 199 p.

Donovan, D. J. and Brothers, K., 1997, **Overview of the District's Las Vegas Valley ground-water model;** Nevada Water Resources Association Conference (poster)

Donovan, D. J., 1998, **Historical water use and aquifer response in Las Vegas Valley;** Changing Water Regimes in Dry Lands Conference (poster).

Katzer, T., Brothers K., Cole, E., Donovan D., and Johnson, M., 1998, **A cost-benefit analysis of artificial recharge in the Las Vegas Valley ground-water system, Clark County, Nevada**; Southern Nevada Water Authority / Ground-Water Management Program, 38 p.

Johnson, M. and Donovan, D. J., 1998, **Hydrogeology and geology of the Las Vegas Valley, Clark County, Nevada;** National Ground Water Association Conference.

Donovan D. J. and Katzer, T., 1999, **A new look at natural recharge in Las Vegas Valley;** Nevada Water Resources Association Conference

Donovan, D. J. and Katzer, T., 2000, **Hydrologic implications of greater ground-water recharge to Las Vegas Valley, Nevada;** Journal of the American Water Resources Association; v.36, n. 5, pgs. 1133 - 1148

Donovan, D. J., 2000, **Evolution of the conceptual hydrogeologic and ground-water flow model for Las Vegas Valley, Clark County, Nevada;** Geologic Society of America, Annual Meeting, Abstracts with Programs, v.32, No. 7 p. A-254

Leising J. F., and Donovan, D. J., 2000, **Groundwater conditions in Las Vegas Valley; as related to Geologic Hazards**: Geologic and hydrologic hazards in the Las Vegas Valley: reducing risk; Association of Engineering Geologists Symposium

Donovan, D. J., 2001, **Evolution of the conceptual hydrogeologic and ground-water flow model for Las Vegas Valley, Clark County, Nevada;** *in* Proceedings 36th Annual Symposium on Engineering Geology and Geotechnical Engineering, Luke, B., Jacobson, E, and Werle J., eds. pgs. 163 - 172

Donovan, D. J., 2001, **Precipitation in eastern Nevada**; Annual Devil's Hole Conference

Las Vegas Valley Water District, 2001, **Water resources and ground-water modeling in the White River and Meadow Valley Flow Systems, Clark, Lincoln, Nye and White Pine Counties:** Hearing Document (Exhibit 54) for LVVWD Coyote Spring Water Right Applications, July 2001, 300 p.

Donovan, D. J., and Katzer, T., 2002, **Recharge and Discharge in the White River and Meadow Valley Flow Systems:** Nevada Water Resources Conference

Donovan, D. J., Wallen, M., 2002, **Historical changes in phreatophyte vegetation in Las Vegas Valley, Nevada:** American Water Resources Association Annual Conference, Abstract Proceedings p. 207

Donovan, D. J., Katzer, T. Brothers, K., Cole, E., and Johnson, M., 2002, **Cost-Benefit Analysis of Artificial Recharge in Las Vegas Valley, Nevada:** Journal of Water Resources Planning and Management, v.128 n. 5, pgs. 356-365

Devitt, D. A., Donovan, D. J., Katzer, T., and Johnson, M., 2002, **A reevaluation of the ground water budget for Las Vegas Valley, Nevada, with emphasis on ground water discharge**: Journal of the American Water Resources Association, v. 38 n.6, pgs. 1735-1751

Donovan, D. J., Dixon, G. L., Brandt, J. M., and Wallen M. M., 2003, **GIS Based Hydrogeologic Map of Tikaboo (North and South) and Three Lakes (North and South) Valleys, Nevada:** Nevada Water Resources Association Conference (poster)

Donovan, D. J., and Katzer, T., 2003, **Natural Recharge and Discharge in Tikaboo (North and South) and Three Lakes (North and South) Valleys, Nevada:** Nevada Water Resources Conference

Southern Nevada Water Authority, June 2003, **Hydrogeology of Tikaboo and Three Lakes Valleys, Clark and Lincoln Counties, Nevada:** Southern Nevada Water Authority, 84 p.

Wallen, M. and Donovan, D .J., 2003, **Revisiting precipitation / natural recharge methodologies in eastern Nevada:**. Annual ESRI conference (poster).

Katzer, T. and Donovan, D. J., 2003, **Hydrogeology of Spring Valley, White Pine and Lincoln Counties, Nevada:**,L as Vegas Valley Water District, 71 p.

Donovan, D. J. Dixon, G. L., Rowley, P. D. and Brandt, J. M, 2004, **Detailed geologic mapping in the Muddy Springs area:** Nevada Water Resources Association Conference

.

McArther R. D., and Donovan D. J., 2004 **Ground-water discharge by evapotranspiration in Cave Valley Lincoln and White Pine Counties, Nevada:** Nevada Water Resources Association Conference

Donovan, D. J., Buqo, T., 2005, **Evidence of Low-Altitude Recharge in Arid Environments;** Annual Devil's Hole Conference

Donovan. D. J., Brandt, J. M., Rowley, P. D, Dixon, G. L., Ekren E. B., 2005 **Generalized Hydrogeologic Map of parts of Clark, Lincoln, White Pine, Nye, Counties Nevada and parts of western Utah:** Nevada Water Resources Association Conference

Donovan, D. J., 2005, **Tectonic Fissures in Dry Lake Valley, Lincoln County Nevada;** Association of Engineering Geologists Annual Conference

Donovan, D. J., Kistinger, G. M., Acheampong, S. Y. 2005, **Characterization of Springs in Eastern Nevada**; Geologic Society of America, Annual Meeting, Abstracts with Programs, v.37, No. 7 p. 325.

Derek A. Sloop

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Las Vegas, Nevada 89123

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Education

M.S. Water Resources Management, University of Nevada, Las Vegas, 1998
B.S. Geology, University of New Mexico, 1993

Technical Work Experience

- Performed data analysis on hydrogeologic data that included data collection, organization, evaluation of data quality, statistical analyses of data, and preparation of datasets for modeling.
- Constructed and maintained numerous Access databases for the central storage of borehole location information, well construction, water levels, lithologic descriptions, geochemical data, and recharge information for incorporation into flow and transport models.
- Employed geochemical modeling technology to produce Piper and Stiff diagrams, calculate saturation indices, and perform speciation calculations.
- Employed GIS technology for the preparation of maps, as well as other data analysis activities.
- Prepared technical reports documenting the results of well development and testing activities, geochemical studies, hydrologic data documentation reports, and transport data documentation reports.

Field Work Experience

- Performed borehole geophysical logging (e.g., electric, acoustic, nuclear, video, induction) in a variety of locations in the U.S. and Guam.
- Collected geologic sample media during well drilling operations.
- Collected groundwater samples using bailers and from sampling ports during pump tests to establish regional and local groundwater chemistry in Southern Nevada.
- Performed water quality monitoring during well development and testing activities.
- Performed depth-to-water measurements using wire-lines and electric tapes.
- Performed surface water discharge measurements using pygmy current meters.
- Packed environmental soil and water samples for shipping.

Laboratory Work Experience

- Prepared environmental soil and water samples for analysis.
- Analyzed water samples using a variety of different analytical instruments including a GFAA, GC-FID, ion-selective electrode, turbidity meter, and pH probe.
- Performed surface-area analyses and cation-exchange capacity measurements.

Professional Experience

HYDROLOGIST II — NOVEMBER '04 - Present
Southern Nevada Water Authority — *Las Vegas, Nevada*

Employed as a hydrologist with the Southern Nevada Water Authority in support of water rights applications and water resource development. Experience includes data analysis, data integration, GIS analysis, surface water sampling, water-level measurements, water quality sampling, database development, site characterization, and report preparation relating to hydrologic flow systems throughout Nevada.

SENIOR HYDROGEOLOGIST — APRIL '04 – Nov. '04
Parsons — *Las Vegas, Nevada*

Employed by Parsons as a sub-contractor to the Southern Nevada Water Authority on groundwater development projects. Assisted with the analysis of groundwater data in support of water rights applications and water resource development. Experience includes data analysis, data integration, GIS analysis, surface water sampling, water-level measurements, water quality sampling, database development, site characterization, and report preparation.

HYDROGEOLOGIST — Nov. '98 – April '04
INTERA, Inc. (formally Shaw E & I and IT Corporation) — *Las Vegas, Nevada*

Employed as a hydrogeologist/geochemist with INTERA, Inc. on a multi-contractor environmental team to assist the National Nuclear Security Administration in investigating and characterizing contamination resulting from historic underground nuclear tests conducted at the Nevada Test Site. Experience includes data analysis, data integration, GIS analysis, groundwater sampling, well drilling activities, and report preparation.

GRADUATE / ASSISTANT RESEARCH GEOCHEMIST — May '96 - Oct. '98
Desert Research Institute — *Las Vegas, Nevada*

Work included collecting and interpreting geochemical data for projects funded by the Department of Energy. Specific projects included investigating certain aspects (e.g. sorption characteristics, retardation factors, cation-exchange properties) of the fate and transport of inorganic contaminants in groundwater while in contact with various rocks types from the Nevada Test Site and other areas, and attempting to quantify the rate of hydrocarbon (TPH) dissolution from contaminated areas at the Central Nevada Test Area. Work also included assisting principal investigators in report preparation, maintenance and operation of the environmental geochemistry laboratory's GFAA, GC-FID, and other instruments.

INORGANIC LABORATORY TECHNICIAN — Dec. '95 - May '96
Lockheed Environmental Systems & Technologies — *Las Vegas, Nevada*

Utilizing EPA guidelines, work included the preparation of soil and water samples using wet chemistry digestion techniques for analysis by ICP-MS and GFAA spectrometry. Also, analyzed environmental samples for total dissolved solids, total suspended solids, pH, turbidity, and percent solids. Additional duties included the analysis of samples for

dissolved hexavalent chromium and silica using colorimetric methods.

GEOLOGIST / LOGGING ENGINEER Dec. '93 - Sept. '95
Century Geophysical Corporation *Las Vegas, Nevada*

Employed as a geologist on projects for both commercial and government clients, worked included the production of electric, nuclear, induction, and acoustic borehole geophysical logs. Also, assisted clients with the interpretation of borehole geophysical logs to help determine such things as subsurface lithology, static water levels, and potential well completions.

Certifications/Training

- What's New in ArcGIS 9, Las Vegas, NV; 2004
- Fundamentals of Remote Sensing, Space Imaging, Las Vegas, NV; 2004
- Learning ArcGIS I (for ArcView 8, ArcEditor 8, and ArcInfo 8), ESRI Virtual Campus Course; 2002
- FEHM (Finite Element Heat and Mass Transfer Code) Workshop, Los Alamos National Laboratory, Los Alamos, NM; 2002
- The Groundwater Pollution and Hydrology Course, Princeton Groundwater, Inc. Short Course, San Francisco, CA; 2000
- Access 97: Basic and Intermediate Training Courses, Bechtel Nevada Corporation, Las Vegas, NV; 2000
- Introduction to ArcInfo Workstation, Community College of Southern Nevada, Las Vegas, NV; 1999
- American Red Cross-First-Aid Provider
- American Heart Association-Adult CPR & First-Aid
- SNWA – Desert Tortoise Training

Computer Proficiency

- Geographic Information Systems (ESRI's ArcGIS, ArcView, ArcInfo, Intergraph's GeoMedia)
- Geochemical Modeling Software (Aquachem, PHREEQC, MINEQL+)
- Word Processing (MS Word, Corel Word Perfect, Adobe FrameMaker)
- Spreadsheets (MS Excel)
- Databases (MS Access)

Selected Technical Publications

Lyles, B.F., G. Pohll, **D. Sloop**, and C. Papelis. 1998. *Evaluation of Potential Hydrocarbon Transport at the UC-4 Emplacement Hole, Central Nevada Test Area,* DOE/NV/11508-43, Publication No. 45167. Las Vegas, NV: Desert Research Institute.

Rehfeldt, K., W. Drici, B. Lester, **D. Sloop**, J. Watrus, T. Beard, M. Sully, W. Fryer, and C. Benedict. 2004. *Hydrologic Data for the GroundwaterFlow and Contaminant Transport Model of*

Corrective Action Units 101 and102: Central and Western Pahute Mesa, Nye County, Nevada, Rev. 0, Shaw/13052-204. Las Vegas, NV: Shaw Environmental, Inc.

Rehfeldt, K., W. Drici, **D. Sloop**, J. Watrus, T. Beard, M. Sully, C. Benedict, A. Wolfsberg, and P. Reimus. 2003. *Contaminant Transport Parameters for the Groundwater Flow and Contaminant Transport Model of Corrective Action Units 101 and 102: Central and Western Pahute Mesa, Nye County, Nevada,* Shaw/13052-201, Rev. 0. Las Vegas, NV: Shaw Environmental, Inc.

Sloop, D.A., 1998. *Equilibrium Studies of Ion Sorption on Zeolitized Tuff from Rainer Mesa, Nye County, Nevada,* M.S. Thesis, University of Nevada Las Vegas, Las Vegas, Nevada.

Awards

Recipient of the 1997 Desert Research Institute's Maxey Award in Water Resources for a paper titled, "*Equilibrium Sorption of Pb(II) and Sr(II) Cations on Zeolitized Tuff from the Nevada Test Site, Nye County, Nevada*".

WEIQUAN DONG, PhD

SENIOR GEOLOGIST

EXPERIENCE SUMMARY

My career spans over ten years in the environmental field as a hydrogeologist and geologist. I have broad practical experience in the field of water resources management, hydrology, geology, geochemistry, environmental isotope, and GIS.

EDUCATION

PhD, Geology, University of Nevada, Las Vegas, 2004.

M.S., Geochemistry, Institute of Geochemistry, Chinese Academy of Sciences, Guiyang, China, 1990.

B.S., Geology, Chengdu University of Technology, Chengdu, China, 1987.

SPECIAL TRAINING

ESRI ONLINE COURSES: Introduction to Visual Basic 6, Learning ArcGIS 8, Part I, and Learning ArcGIS 8, Part II, April 2002.

DYRESM-CAEDYM hydrodynamics and water quality models, Centre for Water Research, the University of Western Australia, June 2003.

Field Monitoring and Laboratory Analysis of Hazardous Materials, University of California, San Diego, July 1997.

Sequence Stratigraphy, Jianghan University of Petroleum, 1988.

EXPERIENCE SUMMARY

2004 – Date. Parsons, SNWA Senior Geologist.

August 2004 – September 2004. University of Nevada, Las Vegas, Research Scientist.

2000 – 2004. University of Nevada, Las Vegas, Research Assistant.

August 1998 – August 2000. Institute for Rare Isotope Measurements, University of Tennessee, Knoxville, Research Assistant.

November 1995 to August 1998. Scripps Institution of Oceanography (SIO), University of California, San Diego, Research Associate.

December 1990 – November 1995. Guangzhou Institute of Geochemistry, Chinese Academy of Sciences, Guangzhou, China, Research Assistant Professor.

August 1987 –November 1990. Institute of Geochemistry, Chinese Academy of Sciences, Guiyang, China, Research Assistant.

REPRESENTITIVE EXPERIENCE

GROUNDWATER HYDROGEOLOGY

Senior geologist for the Southern Nevada Water Authority In-State Water Resources Development Program. Involved in preparation of concept plans that will provide an additional 300,000 acre feet per year of water supply to the Southern Nevada Water Authority (SNWA). My responsibility includes geologic and hydrogeologic investigations, evaluation of basin water geochemistry, and development of data collection for groundwater modeling. QA/QC for precipitation data used to estimate groundwater recharge in SNWA groundwater basins. Development of methodology and procedures for groundwater recharge estimates in regional scales. Preparation of input data for models (Groundwater flow model and isotope groundwater model) that have been adopted for modeling groundwater flow in the basins proposed by SNWA.

Research Assistant, Harry Reid Center for Environmental Studies/ Geoscience Department of the University of Nevada, Las Vegas. (1) Groundwater flow and solute transport in Yucca Mountain with combined geochemical and hydrogeologic approaches. The goal of this project is to conduct integrated laboratory, field, and numerical studies to further understand the groundwater flow regime in Yucca Mountain (YM) and rock-water interaction, to develop parameter estimation techniques, and to arrive at optimal flow and reactive transport models for further use of monitoring potential risk of contamination in YM. The project is underway. (2) Identification on ground water level rise in deep wells of Yucca Mountain. By filtering out the effects of earth tide and barometric pressure on ground water level, I concluded that the rise of ground water level in some wells in Yucca Mountain could be a result of local factors.

Research Assistant, Institute for Rare Isotope Measurements, the University of Tennessee, Knoxville. Projects involved include: (1) Dating groundwater with ^{85}Kr and ^{81}Kr. My responsibility in this project included collecting representative groundwater samples, developing procedures for efficient extraction of krypton from 0.1 to 20 liters of water, performing isotope enrichment to reduce interfering isotopes in the sample with two specialized static mass spectrometers. I developed a low blank procedures used to strip gases from water. Both recovery efficiency and purity for krypton is more than 95%. (2) Designing deep wells for Environmental Hydrology Field Teaching Site at the UT Plant Sci. Farm. This project was to design and drill 1-3 boreholes into the underlying bedrock to depths of 100-300 feet. Based on field investigations, regional geological data, hydrogeologic conditions, and available budget, I recommended three optimal sites for drilling three deep boreholes in bedrock. (3) Aquifer pumping test analysis, Knoxville, Tennessee, USA: Performed aquifer pumping tests (step, constant-rate, and recovery) in shallow and deep aquifers. (4) Preliminary hydrogeologic assessment for the American Brewing Company, Leon County, Texas. The assessment included a period of data collection and literature review to amass sufficient material to give an overview of the hydrogeology of the proposed site. Recommendations were made based on these findings. (5) A study on comparison of ^{85}Kr age dating methods to conventional tritium and CFC methods. Samples were collected from an unconfined sand aquifer near Sturgeon Falls, Ontario. (6) Identification of leaking in Memphis aquifer with ^{85}Kr and tritium. The objective is to determine whether modern infiltration is being rapidly drawn into the confined Memphis Sand Aquifer by the high rates of pumping of municipal wells. The study is currently underway.

Research Assistant Professor and Hydrogeologist, Guangzhou Institute of Geochemistry, Chinese Academy of Sciences. Projects involved include: (1) Mining-related environmental monitoring, Yunfu pyrite mine, Guangdong, China: Monitored stream flows and borehole water levels, conducted surface water sampling, and performed statistical analyses and literature reviews to assess the environmental impacts of past and present mining operations, and to evaluate the effectiveness of acid mine drainage mitigation measures. (2) Hydrologic investigation and monitoring, Guanzhou, China: Supervised piezometer installation using a direct-push percussion drilling technology, performed core logging, installed stream stage gauges, supervised borehole geophysical (gamma ray) logging, redeveloped pre-existing monitor wells, performed an aquifer pumping test, and monitored surface and subsurface water levels in support of a construction dewatering project.

VADOSE ZONE HYDROLOGY

Research Assistant, Harry Reid Center for Environmental Studies/ Geoscience Department of the University of Nevada, Las Vegas. (1) A study on soil moisture variation in

vadose zone of the Nevada Test Site. The soil moisture is very important for waste disposal sites, desert ecosystems, and groundwater contamination in the desert environment. In this project, I modified a soil hydrology model (SHM) which was developed for humid areas and implemented the macropore flow processes into the SHM. The simulations on soil moisture variation were done by varying soil textures, vegetation coverage, and macropore flow. The results from these simulations shown that the soil textures and vegetation coverage have significant effects on soil moisture variation in desert soils, the macropore flow is not important for affecting soil moisture under present climate conditions. More details can be found in my Journal of Hydrology paper. (2) Extraction of paleoclimate information from chloride profiles of vadose zone in southern Nevada. The soil chloride in vadose zones of the southern Nevada, as a natural tracer, achieved climate changes up to 120,000 years. By forward to model the observed chloride profiles with modified HYDRUS-1D, the paleoclimate information was extracted. The input data and chloride deposition rates in the last 18,000 years were prepared based on the results from previous simulations on lake extents of Owens Valley. The measured chloride profile at Amargosa Desert Research Site (ADRS) was successfully simulated with the modified version of the HYDRUS-1D computer code using variable boundary conditions. (3) A study on the impacts of climate change on solute transport in vadose zone of southern Nevada. This project was funded by DOE and cooperated with the team of ADRS, U.S. Geological Survey (USGS) and Desert Research Institute. By performing in-situ measurements on hydraulic properties and displacement experiments on the undisturbed soil cores, I investigated possible effects of climate change on the solute (bromide) transport in the arid vadose zone under matric heads of 0, -2, -5, and -10 cm using undisturbed soil columns collected from the ADRS. Undisturbed soil cores were collected at ground surface, directly below where tension infiltrometer measurements were made. Experiments were conducted by introducing water containing bromide (Br) tracer into a soil column maintained at steady-state conditions. Effluent was collected using a fraction collector inside of a vacuum chamber, and analyzed using a Br ion electrode. Results of breakthrough curves (BTC) exhibited asymmetries and tailing for all core samples. The observed data were well fitted to a one-region model, except for the cores at saturation, and an core at the matric head –5 cm, from which the observed data were better fitted to a two-region model.

Research Assistant, Institute for Rare Isotope Measurements, the University of Tennessee, Knoxville. Rock mulch experiment: Investigation of rock mulches to promote water conservation in semi-arid agriculture. By measuring soil temperature, water content in the columns of soil overlain with various thickness of gravel, the process of soil evaporation and energy flux at the soil surface and at the base of rock mulch layers were quantified. Finally, an optimal design for rock mulch systems was obtained.

SURFACE HYDROLOGY

Research Assistant, Harry Reid Center for Environmental Studies/ Geoscience Department of the University of Nevada, Las Vegas. (1) Extraction of paleoprecipitation and paleotemperature from lake records in the Owens Valley, CA with a coupled catchment-lake hydrology model. The goal of this project is to obtain quantitative paleoprecipitation and paleotemperature for the southern Nevada in the last 18,000 years. The derived paleoprecipitation and paleotemperature were used as major inputs to simulate solute transport in the vadose zone of Nevada Test Site and to predict future groundwater recharge. The coupled catchment-lake model was implemented by coupling a surface hydrology model and lake energy balance model. The surface hydrology model has three modules: the snow module

that computes mean monthly snowfall, snowmelt, snowpack, ice accumulation, ice transport, and icemelt for each grid cell based on the input of temperature, precipitation, and elevation of that cell, the runoff module that calculates mean annual runoff from available water (rain, snowmelt, and icemelt), and the lake module computes lake extent from the results of basin-wide mean annual runoff calculated by the runoff module and lake evaporation. The lake energy balance model calculated evaporation of the lake surface based on energy budget of water body in lake. This physically-based lake model, which explicitly represents the physical processes governing the energy and water balances of the lake, offers a more robust way to predict climate induced changes in water volume, level, and outflow of the lakes. As a result, a quantitative time-series of paleoclimate information for the last 18,000 years was obtained. A manuscript on this study is ready to be submitted for publication. (2) Simulation on the variation of temperature, evaporation, and chemicals in Boulder Basin, Lake Mead with DYRESM-CAEDYM. The purpose of this project was to model water level, temperature and solute profiles of the Boulder Basin, Lake Mead by considering water balance, solute loading, and energy balance with the DYRESM-CAEDYM.

GEOLOGY AND GEOCHEMISTRY

Research Associate, Scripps Institution of Oceanography (SIO), University of California, San Diego. Research projects involved included the study of cosmic ray-produced radioisotopes in diverse terrestrial environments and using them as quantitative tools to study weathering, erosion, and paleoclimate change. I proposed a study of the Tibet uplift by determining erosion rates of bedrock surfaces with using ^{10}Be and ^{26}Al isotopes. My principal duty in SIO was managing a chemistry laboratory, performing a variety of chemical analyses, and preparing targets from a variety of geological samples for ^{10}Be and ^{26}Al Accelerator Mass Spectrometry (AMS) measurements. I also had experience working on the Pb isotopic anomaly of the K/T boundary at Dr. Macdougall's laboratory for six months. During that period, I learned complete chemical procedures for preparing targets for Pb isotopic measurements and techniques for operating thermal ionization mass spectrometry.

Research Assistant Professor, Guangzhou Institute of Geochemistry, Chinese Academy of Sciences. (1) Evolution and framework of lithosphere in Southeast China. Based on field investigation, stratigraphic correlation, geochronology, geochemical analysis and basin analysis, the evolution and framework of lithosphere in Southeast China were studied. (2) Gold deposits and hydrothermal sedimentation. Many gold mines in China are closely related to hydrothermal sedimentation, so the hydrothermal sedimentation becomes one of the most important geological markers for locating gold. My research on this subject was to characterize petrographic, geochemical properties and tectonic setting of the hydrothermal sedimentation for typical gold mines in China. (3) Super-large ore deposits and hydrothermal sedimentation. Some super-large ore deposits such as Wengfu Phosphorite, Dajiangping Pyrite, Yunfu, Dahebian barite deposits, are formed mainly by hydrothermal sedimentation. The study was done by studying temporal and spatial distribution, sedimentary and geochemical characteristics, of these super-large ore deposits.

Research Assistant, Institute of Geochemistry, Chinese Academy of Sciences. Completed projects include: (1) a study on the origin of bedded chert of Taiyangding Group, west Qinling Orogenic Belt. The bedded chert with reef carbonate formed a reef-chert suite that is major host rocks of gold and uranium ore deposits. Based on field investigation, laboratory petrologic examination and geochemical analyses, I concluded that the bedded chert was formed by hydrothermal sedimentation. (2) Paleozoic tectonic framework of

west Qinling Orogenic belts. This study was performed by studying rare earth elements (REEs) of sedimentary formations.

AWARDS AND GRANTS

(a) Research Grant from the Graduate Student Association, University of Nevada, Las Vegas, 2002.

(b) Research Grant from the Geological Society of America, 2001.

(c) Research Assistantship from University of Nevada, Las Vegas, 2000-2004.

(d) Travel Grant from Geological Society of America, 2000.

(e) Research Assistantship from University of Tennessee, Knoxville, 1998-2000.

(f) Scholarship for Outstanding Young Scholar from Chinese Academy of Sciences, 1995.

(g) Award of Scientific Achievement, from Guangzhou Institute of Geochemistry, Chinese Academy of Sciences, China, 1994.

(h) Director Grant from Guangzhou Institute of Geochemistry, Chinese Academy of Sciences, China, 1993.

(i) Director Grant from Guangzhou Institute of Geochemistry, Chinese Academy of Sciences, China, 1991.

(j) The Outstanding Paper Award from Chinese Mineralogy, Petrology, and Geochemistry Society, 1990.

(k) "Five-Four Youth Award", Guangzhou Institute of Geochemistry, Chinese Academy of Sciences, China, 1990.

(l) "Three-Best Student", Chengdu University of Technology, 1986.

PROFESSIONAL AFFILIATIONS

CPG (10938) American Institute of Professional Geologists

American Geophysical Union

Geological Society of America

Sigma Xi

Reviewing Activity:

Water Resources Research

Journal of Arid Environments

PUBLICATIONS

Dong, W., 2004. Extraction of paleohydrology and paleoclimate proxies from vadose zones and paleolake records in the southwestern Great Basin. Dissertation, University of Nevada, Las Vegas.

Dong, W., Yu, Z., Young, M. and Stetzenbach, K. J., (manuscript). Evaluating the Impacts of Climate Change on Solute Transport in Vadose Zone of Southern Nevada.

Dong, W., Yu, Z., Orndorff, R.L., and Stetzenbach, K.J., (manuscript). Temperature and Rainfall Estimates for past 18,000 Years in Owens Valley, California with A Coupled Catchment-Lake Model.

Chen, D., Dong, W., Qi, L., Chen, G., and Chen, X., 2004. Pb-Pb Ages for Doushantuo Phosphorites Constraints on Early Metazoan Evolution and Glacial Events During Terminal Neoproterozoic in South China, Precambrian Research, 132, 123-132.

Chen, D., Dong, W., Qi, L., Chen, G., and Chen, X., 2003. REEs Constrain Paleoenvironment Changes for Doushantuo Phosphorites in Weng'an Mine, South China During Terminal Proterozoic, Chemical Geology, 201, 103-118.

Lal, D., Harris, N.B., Sharma, K.K., Gu, Z., Ding, L., Liu, T., Dong, W., Caffee, M.W., and

Jull, A.J.T., 2003. Erosion history of the Tibetan Plateau since the Last Interglacial: constraints from the first studies of cosmogenic 10Be from Tibetan bedrock, Earth and Planet. Sci. Lett., 217, 33-42.

Dong, W., Yu, Z., and Weber, D., 2003. Simulations on water variation in arid regions. J. Hydro, 275, 165-181.

Dong, W., Lal, D., Ransom, B., Berger, W., and Caffee, M. W., 2001. Marine biogeochemistries of Be and Al: A study based on cosmogenic 10Be, Be and Al in marine calcite, aragonite, and opal. Proc. Indian Acad. Sci. (Earth Planet. Sci.), 110, 95-102.

PUBLICATIONS IN CHINESE:

Chen, D., Chen G., Pan, J., Ma, S., Dong, W., Gao, J., and Chen, X., 1998. Hydrothermal Sedimentation Characteristics of the Dajiangping Superlarge Pyrite Deposit, Yunfu, Guangdong. *Chinese Journal of Geochemistry*, 17, 331.

Chen, D., Ma, S., and Dong, W. et al., 1998. Pb and Nd isotopes of Dajiangping pyrite deposit and metal source, Guangdong, *South China.Mineral Deposits*, 17(4).

Chen, D., Li, X., and Dong, W. et al.,1998. Metamorphic new-formation zicorns, SHRIMP ion microprobe U-Pb age of the amphibolite of Hexi Group, Zhejiang and its implications. *Acta Mineralogica Sinica*, 18(4).

Dong, W., Chen, X., and Gao, J., 1994. Origin of the chert of Taiyangding Group, west Qinling orogenic Belt. *Geochemistry, Supply.*

Dong, W., Chen, X., and Chen, D., 1994. The discovery and significance of the eclogite of Badu Group in Zhejiang. *Press of Metallurgy and Geology, Beijing.*

Dong, W., Chen, D., and Chen, X., 1994. The discovery and significance of the meteoric dust of Badu Group in Zhejiang. *Press of Metallurgy and Geology, Beijing.*

Chen, D., Dong, W., Chen, X., 1994. The origin and pb-isochron of magnetite. *Press of Metallurgy and Geology, Beijing.*

Gao, J., Dong, W., 1994. The metallization and prospect on micro-fine grain gold in subzone of west Qinling orogenic belt. *Press of Chinese Science and Technology, Beijing.*

Dong, W., 1992. REE limit of sedimentary background of early paleozoic in west Qinling orogenic belts. *Beijing Press of Chinese Science and Technology, Beijing.*

Chen, X., Gao, J., Chen, D., and Dong, W., 1992. Term and sedimentary marker of hydrothermal sedimentation. *J. Sedimentology*, No. 3.

Dong, W., 1991. Gold and hydrothermal sedimentation. *Journal of Petrology, Mineralogy and Geochemistry.*

ABSTRACTS

Dong, W, Joyner, C. C., and Thonnard, N., 2000. Low-blank and efficient groundwater sampling and gas separation for krypton-85 and krypton-81 analyses. *2000 GSA south-central abstract.*

Zhu, B. Q., Wang, Y. X., Chen, X. P., Zhao, Z. H., Wang, H. F., Chen, D. F., Dong, W. Q., Li, X. H., Bao, Z. W., 1992. Huangshan-Wenzhou geochemical section of lithosphere in Southeast China. 30th international geological congress (1996: Beijing, China). *30th international geological congress; abstracts: [International Geological Congress].*

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EDUCATION

Ph.D. Hydrology/Hydrogeology University of Nevada, Reno **1996**
Dissertation title: "*Geochemical Evolution of the Shallow Groundwater System in the Southern Voltaian Sedimentary Basin of Ghana*
M.S. Geoscience (Hydrogeology) University of Nevada, Las Vegas **1992**
Thesis Title: *Isotope Hydrology of Lehman and Baker Creeks Drainages, Great Basin National Park, Nevada*
B.Sc. Geological Engineering Univ. of Science and Technology **1984**
Kumasi, Ghana

ADDITIONAL TRAINING

- Isotopic & Hydrogeological Characterization of fractured Rock settings: Current and Novel Approaches, National Groundwater Association, Baltimore, Maryland 2005
- Workshop in Geographic Information Systems (GIS) and Image Processing Desert Research Institute, Reno 1994
- Short course in Principles and Applications of Modeling Chemical Reactions in Groundwater, Colorado School of Mines, Colorado, Golden, USA 1993

CERTIFICATION

Certified Environmental Manager, State of Nevada

FELLOWSHIPS/AWARDS

Who's Who, Strathmore's Directory 2000 - 2001
Graduate Students Association Grant, University of Nevada, Reno 1994 & 1995
Dirk Doorenbos Award in Hydrology/Hydrogeology for best student paper
University of Nevada, Reno 1993
Academic Achievement Award for 2nd best M.S. Thesis in Water Resources
American Water Works Association, USA 1993
Academic Merit Award
University of Nevada, Las Vegas, Nevada, USA 1992
George Burke Maxey Fellowship in Hydrology/Hydrogeology for best research proposal,
University and Community College System of Nevada 1991
Lily and Wing Fong Scholarship in Geoscience
University of Nevada, Las Vegas, Nevada, USA 1991
Graduate Students Association Grant, University of Nevada, Las Vegas 1991
International Atomic Energy Agency (IAEA) Fellowship in Isotope Hydrology
International Atomic Energy Agency, Vienna, Austria 1989

PROFESSIONAL EXPERIENCE

Hydrologist, Southern Nevada Water Authority April 2001 - Present

- Develops hydrologic programs and data collection requirements
- Collects, interprets and analyzes data regarding hydrologic systems throughout Nevada and the Colorado River Basin states
- Develops and implements effective protocols and procedures for water quality sampling and interprets geochemical variability to deduce flow paths and source water

Hydrogeologist, Broadbent & Associates, Inc., Henderson, Nevada May 2000-April 2001

- Evaluated water resources for domestic and industrial use
- Performed environmental, hydrological and geological investigations related to leaking underground storage tanks
- Operated and maintained soil and groundwater remediation systems

Consulting Hydrogeologist, Summit Envirosolutions, Inc., Reno, Nevada 1997-1999

- Reviewed and evaluated project proposals and reports in water resources and environmental assessment
- Conducted baseline surveys and environmental investigations for the remediation of contaminated groundwater for water supply

Consulting Faculty, Keck Geology Consortium Project, Lancaster, Pennsylvania, USA 1999

- Taught and advised students on research involving the installation of data loggers for rain gauges and pressure transducers, weirs, and staff gauges on streams and rivers for the analysis of the hydrologic and nutrient budgets of a watershed
- Conducted training in augur drilling and well installation and the measurement of nutrients (nitrate and phosphate) and other water quality parameters (pH, specific conductance, temperature and dissolved oxygen) in the laboratory
- Carried out soil, surface water and groundwater sampling with students and taught them how to analyze the samples for trace elements and major ion concentrations using ICP and AAS

Consulting Faculty, Keck Geology Consortium Project, Smith College, Northampton 1998

- Taught field and laboratory courses involving the installation of staff gauges on streams and rivers, discharge measurements, pitting and augur drilling, collection and analysis of soil, surface water and groundwater samples
- Mentored and advised students on a project to determine the land use impact on the water quality of the Mill River watershed

Associate Faculty, Feather River College, Quincy, California 1997

- Taught a Water Quality Monitoring course for second year students. Course involved water resources and water quality data management, groundwater and surface water sampling and analysis

Postdoctoral Research Associate, Desert Research Institute, Reno, Nevada 1996

- Studied groundwater velocities at the southern Nevada Test Site (NTS) using groundwater and geochemical modeling and environmental isotopes techniques

Graduate Research Associate, Desert Research Institute, Reno 1992-1996

- Co-principal investigator for the Conrad N. Hilton Foundation on a $1.4m groundwater resources development in Ghana, West Africa
- Prepared project proposals, evaluated the water supply needs for the various

communities and prepared work plans and budget
- Used GIS and remote sensing techniques for site selection and groundwater management
- Collected and analyzed all hydrogeologic, geochemical and isotopic data using various DOS and UNIX based softwares, and prepared reports
- Co-ordinated and maintained communication with our international collaborators
- Investigated the geochemical evolution and trace element geochemistry of groundwater in a siliciclastic sedimentary basin using aqueous geochemistry and isotopic techniques

Graduate Research Assistant, Desert Research Institute, Las Vegas 1990 - 1992
- Prepared water, soil and wood shaving samples on vacuum extraction lines and analyzed them on mass spectrometers for their stable isotopic composition
- Carried out research on the relationships among the various water bodies in Great Basin National Park, Nevada, using chemical and isotopic techniques
- Actively participated in water resources and environmental assignments at various locations in Nevada

Research Officer, Water Resources Research Institute, Accra, Ghana 1985 -1989
- Prepared project proposals, budget schedules, work plans and site safety plans for groundwater studies
- Explored for groundwater using surface geophysical techniques
- Sited and supervised drilling operations for over 100 water supply and industrial wells using rotary drilling rig
- Conducted aquifer tests and assessed water quantity and quality
- Designed and constructed monitoring well networks for project monitoring and appraisal

Assistant Engineer, Architectural and Engineering Services Corporation, Accra, Ghana 1985
- Collected, measured, and evaluated engineering properties of soils for building and road construction
- Supervised drilling for rock and soil samples for laboratory analysis using cable tool drilling rig

Superintendent, Tema Secondary School, Tema, Ghana 1984
- Taught mathematics at the ordinary and advanced levels (High School)

Geological Engineer Trainee, Jaworzno Coal Mining Company, Jaworzno, Poland 1981
- Monitored geophones and collected rock and water samples for analysis

ADDITIONAL ACTIVITY
- Member, technical review panel, Charles A. and Anne Morrow Lindbergh Foundation 1997 - Present

PROFESSIONAL AFFILIATIONS
American Geophysical Union
National Ground Water Association
Geological Society of Africa
Geological Society of America

PUBLICATIONS

Deverel, S., Thomas, J., Decker, D., Earman, S., Mihevc, Acheampong, S., 2005, Groundwater evaporation estimates using stable isotope and chloride data, Yelland Playa, Spring Valley, Nevada, DHS Publication No. 41219, 16 p.

Brothers, K., Johnson, J., Acheampong, S.Y., Burns, A., Donovan, D., and Wallen , M., 2001, Water resources and ground water modeling in the White River and Meadow Valley flow systems, Clark, Lincoln, Nye and White Pine Counties, Nevada, *Report submitted to the* State Engineer of Nevada, Las Vegas Valley Water District, 184 p.

de Wet, A., Weaver, S. and Acheampong, S.Y., 2000, Hydrology, Geochemistry, Sedimentology and Geophysics of the Baker Woodlands Environmental Research Site, Lancaster, Pennsylvania, In: C. V. Mendelson and C. Mankiewicz, (Editors), *Proceedings of the 13th Keck Research Symposium in Geology*, Whitman College, Walla Walla, Washington, pp. 245 - 249.

Acheampong, S. Y., and Hess, J.W., 2000, Origin of the Shallow Groundwater System in the Southern Voltaian Sedimentary Basin of Ghana: An Isotopic Approach. *Journal of Hydrology,* (233):37-53.

Acheampong, S.Y., and Hess, J.W., 1999, Hydrogeologic and Hydrochemical Framework of the Shallow Groundwater System in the Southern Voltaian Sedimentary Basin of Ghana. Reply to comments by Pradeep Raj, *Hydrogeology Journal,* 7(6):592-595.

Newton, R.B., Acheampong, S.Y., and Rhodes, A.L., 1999, Land-use impacts on the hydrology and chemistry of the Mill River in Hatfield, Massachusetts, In: C. V. Mendelson and C. Mankiewicz, (Editors), *Proceedings of the 12th Keck Research Symposium in Geology,* Carleton College, Northfield, Minnesota, pp. 120 - 124.

Acheampong, S.Y., and Hess, J.W., 1998, Hydrogeologic and Hydrochemical Framework of the Shallow Groundwater System in the southern Voltaian Sedimentary Basin of Ghana, *Hydrogeology Journal,* 6(4):527-537.

Hershey, R.L., and Acheampong, S.Y., 1997, Estimation of Groundwater Velocities from Yucca Flat to the Amargosa Desert using Geochemistry and Environmental Isotopes, *Water Resources Center, Publication No. 45157,* Desert Research Institute, Reno, Nevada, USA.

Acheampong, S.Y., and Hess, J.W., 1996, Major Ion and Isotope Geochemistry of the Southern Voltaian Sedimentary Basin of Ghana, In: Nyambok, I., and Ichangi, D., (Eds) *Proceedings of the 10th International Conference of the Geological Society of Africa*, 9-13 October, 1995, Nairobi, Kenya.

Acheampong, S.Y., and Hess, J.W., 1995, Environmental Isotope Evidence for the Origin of the Shallow Groundwater System in the Southern Voltaian Sedimentary Basin of Ghana, *EOS, American Geophysical Union,* Vol. 76, No. 17.

Minor, T., Russel, C., Chesley, M., Englin, J., Sander, P., Carter, J., Knowles, R., Acheampong, S.Y., and Mckay, A., 1995, Application of Geographic Information System Technology to Water Well Siting in Ghana, West Africa: A Feasibility Study, *Water Resources Center Publication No. 44033,* Desert Research Institute, Reno, Nevada, USA.

Technical Abstracts

Acheampong, S.Y., 2006, Strontium isotope, temperature, and deuterium as indicators of variation in groundwater chemistry and flow patterns in southern Nevada, *Technical Abstracts,* Nevada Water Resources Association, February 2006, Mesquite, Nevada.

Donovan, D.J., Kistinger, G.M., and Acheampong, S.Y., 2005, Characterization of Springs in eastern Nevada, *In:* Geological Society of America, Annual Meeting and Exposition, Salt Lake City, Utah, *Abstracts with Programs*, vol. 37, p. 325, 143-2.

Acheampong, S.Y., 2005, Strontium isotope studies of groundwater in parts of southern and eastern Nevada, Geological Society of America Annual Meeting and Exposition, Salt Lake City, Utah, *Abstracts with Programs,* Vol. 37, p. 319, 140-9.

Acheampong, S.Y., 2005, Estimation of circulation depths of some low temperature thermal springs in east-central Nevada, *Technical Abstracts,* Nevada Water Resources Association, February 2005, Reno, Nevada.

Acheampong, S.Y., 2004, Estimation of gains and losses along the lower Virgin River using discharge measurements and geochemistry, *Technical Abstracts,* Nevada Water Resources Association, February 2004, Mesquite, Nevada.

Acheampong, S.Y., 2003, Arsenic input into Lake Mead – Implications of the current drought in the West, *Technical Abstracts,* Nevada Water Resources Association, February 2003, Reno, Nevada.

Wolf, T.J., and Acheampong, S.Y., 2003, Benefits to regional ground water studies using Advanced Surveying Systems, *Technical Abstracts,* Nevada Water Resources Association, February 2003, Reno, Nevada.

Acheampong, S.Y., Durbin, T.J., Donovan. D.J., Johnson, J., Burns, A., and Wallen, M.W., 2002, Groundwater modeling in parts of Clark, Lincoln, and White Pine counties, *Technical Abstracts,* Nevada Water Resources Association, February 2002, Las Vegas, Nevada.

Acheampong, S.Y., and Hess, J.W., 1995, Major Ion and Isotope Geochemistry of the Southern Voltaian Sedimentary Basin of Ghana, *Technical Abstract, 10th International Conference of the Geological Society of Africa, 9-13 October, 1995, Nairobi, Kenya.*

Acheampong, S.Y., 1995, Stable Isotopic Behavior of Small Lakes in Great Basin National Park, *Abstracts of Technical Papers and Posters, Nevada Water Conference,* March 14-15, Nevada Water Resources Association, Reno, Nevada.

Acheampong, S.Y., and Ingraham, N.L., 1993, Stable isotopic study of the water resources of Great Basin National Park, Nevada, *Abstracts of Presented Papers and Posters, 2nd Biennial Conference of Research on the Colorado Plateau,* 25-28 October, 1993, Co-operative Park Studies Unit, Northern Arizona University, Flagstaff, Arizona.

Acheampong, S.Y., and Ingraham, N.L., 1993, The effects of Evaporation-Inflow Ratio on the Isotopic Compositions of Alpine Lake Systems, *EOS Transactions, American Geophysical Union,* Vol. 74, No. 43.

Thesis, dissertation and other Publications

Acheampong, S.Y., 1996, Geochemical Evolution of the Shallow Groundwater System in the Southern Voltaian Sedimentary Basin of Ghana, *unpublished Ph.D. Dissertation,* University of Nevada, Reno, 140p.

Acheampong, S.Y., 1992, Isotope Hydrology of Lehman and Baker Creeks Drainages, Great Basin National Park, Nevada, *unpublished M.S. Thesis,* Department of Geoscience, University of Nevada, Las Vegas, 107p – Adjudged 2nd best thesis by the American Water Works Association.

Acheampong, S.Y. and Owusu, D., 1988, Rational water conservation and utilization techniques in the rural areas of Ghana, Report of field survey of techniques used in rural areas, *Internal Report, Water Resources Research Institute,* Council for Scientific and Industrial Research, Accra, Ghana.

Acheampong, S.Y., 1988, Ground water exploration at the Bitumen Plant site of construction Pioneers, Ablekuma, *Water Resources Research Institute,* Council for Scientific and Industrial Research, Accra, Ghana.

Acheampong, S.Y., Frempong, D.G., and Dapaah-Siakwan, S., 1987, Preliminary investigation for ground water at the premises of Cocoa Processing Company limited, Tema, *Water Resources Research Institute,* Council for Scientific and Industrial Research, Accra, ISBN 9964-85-095-6.

Acheampong, S.Y., and Dapaah-Siakwan, S., 1986, Ground water exploration at the Lever Brothers (GH) Limited Plant Site, Tema, *Water Resources Research Institute*, Council for Scientific and Industrial Research, Accra, Ghana, ISBN 9964-85-092-1.

Acheampong, S.Y., Gyau-Boakye, P., Owusu, D., and Ayibotele, N.B., 1985, Report on the water conservation and utilization techniques in the Afram Plains, *Water Resources Research Institute,* Council for Scientific and Industrial Research, Accra, Ghana, 35p.

Gavin M. Kistinger
Southern Nevada Water Authority
1900 E. Flamingo Road
Las Vegas, NV 89119

Education

A.A. General Education, Hartnell College, 2000
University of Nevada Las Vegas

Professional Experience

1995 to Present *Southern Nevada Water Authority* *Las Vegas, NV*
Hydrologist II

I was employed from 1995 to 1998 as a Geologic Technician to collect groundwater data to be applied towards operation and management of the Las Vegas Valley Water District's production and artificial recharge wells. This included water levels, water quality sampling, and field measurements of water quality. From 1998 to 2003 I was employed as a Hydrologist I. My duties included hydrologic data collection and analysis for the operation of the Las Vegas Valley, Kyle Canyon, Jean, and Searchlight Water Systems. This included operating and maintaining groundwater monitoring networks and some water quality sampling. Data maintenance including QA/QC of all data collected, data entry, and database maintenance were also part of my duties. I was also responsible for operation and maintenance of the one surface water gaging station on the Muddy River. I made water level measurements in several basins in Clark, Lincoln, Nye, and White Pine Counties and authored several compliance reports that were submitted to the Nevada State Engineer in support of water rights for the Jean Water System. Since 2003, I have been employed as a Hydrologist II. I serve as SNWA's representative for Joint Funding Agreements with the U.S. Geological Survey and Nevada Department of Water Resources. I operate and maintain one gaging station on the Muddy River, analyze the data from the gaging station, and compute the annual discharge record. I then submit the data to the USGS for publication in their annual data report. I am responsible for the oversight of data collection outside of the Las Vegas Valley, including the QA/QC of discharge measurements at springs and streams and water levels.

1993 to 1995 *U.S. Geological Survey, Las Vegas Office* *Las Vegas, NV*
Hydrologic Intern

I was employed as an intern with the U.S. Geological Survey from 1993 to 1995. My duties included: QA/QC of data collected for the Weapons Program at the Nevada Test Site and Yucca Mountain Project; operation and maintenance of several gaging stations on the Muddy River; water level measurements in the Las Vegas Valley and the Carbonate Rock network in southern and eastern Nevada; and data entry and database maintenance.

1993 to 1991 U. S. Geological Survey, Salinas Sediment Lab/Field Office Salinas, CA
Hydrologic Trainee

While assigned to the California District Sediment Laboratory, I was responsible for bed load and bed material analyses, preparation of suspended sediment samples, logging in of sediment samples, inventory and shipping of sampling materials, and general laboratory maintenance. While assigned to the Salinas Field Office, I was responsible for the operation and maintenance of 14 surface water gaging stations, which included measurement of suspended sediment, bed load and bed material as well as discharge. I also computed the annual discharge records for these streams, which were included for publication in the California Annual Data Report. I received two Special Achievement Awards (1991, 1992).

Technical Activity Work Summary

- Performed data analysis including the QA/QC of raw data to be included into databases
- Written several well construction contracts, and served as the technical lead during the construction of the wells
- Written well abandonment contracts for the Las Vegas Groundwater Management Program and oversaw their completion
- Authored several compliance reports for the Jean Water System to the Nevada Department of Water Resources
- Conducted numerous shallow groundwater investigations in Las Vegas Valley for the Las Vegas Valley Water District
- Performed sediment bed load and bed material sediment analysis
- Assisted in preparation of technical reports

Field Activity Work Summary

- Performed surface water discharge measurements at springs and streams in California and Nevada
- Performed sediment sampling in both California and Nevada
- Operated and maintained stream gaging stations in California and Nevada
- Collected subsidence data to help determine the lateral component of land subsidence in southern Nevada
- Performed water quality and water chemistry sampling at surface water and groundwater sites in both California and Nevada
- Collected field data to aid in the management of groundwater production and artificial recharge wells in the Las Vegas Valley, and groundwater production wells in Searchlight, Jean, and Kyle Canyon

References

Johnson, M. E., Donovan, D. J., Kistinger, G. M. 1998. Summary of the 1998 Aquifer Testing of MX-5, Coyote Springs Valley, Clark County, Nevada, Las Vegas, Nevada: Southern Nevada Water Authority - Resources Department.

Smith, D. L., Johnson, J. A., Donovan, D. J., Kistinger, G. M., Burns, A. 2004. Climate and Barometric Pressure Influences on Pederson Spring Discharge and the Carbonate Aquifer Near the Muddy Springs, Southern Nevada, Journal of the Nevada Water Resource Association, Fall 2004, Vol. 1, No. 1, pp. 76-103

Presentations

Donovan, D.J., Kistinger, G.M. Acheampong, S.Y., 2005, Charterization of Springs in Eastern, Nevada, Geological Society of America 2005 Annual Meeting and Exposition, Abstracts with Programs, Abstract No. 143-2, p.325

Kistinger, G.M, 2003, Correlation Between Groundwater Levels, Spring Discharge and Precipitation in the Red Rock Canyon and Blue Diamond Area near Las Vegas, NV, Poster presentation at the 2003 Nevada Water Resource Association Annual Conference

Kistinger, G.M., 2004, Challenges of Accurately Assessing Surface Water Resources in Southern Nevada and Eastern California, Abstract and Presentation at the 2003 Nevada Water Resource Association Annual Conference

Shanahan R. D., Kistinger, G.M. 2006, Historical Estimates of Evapotranspiration in Eastern Nevada and the Variability in the Hydrologic Parameters that Influence Evapotranspiration, Abstract and Presentation at the 2004 Nevada Water Resource Association Annual Conference

Smith, D. L., Johnson, J. A., Kistinger, G. M., Donovan, D. J., 2004. Effects of Regional Climate on Pederson Spring Discharge and the Carbonate Aquifer in the Vicinity of Muddy Springs, Southern Nevada Abstract and Presentation at the 2004 Nevada Water Resource Association Annual Conference

Smith, D. L., Johnson, J. A., Kistinger, G. M., 2004. Barometric Pressure Response of the Carbonate Aquifer in the Vicinity of Muddy Springs and Implications to Discharge of Pederson Spring, Clark County, Nevada. Abstract and Presentation at the 2004 Nevada Water Resource Association Annual Conference

Zane L. Marshall

Work Contact Information

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Resources Department
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Las Vegas, Nevada 89119
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(702) 862-3713

Personal Contact Information

286 Juniper Springs Street
Henderson, Nevada 89052
Z_Marshall@hotmail.com
(702) 838-6680

ACADEMIC BACKGROUND

University of Nevada Las Vegas
4505 S. Maryland Parkway.
Las Vegas, NV 89154-5012
(702) 895-3399

1999-Present Master of Arts in Science in Biology and Statistics
Graduate Research Project: "Phylogeography and Conservation Biology of the Desert Pocket Mouse (*Chaetodipus penicillatus sobrinus*)." Degree in progress with 52 graduate credits completed and research nearing completion. Expected graduation is in December 2006.

1996 Bachelor of Arts in Environmental Studies, Minor in Biology
Senior Thesis: "Critical Evaluation of the Issues and Policies Concerning the Management of Biological Resources Associated with the Virgin River"

Awards and Scholarships
Dean's Honor List
National Deans' List
University President's Scholarship

Scholastic Organizations
The Honor Society of Phi Kappa Phi
UNLV Alumni Association

WORK EXPERIENCE

2002-Present Senior Biologist
Southern Nevada Water Authority
Resources Department

Professional Staff Supervision and Project Team Leadership
Supervise a team of up to 12 professional environmental staff, conduct staff performance evaluations, prepare staffing plans and carry out staff management activities. Lead multidisciplinary research teams, which include senior professional staff, on various environmental and water resource related projects.

Project Management
Administer research, planning and construction projects dealing with sensitive, threatened and endangered species, and national and international environmental policy with total annual budgets exceeding $2,000,000. Lead and/or participate in field research activities. Interpret research results and give presentations, both written and oral, to internal management, outside agencies, professional organizations and the public.

Biological Studies Principal Investigator
Design and implement scientific investigations concerning the distribution, status and ecology of sensitive biological resources, including the following taxonomic groups: small mammals, bats, raptors, passerines, fish, amphibians and vascular plants.

Environmental Policy and Planning
Actively participate in environmental planning processes such as multi-species conservation programs and Endangered Species Act (ESA) recovery teams. Review and address environmental documents, position papers, legal briefs and court decisions. Coordinate and participate in educational tours and workshops concerning environmental issues such as the Colorado River Delta in Mexico and the Salton Sea.

Interagency Coordination and Cooperation
Establish relationships with state and federal agencies and other stakeholders, both in the United States and Mexico, and work in teams to identify problems and develop cooperative solutions concerning sensitive biological resources.

Environmental Compliance
Conduct environmental investigations and associated analyses, and prepare reports and other documentation required by the National Environmental Policy Act, Endangered Species Act, Clean Water Act and Federal Land Policy Management Act. Interpret environmental laws, regulations and policies relevant to the agency's mission.

1996-2002 Environmental Biologist I/II
Southern Nevada Water Authority
Resources Department

Conducted field surveys for sensitive, threatened and endangered species. Managed environmental consultants. Reviewed and contributed to biological research reports. Participated as a member of several ESA recovery teams and as a technical member of multiple committees during the development of the Clark County Multi-Species Habitat Conservation Plan and Lower Colorado River Multi-Species Conservation Program.

1995-1996 Environmental Intern
Las Vegas Valley Water District
Research Department
1001 S. Valley View Blvd.
Las Vegas, Nevada 89153
(702) 870-2011

Supported technical staff in conducting biological resource investigations. Participated in field surveys for sensitive, threatened and endangered species. Worked with environmental consultants. Reviewed and summarized publications and reports concerning biological resources.

1995 Environmental Intern
Southwest Gas Corporation, Inc.
Corporate Office, Staff Engineering Department
5241 Spring Mountain Road
Las Vegas, Nevada 89103
(702) 876-6405

Produced State Fire Marshal reports. Assisted in storm water runoff management and permitting, waste storage facility audits, underground storage tank compliance, and hazardous and special waste management. Aided in the management of environmental contractors. Worked to design and implement a corporation-wide environmental compliance program.

1992-1995 Environmental Technician
Dames & Moore, Inc.
Las Vegas Office, Environmental Department
4220 South Maryland Parkway
Las Vegas, Nevada 89119
(702) 796-7800

Performed paleoenvironmental analyses using packrat middens, sediment core samples, and pollen samples. Conducted sensitive, threatened and endangered

species surveys for plants, birds, reptiles, and small mammals. Participated in cultural resource surveys and prepared artifacts for museum curation.

MILITARY EXPERIENCE

1990-1998 Sergeant (Honorably Discharged)
United States Marine Corps Reserve
3rd Platoon, Fox Company, 2nd Battalion, 23rd Marines, 4th Marine Division
5755 Blytheville Road, Building 1032, Las Vegas, Nevada 89115
(702) 632-1501

Completed Marine Corps Boot Camp, School of Infantry and Anti-tank TOW Missile Weapon System School. Participated in infantry training exercises and performed volunteer duties as a member of the Honor Guard and Color Guard. Supervised up to 40 marines with limited oversight during Desert Storm. Developed and conducted military training courses in infantry combat techniques.

Badges, medals and awards include: Meritorious Unit Citation, Selected Marine Corps Reserve and National Defense Service medals; six Expert Rifleman badges; meritorious promotions to Private First Class and Corporal; and, three meritorious awards for outstanding leadership and performance.

VOLUNTEER EXPERIENCE

2004-Present Volunteer Biologist
North American Breeding Bird Survey
USGS Patuxent Wildlife Research Center
Laurel, MD 20708

Conduct breeding bird surveys on established transects in the Great Basin Desert as part of a nation-wide program.

2003-Present Board Member (Director)
Great Basin Bird Observatory
1755 E. Plumb Lane, Ste. 256 A
Reno, NV 89502
(775) 323-4226

Provide organizational oversight, review and approve budgets and expenditures, and provide technical advice concerning research methods.

2003-Present Volunteer Biologist
Great Basin Bird Observatory

1755 E. Plumb Lane, Ste. 256 A
Reno, NV 89502
(775) 323-4226

Conduct breeding bird monitoring surveys in the Mojave and Great Basin Deserts as part of a statewide program.

2001-Present Research/Technical Cave Diver
Death Valley National Park
Devils Hole Research Dive Team
Resources Management Division
Death Valley, CA 92328
(760) 786-3252

Participate in population counts and various research and monitoring activities concerning the endangered Devils Hole pupfish (*Cyprinodon diabolis*), and continued exploration of Devils Hole. Provide technical recommendations concerning Devils Hole to the Ash Meadows Recovery Team.

1992-1993 Field Technician
University of Nevada, Las Vegas
Geological Sciences Department
4505 S. Maryland Pkwy.
Las Vegas, NV 89154
(702) 895-3262

Assisted graduate students in collecting and analyzing water samples from springs in remote backcountry locations within Grand Canyon National Park.

1992-1993 Biology Research Assistant
University of Nevada, Las Vegas
Department of Biological Sciences
4505 S. Maryland Pkwy.
Las Vegas, NV 89154
(702) 895-3399

Assisted graduate students in phylogenetic studies of sensitive, threatened and endangered species in a DNA sequencing laboratory. Prepared mitochondrial DNA (mtDNA) samples for amplification in polymerase chain reaction equipment. Labeled mtDNA samples with radioactive isotopes. Prepared polyacrylamide gels and ran amplified mtDNA samples through gel electrophoresis.

POSTERS AND PRESENTATIONS

Nevada Water Resources Association. 1996. Las Vegas, NV. Presentation: "Environmental resource investigations in the lower Virgin River."

The Wildlife Society. September 1997. Snowmass, CO. Poster: "Vegetation classification of Great Basin and Mohave Desert vegetation using satellite images, GIS, and ERDAS imaging software."

University of Nevada, Las Vegas, Department of Biological Sciences, Student Symposium. October 2003. Las Vegas, NV. Presentation: "Phylogeography and conservation biology of the Desert Pocket Mouse (*Chaetodipus penicillatus sobrinus*)."

American Society of Mammalogists. June 2004. Arcata, CA. Presentation: "Phylogeography of the Desert Pocket Mouse (*Chaetodipus penicillatus*) with emphasis on the conservation of *C. p. sobrinus*."

Devils Hole Workshop. June 2004. Pahrump, NV. Presentation: "Research and management concerning the Devils Hole pupfish – A status update."

Desert Fishes Council. November 2004. Tucson, AZ. Presentation: "In-state water resource planning and development."

Bureau of Land Management, Cooperating Agency Biological Resources Technical Committee for the Clark, Lincoln and White Pine Counties Groundwater Development Project. June 2005. Las Vegas, NV. Presentations: "Biological resource investigations overview", "Mojave Desert wetland, riparian and aquatic ecosystems and associated sensitive resources occurring within the biological resources study area" and "Great Basin terrestrial wildlife."

Nevada Water Resources Association, Colorado River Symposium. October 2005. Las Vegas, NV. Presentation: "Importance of the Colorado River to environmental resources".

Nevada Water Resources Association, Annual Meeting. February 2006. Mesquite, NV. Panel Moderator: "Biological Topics in Basin and Range Hydrogeology."

Bonneville Chapter of American Fisheries Society. March 2006. Park City, UT. Presentation: "Planning for a sustainable Nevada."

PROFESSIONAL ORGANIZATIONS, COMMITTEES AND RECOVERY TEAMS

Professional Organizations
Colorado River Water Users Association
Cooper Ornithological Society
Desert Fishes Council

Ecological Society of America
Great Basin Bird Observatory
Nevada Water Resources Association
Society of Conservation Biology
Southwestern Association of Naturalists

Natural Resource Committees
Clark County Multi-Species Conservation Plan Implementation and Monitoring Committee
Lower Colorado River Multi-Species Conservation Program (LCR MSCP) Steering Committee
LCR MSCP Adaptive Management Subcommittee (Chair)
LCR Native Fishes Workgroup

Conservation and Recovery Teams
Ash Meadows Recovery Team
Big Springs Spinedace Recovery Implementation Team
Lower Virgin River Recovery Implementation Team
Muddy River Recovery Implementation Team
Railroad Valley Recovery Implementation Team
Relict Leopard Frog Conservation Team
Southwestern Willow Flycatcher Regional Recovery Implementation Team
Virgin River Fishes Recovery Team
White River Recovery Implementation Team

SPECIAL TRAINING

Leadership Training
Las Vegas Valley Water District Leadership Academy (All required courses)
USMC Non-commissioned Officer Leadership Course

Technical Training
HEP500, Habitat Evaluation Procedures
Population Viability Analysis Methods
Desert Tortoise Ecology and Survey Techniques
Southwestern Willow Flycatcher Ecology and Survey Techniques
Fisheries Field Techniques
Mammalogy Field Techniques
Vascular Plant Taxonomy
Plant Ecology
Habit Conservation Planning
Population Genetic
Multivariate Statistics
Statistical Research Design
Extended Range and Full Cave SCUBA

MICHAEL M. WALLEN

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as Vegas, Nevada 89107
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Southern Nevada Water Authority
Data Resources Division
1900 East Flamingo Rd. Suite 180
Las Vegas, Nevada 89119
(702) 862-3788
michael.wallen@lvvwd.com

Employment

Senior GIS Analyst, Southern Nevada Water Authority (SNWA) (October 2002 – Present)

- Advance the development, management and maintenance of the SNWA Resources Departmental Geographical Information Systems (GIS).
- Utilize GIS and remote sensing technology on panchromatic, natural/false color and multispectral satellite imagery and aerial photography for the interpretation and analysis of historical and current urbanized, agricultural and rural land use and land cover of the southwestern United States primarily for the Colorado River Basin, Great Basin, State of Nevada and the Mexican Delta of the Colorado River for multiple hydrological, biological, environmental and conservation projects.
- Conduct topologic, historic, hydrologic, geologic, biologic, environmental and demographic interpretation, analysis and field work using the latest GIS and remote sensing technologies and techniques.
- Develop, maintain and manage feature source spatial relational databases and their ability to link or join together with coverage/shapefile and/or grid attribute tables, external databases and/or software.
- Conduct analysis of all phases of the water right process to include field and legal investigations, surveys, the Application and Permit process and Point-of-Diversion and Place-of-Use Mapping.
- Collect, process and manage the SNWA Data Resources geospatial raster and vector datasets within departmental working directories and repositories.
- Plan, collect and post process field data gathered with conventional and survey grade GPS equipment.
- Plan, collect and post process field data collected in various hydrological, biological, environmental and conservation studies and data collection exercises.
- Conduct hardware and software analysis on SNWA's geospatial data with emphasis on performance issues and spatial data storage requirements and deployment.
- Keep abreast of the latest GIS, remote sensing and Global Positioning Systems (GPS) technologies, hardware, software and techniques as they can be applied to SNWA's workflow.
- Interact with various local, state and federal agencies, private organizations and companies, educational institutions and private individuals on data and technology needs, availability and sharing.
- Cross train SNWA, consultants and other professionals and students in the use of GIS, GPS and remote sensing hardware/software and technologies as it applies to their discipline.

GIS Analyst, Southern Nevada Water Authority (SNWA) (October 1998 – October 2002)

- Advance the development, management and maintenance of the SNWA Resources Departmental Geographical Information Systems (GIS).
- Conduct topologic, historic, hydrologic, geologic, biologic, environmental and demographic interpretation, analysis and field work using the latest GIS and remote sensing technologies and techniques.
- Took the lead in database design, development and maintenance of the departmental geographic based data as the departments' database administrator, this included conversions made between various hardware, software and RDBMS platforms and maintenance of geographical repository data.
- Generated presentation quality hardcopy and digital graphics and analysis in the form of maps, graphs, charts and tables.
- Provided technical support and training for the SNWA staff and other GIS departments both within and outside SNWA/LVVWD.
- Supervised one intern on multiple projects concerning the use of GIS in land use classification, geologic mapping and profiling, disk management and processing of satellite imagery/aerial photography.
- Assist in various hydrological and biological field studies and data collection exercises.
- Participate and contribute to the geographical information systems process improvement team study.

GIS Specialist, Las Vegas Valley Water District (LVVWD) (February 1993 – October 1998)

- Advanced the development, management, maintenance and performed analysis using LVVWD Resources departmental GIS. This included continuous tracking and updating of existing and proposed land use within the urbanized areas of the Las Vegas Valley and Boulder City, performed analysis to determine sites for new facilities, water distribution system network analysis, terrain analysis, hydrologic analysis and geographically referenced image integration and interpretation.
- Took the lead in database design, development and maintenance of the departmental geographic based data as the departments' database administrator, this included conversions made between various hardware, software and RDBMS platforms and maintenance of geographical repository data.
- Generated presentation quality hardcopy and digital graphics and analysis in the form of maps, graphs, charts and tables.
- Provided technical support for other GIS departments both within and outside SNWA/LVVWD.

Engineering Technician, Las Vegas Valley Water District (LVVWD) (July 1980 – February 1993)

- Initiated, designed, managed, maintained and generated analysis of LVVWD Planning Departments' GIS applications and projects. This included the development of base maps to be used with various projects throughout LVVWD, the sighting of new facilities, population, land use and water use projections, and water distribution system modeling utilizing both manual and digital drafting techniques.
- Performed data conversions between various hardware, software and RDBMS platforms.
- As the Districts water-rights technician I was involved in all facets of purchasing, permitting, maintaining and monitoring LVVWD ground-water rights. I was also responsible for tracking potential LVVWD and other State of Nevada water rights to be protested.
- Interacted with all departments of LVVWD/SNWA, federal, state and local agencies, contractors and the general public concerning LVVWD business.
- Developed and maintained the Engineering departmental library.

Draftsman, Las Vegas Valley Water District (LVVWD) (November 1979 – July 1980)

- Manual drafting of LVVWD facilities, as-built drawings and redline markups for outside agencies and contract drafting.

Transit man, Rodman and Draftsman, Sweetser Engineering, Cape Cod, Massachusetts (June 1976 – September 1979)

- Responsible for all phases of private property perimeter surveys and subdivision layouts.

Education

- **Clark County Community College,** North Las Vegas, Nevada (1990 – 1994)
  34 Credits towards Associate of Applied Science with GIS emphasis

- **Cape Cod Community College**, Hyannis, Massachusetts (1978 – 1979)
  7 Credits towards Associate of Applied Science

- **United Technical Institute,** Boston, Massachusetts (1974 – 1975)
  Graduated with certificate in Architectural Drafting

- Harwich Jr. Sr. High School, Harwich, Massachusetts (1968)
  Graduated

Professional Associations

American Society of Photogrammetry and Remote Sensing
American Water Works Association
CA/HI/NV/GUAM Regional ESRI User Group
Colorado River Water Users Association
Nevada Geographic Information Society
Nevada State Mapping Advisory Committee
Nevada Water Resources Association
Southern Nevada regional ESRI User Group

Professional Training

- **General Computing**
  - Introduction to Computers
  - Lotus 1-2-3, Symphony, Manuscript, WordPerfect
  - Excel, Access, Dbase IV
  - Oracle Introduction, Applications Development
- **Water Related Training**
  - Water Distribution System Operator Grades I & II
  - TR-25 Watershed Modeling
  - Practical Hydraulics

- **Geographical Information Systems**
  - ARCINFO Introduction, INFO9, Applications Programming, Grid
  - ArcView 3.1, 3.2, Avenue Programming
  - Introduction to ArcGIS I and II
  - Whats New in ArcGIS 9
  - ArcView & ArcGIS Spatial and 3D Analysis Extensions
  - Visual Basic for GIS
  - Introduction to Programming ArcObjects using VBA
  - Managing a GIS
  - Terrain Modeling
  - Integrating Imagery into Your GIS: Practical issues and Real Options
  - Using AM/GIS for Infrastructure Management
  - Creating Beautiful Maps with ArcMap
  - GIS Hydro 1998, 1999, 2000, 2001 & 2002
  - Building Geodatabases I
  - AutoCAD 12.0
- **Remote Sensing**
  - ERDAS Imagine, Fundamental, Advanced, Professional, Spatial Modeling
  - Exploring ENVI
  - Multispectral Remote Sensing with ENVI
  - Decision Making using Satellite Imagery and Remote Sensing
  - Fundamentals of Remote Sensing, Space Imaging
  - Assessing the Accuracy of GIS Information Created from Remotely Sensed Data: Principles and Practices
  - Feature Extraction using VLS Feature Analyst
- **Global Positioning Systems**
  - Global Positioning Systems, Trimble GPS
  - Practical GPS Data Collection and Processing Using Trimble GeoXT Handheld Receiver

Computer Experience

- **Hardware**
  - VAX/VMS
  - PRIMOS Mainframe
  - IBM AS400 Mainframe
  - TEKTRONIX Workstation
  - SUN Workstation (Unix)
  - Personal Computer (PC), Laptop & Notebook
  - Trimble GPS TC-1, Pro XRS, GeoExplorer 3, GeoXT & GeoXH
  - Leica 1200TM GPS Receiver
  - HP iPAQ Pocket PC, Dell Axiom Pocket PC
  - All too familiar with peripheral digitizers, plotters, scanners and printers
- **Operating Systems**
  - VAX/VMS
  - PRIMOS
  - UNIX
  - DOS
  - RPG
- **GIS Software**

- ArcInfo Workstation 9.1 (Unix & PC)
  - Arc, Arcedit, Arcplot, Arctools, Tin, Grid, Network, Cogo & AML
- ArcGIS Desktop 9.1
  - ArcMap, ArcCatalog, ArcToolBox, ArcGlobe, ModelBuilder, Spatial Analyst, 3D Analyst, Survey Analyst, Geostatistical Analyst
- ArcView 3.3
  - Spatial Analyst, 3D Analyst & Geostatistical Analyst, Avenue
- AutoCAD 12.0

- **Remote Sensing Software**
  - Leica ERDAS Imagine 8.7
    - Fundamental, Essential, Professional
    - Stereo Analyst
    - Photogrammetry Suite
    - Image Analyst for ArcView
    - Image Analyst for ArcGIS
  - ITT Visual Information Systems
    - ENVI 4.2
    - IDL 6.3
    - ENVI FLAASH
  - Visual Learning Systems
    - Feature Analyst 4.1
- **GPS Software**
  - Trimble
    - GPS Pathfinder Office
    - TerraSync
    - GPSCorrect
  - ArcPad 7.0
- **Additional PC Software**
  - Microsoft suite of applications
  - Kedit
  - XWINDOWS
  - KYPIPE
  - CYBERNET
  - Adobe Acrobat
- **Relational Database Management Systems (RDBMS)**
  - Oracle
  - Lotus
  - Dbase
  - Microsoft Excel
  - Microsoft Access
  - ESRI INFO 9 and Geodatabase

Professional Papers and Posters

"Controlling Energy by Operating Strategies Developed Through Computer Modeling"

Joint Paper with David Donnelly delivered at the AWWA California-Nevada Energy Commission Seminar, October 1985 at San Diego, California and published in the AWWA Business Management Division's 1985 Energy Economics Report.

"Using GIS to Generate Existing and Future Water Demands"

Paper delivered at the Nevada State GIS Conference, December 1991 at Las Vegas.

"Spatially Digging a Hole in the Desert – Locating Potential Major Facility Sites Using GIS"

Paper delivered at the Nevada State GIS Conference, December 1995 at Las Vegas.

"Construction Status of Land Use within the District Service Area for Summer 1994"

Presented at the 14th annual ESRI International User Conference, May 1994, at Palm Springs, California.

"Water Demand Forecasting and Generation for the Las Vegas Valley Water District"
Presented at the 14th annual ESRI International User Conference, May 1994, at Palm Springs, California.

"Environmental Decision Support System for Water Resource Assessment"
Joint poster with Janet Monaco and Chiuwen Ray presented at the 15th annual International User Conference, May 1995 at Palm Springs, California – used by ZEH Graphics (plotter software) as a demonstration plot of their product, was still in use at conferences in July of 2002.

"Land Use within Southern Nevada with Emphasis on Developed Lands in an Area Served by the Las Vegas Valley Water District for the Summer of 1994 and Projected Development to a Maximum Day Demand of 509 Million Gallons."
Presented at the 15th annual ESRI International User Conference, May 1995, at Palm Springs, California – presented at the Nevada State GIS Conference, December 1995 – used as a State and Federal Senate hearing display.

"Two Views of the Las Vegas Valley Comparing Slope, Topography, Existing Development and Surrounding Federally Protected Lands"
Presented at the Nevada State GIS Conference, December 1995 at Las Vegas – used as a State and Federal Senate hearing Display.

"The Role of Water Reuse in the City of Las Vegas"
Presented at the AWWA Conference, February 1996 at San Diego, California.

"Drainage Areas within the Upper and Lower Divisions of the Colorado River Basin and the Great Basin"
Presented at the Nevada State GIS Conference, April 2000, at Las Vegas – Awarded 3rd Place in the Cartographic Category of the poster contest. Presented at the 21st annual International User Conference, July 2000 at San Diego, California.

"Decadal Development Within the Las Vegas Valley, Nevada, from the Year 1950 through 1999"
Presented at the Nevada State GIS Conference, April 2000, at Las Vegas – Awarded 2nd Place in the Cartographic Category of the poster contest. Presented at the 21st annual International User Conference, July 2000 at San Diego, California – Published in the July 2001 ESRI Map Book "Geography - Creating Communities" under the natural resources category. Used as an exhibit before the U.S. Congress in 2005 as justification for continuing the Landsat satellite platform program by Kass Green, President of the Alta Vista Company

"Revisiting Precipitation/Natural Recharge Estimate Methodologies in Eastern Nevada"
Presented at the 23rd annual ESRI International User Conference, July 2003, at San Diego, California

Additional Achievements

Contributed numerous amounts of data, products, expertise and advice that others have used in conjunction with their own projects in the forms of applications, technical papers/reports, posters, presentations, tour guides, hearings, teaching aids and student projects.