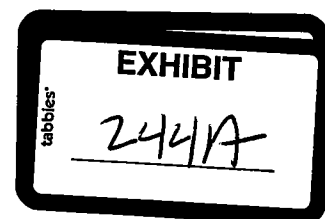


**Mahannah & ASSOCIATES,  
LLC**

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**STATEMENT  
OF  
QUALIFICATONS**



# **Mahannah & ASSOCIATES, LLC**

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## **SELECTED EXPERIENCE**

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# **Mahannah & ASSOCIATES, LLC**

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## **SELECTED EXPERIENCE**

### **Engineering**

- 2009-10     Production Well & Pump Design Design and Specifications for the construction of water supply wells, pumps and controls to meet cooling tower demands for the 50MW Blue Mountain Geothermal Project, Desert Valley, NV. Client: Nevada Geothermal Power Company, Reno, NV & Vancouver, BC
- 2007        Updated Churchill County Water Resource Plan Update of Churchill's 2025 & 2050 water resource plan to evaluate the 5, 10 & 20 demands and potential supplies. Project in coordination with V Point. Client: Churchill County, NV
- 2001-02    Preliminary Regional Water Distribution System Design Project included the use of WaterCAD distribution modeling software to size pipelines, storage tanks and pump stations for a regional water distribution for the Lahontan Valley for the planning horizons of 2025-2050. Client: Churchill County, Nevada
- 2001        Pump Station Design Project included the design and specifications for a pump station and screening mechanism to pressurize water from an irrigation canal for the irrigation of a cemetery. Client: Churchill County, Nevada
- 2000        Pump Station Design & Irrigable Acreage Determination Soils and topography investigation to determine potential irrigated acreage, design of a pumping plant, screening mechanism and controls to distribute irrigation water to an exclusive equestrian residential development. Client: Galena Canyon Development, Nevada
- 1998-00    Churchill County Water Resource Plan Developed a draft water plan to meet the quasi-municipal needs of a rural county for a planning horizon of 2025 & 2050. Project included preliminary engineering and cost estimates for six different water supply alternatives. Client: Churchill County, Nevada
- 1998        Design & Specification of Ponds, Pumping Plant, Diversion & Water Right Filings Developed design and specifications for two lined ponds, waterfall, re-circulation pumping plant, diversion structure and associated water right filings for a residential development. Client: George Benesch, Reno, Nevada
- 1997        Design & Specification of a Ground Water Well & Deep Turbine Pump Design, specify and oversee the construction of a high capacity ground water well and deep turbine pumping plant. Client: Hetrick Brothers Farms, Orovada, Nevada

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- 1996      Mining & Domestic Water System Design and Specification Project included pipeline/storage tank/distribution system design, preparation of bid specifications, permitting & oversee construction. Client: Florida Canyon Mine, Imlay, NV
- 1996      Preliminary Water Importation System Design Project included preliminary design of well field, 60+ miles of distribution pipeline, pump stations, etc. to import approximately 14,000 AFA of groundwater from Dixie Valley to Churchill County. Client: Churchill County, NV
- 1994      Quasi-Municipal Water System Design and Specification. Project included pipeline/distribution system design, preparation of bid specifications & oversee construction. Client: Mt. Rose Bowl Water Company.
- 1994      Groundwater Well and Pump Design and Construction Supervision and Aquifer Testing, Big Smoky Valley, Nevada. Client: RO Livestock.
- 1992-93      Groundwater Well and Pump Design and Construction Supervision for Julian Smith, Washoe Valley, Nevada. Client: Julian Smith.
- 1991      Groundwater Well and Pump Design and Construction Supervision for the Hetrick Brothers Farms, Quinn River, Nevada. The well replaced an existing inefficient sand pumping well. The capacity was increased to 4000+ gallons per minute yielding in a well efficiency of 92%, resulting in reduced operating costs. Client: Hetrick Brothers Farms
- 1990-93      Pipeline and Diversion Structure Design and Construction Supervision for the RO Livestock, Big Smokey Valley, NV. Project involved dealing with regulatory agencies such as the BLM, United States Forest Service, Nevada State Engineer, and the Army Corps of Engineers. Client: RO Livestock.
- 1986-93      Agricultural Pumping Plant Efficiency Testing. Conducted for Sierra Pacific Power Co. in an effort to reduce the agricultural energy demand. Client: Sierra Pacific Power Co.
- 1989      Groundwater Well Rehabilitation using acidization procedures, Barger Ranch, Elko, NV. Client: Soil Conservation Commission, State of NV.
- 1989      Design and Oversee the Construction of a test hole and production well; new deep turbine pump at the Hunewill Ranch, Wellington, NV. Client: Hunewill Ranch.
- 1986-89      Reduced Agricultural Energy Project. Trial phase project sponsored by Sierra Pacific Power Co. in an effort to reduce the agricultural customers power

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- consumption (kilowatt-hours) and power demand (kilowatts). Client: Sierra Pacific Power Company & State of NV.
- 1986-88     CDB Land Application of Secondary Effluent, Washoe County, NV. Monitor chemical and hydraulic loading for the application of effluent on alfalfa, preparation of annual reports; an operations and maintenance manual. Client: Washoe Co., Utility Div.
- 1984        Research and Development of Self-Cleaning Screen Intakes. Two proto-type self-cleaning models for diversion waters were designed and installed. Client: University of NV.
- 1983-84    Sprinkler and Auger Hole Infiltration Studies in the Tahoe Basin. A portable tank, pump and sprinkler apparatus was developed to measure on-site infiltration rates on steeply sloped building sites. Client: W.C. Kelly.
- 1983-84    Mesquite Sewer Treatment Plant Upgrading. Provided chemical and hydrological loading and irrigation design and specifications for agricultural wastewater land application system. Client: Clark County Sanitary District.
- 1983        Irrigated Agricultural Feasibility Statement for Hot Creek and Railroad Valleys, Nevada. Prepared for investors interested in developing desert land entries and Cary Act land. Client: D.W. Bohmont
- 1982        Getchell Mine Pipe Dewatering Disposal. Provided an alternative for disposal of mining water wastes on agricultural range lands. Client: Shell Oil Co.
- 1978-82    Land Application of Treated Municipal Effluent for Agricultural Irrigation. A hydraulic and chemical loading plan for the processing of secondary wastewater for the community of Elko was developed including irrigation design, soils survey, and agronomic and irrigation monitoring program. Clients: City of Elko & Chilton Engr.
- 1978-79    Land Application of Wastes in Northern Nevada. Survey and appraisal for existing and potential land application sites throughout Nevada. Technical Reviewers. Clients: State of NV & URS Engineers.
- 1977-78    USA vs. Alpine Land and Reservoir Co., et al. Irrigation diversion measurements on the Carson River above Lahontan Reservoir to develop baseline data relative to irrigation duty and diversion practices for incorporation into the Alpine Decree. Client: Carson Valley Subconservation District.

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- 1977      Uppaway Irrigation Design. Development of an irrigation design and scheduling procedure for the Uppaway Residential Development Project at Glenbrook, Nevada. Client: State of NV.
- 1975      Procedures and Source Materials for Identification of Public Lands Suitable for Agricultural Production. A comprehensive approach to site suitability assessment through physical resource and economic analysis methodologies.

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## **Hydrology**

- 2009      TROA Water Right Change Applications Expert Witness Testimony before Nevada State Engineer Prepared expert reports and provided expert witness testimony on municipal and agricultural consumptive use issues before the Nevada State Engineer relating to TROA related change applications. Client: TCID, Churchill County & City of Fallon.
- 2008-2009      Dixie Valley Cooperative Water Resource Study (5) Year (2009-2013) \$5M Cooperative Water Resource Study of Dixie Valley & Tributary Basins with the BOR, USGS and Private Consultants. Client: Churchill County, NV & BOR
- 2009      Surface-Groundwater Interaction Panel Organization Organized and moderated a distinguished panel of speakers including Colorado Supreme Court Justice, Gregory Hobbs; USGS Scientist, Stan Leake; Northern Colorado Water District Engineer, Jon Altenhofen; and University of Arizona Professor, Dr. Tom Maddox on the Interactive Roles of Surface & Groundwater for the Nevada Water Resource Association (NWRA) Annual Conference. Justice Hobbs provided the Keynote Address. Client: Pro bono
- 2009      Drilling & Exploration Program Test hole drilling, test well construction and aquifer testing to locate adequate water quantity and quality to meet cooling demands for Blue Mountain Geothermal Project, Desert Valley, NV. Client: Nevada Geothermal Power Co., Reno, NV & Vancouver, BC
- 2008      Expert Witness Testimony & Report, Protested Dayton Valley Groundwater Transfers Prepared written direct and rebuttal testimony/reports to support Protestant's position in Protested underground transfers in Dayton Valley, NV. Client: Churchill County, NV
- 2008      Enel North America Geothermal Monitoring Plan Development of a Ground Water Monitoring Plan to monitor effects of Geothermal pumping and injection of the shallow and deep aquifer systems, Stillwater, NV. Client: Churchill County, NV
- 2007      Expert Witness Testimony before State Engineer – Aqua Trac Applications Preparation of expert report and testimony before the State Engineer on Aqua Trac Applications seeking new underground appropriations in Granite Springs Valley, NV. Client: C-Punch Ranch, Pershing and Churchill Counties, NV
- 2006      Hydrologic & Water Right Evaluation of Desert Valley Client: Nevada Geothermal Power, Reno, NV & Vancouver, BC

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- 2004      Hage v. U.S Provided expert witness testimony before the U.S Federal Court of Claims regarding water rights, surface and groundwater hydrology associated with Monitor and Ralston Valleys. Client: Pine Creek Ranch, Monitor Valley, Nevada
- 2004      Lahontan Valley Arsenic GIS/Mapping Study GIS/Mapping of existing water quality parameters with depth. Sample collection and test hole drilling with depth specific sampling was also conducted. Client: Churchill County, Nevada
- 2003      Lahontan Alluvial Fan Recharge, Storage & Recovery Pilot Project Report Test hole drilling, logging, water level measurements and infiltration testing on the Wildgoose Farm to asses the artificial recharge potential of the site. Client: Churchill County, NV.
- 2002      Base Line Well Field Inventory Conducted well testing on Lessor's domestic, stock, commercial, geothermal wells within a geothermal resource area near Stillwater, Nevada. Client: Stillwater Holdings, LLC, Stillwater, Nevada
- 2002      Ground Water Investigation Investigation to evaluate potential impacts of a development on local ground water resources assuming individual sewage disposal systems will be used for each of the proposed 27 one-acre home sites. Client: Harry Fry, Washoe County, NV
- 2000-01      Recharge, Storage & Recovery Pilot Project Pilot project to map soils, conduct infiltration tests, test drilling, water quality sampling to determine the suitability of a site to recharge surface water into a ground water aquifer, store and recover for quasi-municipal purposes. Client: Carson Water Subconservancy District, Churchill County, Nevada
- 1999      Expert Witness Testimony regarding Water Right Permit Cancellation Water right abstracting, file review, report preparation and expert witness testimony before the Nevada State Engineer resulting in a ruling which reinstated several cancelled permits. Client: Mt. Rose Service Company, Washoe County, Nevada
- 1996-98      Expert Witness Water Rights Testimony Review of aerial photographs, historical data in preparation of expert witness testimony before the Nevada State Engineer regarding forfeiture and abandonment of Truckee Meadows Decreed surface water rights. Client: City of Fallon & Churchill County, Reno, Nevada
- 1995-96      Mine Dewatering & Artificial Recharge of Groundwater Oversee and monitor mine dewatering and artificial recharge of groundwater in the Kelly Creek groundwater basin for the Twin Creeks Mine and the Getchell Mine. Client: Adams Peak Properties, Golconda, NV



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- 1995      Groundwater Well Rehabilitation, Aquifer Testing & Deep Turbine Pump Design.  
Client: Sierra Pacific Power Company- Ft. Churchill Station, Mason Valley, NV
- 1994-96      Truckee River Unappropriated Water Analysis. Evaluation of the unappropriated  
Truckee River waters in support of the Truckee Carson Irrigation District,  
Application 9330 and associated agricultural and economic benefits if application  
were granted. Expert witness testimony before the Nevada State Engineer. Client:  
Truckee Carson Irrigation District.
- 1994      Groundwater Hydrologic Investigation and Evaluation in Support of a Water  
Appropriation Before the Nevada State Engineer, Fallon, Nevada. Client: A & A  
Dairy.
- 1994      Expert Witness Preparation and Testimony in Court of Federal Claims No. 93-85L,  
RO Livestock vs. United States. Client: RO Livestock.
- 1993      Groundwater Drainage Evaluation and De-Watering Design. Evaluation and design  
of groundwater de-watering system for the Franktown Meadows Equestrian Center,  
Washoe Valley, Nevada. Client: Franktown Meadows Equestrian Center.
- 1993      Artificial Recharge Evaluation of Groundwater Injected Into Wells Adjacent to the  
Truckee River and Resultant Potential Impacts to Downstream Water Users. Client:  
Truckee-Carson Irrigation District.
- 1992-93      Water Resource Evaluation for the City of Wells, Nevada. Client: George Yan,  
Mayor, City of Wells.
- 1992-93      Surface and Groundwater Investigation. Data collection, testing, evaluation, in  
support of expert witness testimony for the defendant regarding the source/cause of  
septic flooding near Verdi, Nevada in Gardner vs. DeDomenico. Defendant was the  
prevailing party since plaintiffs filed and were granted their "motion to dismiss".  
Client: Michael DeDomenico.
- 1992      Expert Witness Testimony and Water Right/Resource Investigation. Testimony  
before the Nevada State Engineer in support of water right change applications  
made by the applicant: Reno Organization for Motor Sports (ROMP) which were  
protested by adjacent neighbors. Client: Stevan Goodall, ROMP.
- 1992      Groundwater Right Transfer Impact on the Truckee River. Westpac Utilities  
transferred a groundwater right to a point of diversion near the Truckee River.  
Studies included analytical modeling, construction of a MODFLOW groundwater  
finite difference flow model and physical stream flow measurement to quantify river  
depletion caused by pumping. The conclusion resulted in an agreement between

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Westpac and Truckee-Carson Irrigation District (TCID) whereby Westpac would limit their groundwater pumpage within a one-half mile corridor on either side of the river. Client: Truckee Carson Irrigation District.

- 1991 Groundwater Drainage Evaluation. Evaluation of groundwater drainage and abandoned drain line to support Wetland's Designation for White Creek Development, Truckee Meadows, Nevada. Client: White Creek Development.
- 1990 Water Rights Claim, Clear Creek Watershed, NV. Water rights survey for both surface and ground water rights along the Clear Creek Watershed. Client: Donald Schulz.
- 1990 Water Rights, Truckee River, CA & NV. Survey of all claimed and exercised water rights on the Truckee River and through the Truckee Meadows area, CA-NV. Client: TCID.
- 1989 Market Water Right Values. Survey of market water rights values for the Truckee Meadows area, 1983-89. Client: Robert Helms Construction, Inc.
- 1987-89 Water Resources of the Upper Long Valley California and Nevada. Developed surface and ground water model to determine the effects of withdrawing a safe groundwater yield annually and conducting artificial recharge of surplus surface waters. Studies included test hole drilling, production well design and construction, aquifer testing, surface water gaging, and evaluating recharge potential. Client: Evans Ranch, Inc.
- 1986-87 Water Rights. Evaluation of the effects of urban development on the water rights of downstream water users along the Truckee and Carson Rivers. Clients: Truckee Carson Irrigation District & Douglas County.
- 1986 Twin Lakes Groundwater Monitoring Well Design & Installation. Design and installation of monitoring wells on behalf of the Lahontan Water Quality Control Board, CA. Client: State of California.
- 1986 Water Right Application preparation and surveys in Dixie Valley, NV. Client: Durbin & Mahannah.
- 1981 Bush Ranch Preliminary Hydrological and Irrigation Practice Investigation. Evaluation of the amount of irrigation water salvageable through the practice of pipelining creek water, thereby allowing additional irrigated land for development. Client: Bush Ranch.

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- 1981      Sierra Estates Groundwater Well Development. Provided groundwater well test hold logging procedures; construction/development specifications. Client: Sierra Estates.
- 1980      Groundwater Well Pumping Effects Upon Downstream Water Users Rights on the Carson River. Evaluation of proposed groundwater well development effects in and around the municipality of Dayton on downstream agricultural surface water rights. Clients: Truckee Carson Irrigation District and Douglas County.

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## Agriculture

- 2006      Wildgoose Soil Moisture Study Soil moisture study involving ET measurements, applied water, application efficiency, neutron probe soil moisture measurements on the Wildgoose Farm. Client: Churchill County, Fallon, NV
- 1997-00      Expert Witness Testimony before the Nevada State Engineer Represented numerous agricultural clients within the Newlands Reclamation Project in defending their water rights against claims by the Pyramid Lake Paiute Tribe that they had been abandoned or forfeited. Clients: Newlands Water Protective Association and individual farmers, Fallon, Nevada
- 1998      Nebraska v. Wyoming Consulted with other experts with regard to forage production, methods of irrigation, cultural practices and water use in this litigation. Client: State of Nebraska
- 1998      Bench/Bottom Land Soils Classification Assist in documentation of reclassification of soils within the Newlands Project from Bottom soils to Bench soils. Client: Joe Serpa, Fallon, Nevada
- 1994-02      Bruneau River Adjudication Prepare, survey and file numerous stock water proofs for the adjudication process before the Nevada State Engineer. Clients: C.E. Brackett Cattle Co., Brackett Livestock, Inc., Blick Ranches & Barinaga Ranches
- 1993      Ranch/Farm Evaluation and Testing for the Nevada Agricultural Foundation. Client: Nevada Agricultural Foundation.
- 1993      Ranch/Farm Evaluation and Recommendations for Carrillo Ranch, Big Smokey Valley, Nevada. Client: Carrillo Industries, Inc.
- 1992-93      Water Right Proof Filings, Well and Pump Testing, Pump Design, and Irrigation System Design for the Winters Creek Ranch, Washoe Valley, Nevada. Client: Myron Sayan.
- 1992      Evaluation and Documentation of Un-Metered Power Usage in support of expert witness testimony for the plaintiffs in Valley Electric Association vs. Wallace, Fish Lake Valley, Nevada. Client: Valley Electric Association.
- 1985-93      Research and Development of the Modified Atmometer to predict crop evapotranspiration. Client: ETgage Company.
- 1985-87      Review of the Proposed Bench/Bottom Designation for the Newlands Project. Provided technical evaluation and assessment relative to bench and bottomland

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designation and irrigation requirements for alfalfa and grain production in the Newlands Project. Client: TCID.

- 1977-80      Crop Water Consumptive Use Guidelines for the State of Nevada. Development of common methodologies to estimate crop water consumptive use requirements in the State of Nevada. Client: State Soil Conservation Commission.
- 1975-77      Humboldt River Irrigation Study. A study to determine the irrigated agricultural costs and benefits potentially experienced as a result of proposed upstream reservoirs on tributaries of the Humboldt River. Client: Upper Humboldt Water Users Association.
- 1973-77      Upper Carson River Study. A similar four year study to determine the water requirements for alfalfa production in the Upper Carson Valley. Client: Carson River Sub-conservancy District.
- 1970-74      Newlands Irrigation Project Study. A four year field and lysimeter study designed to determine Project irrigation requirements for alfalfa production and to ascertain if salvageable water was available. Client: State of NV.

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## **Environment**

- 2004-06      Swingle Bench Dust Monitoring Instrumentation and measurement of metrological conditions and dust collection on stripped, native and irrigated sites. Client: Churchill County, NV
- 1998-02      Development of a Wetlands/Wildlife Restoration Project Project included water right filings, well drilling & specifications for several warm geothermal artesian wells, proof filings to convert an abandoned ranch into a wetlands habitat for the benefit of resident wildlife and migratory birds. Client: David Rumsey & Mike Moore, Smoke Creek Desert, Nevada.
- 1993          Drip Irrigation System Evaluation and Recommendations. Evaluation of Leachate application system for the Wharf Resources, Incorporated (USA), South Dakota. Client: United States Fish and Wildlife Service.
- 1990          Evaluation of Development Impacts on Lake Tahoe Environment. Provided expert testimony in major environmental law suit as to the effects of both commercial and residential development on Lake Tahoe water quality, air quality, and soil erosion. Client: W.C. Kelly.
- 1989          Conduct soil moisture measurements using a Neutron Soil moisture probe for the Desert Research Institute, Bishop, CA. The project was an effort to determine the effects several of Southern California Edison's hydropower diversions will have on Bishop Creek. Client: Desert Research Institute, University of NV System.
- 1980-82      Water Quality Technical Advisors and Public Representatives. Review and technical advisors to lower Truckee-Carson water users respective of upstream quality management plans and discharge requirements. Clients: Churchill Co., Lyon Co., Storey Co., City of Fallon, and TCID.
- 1977          Soils Evaluation. Soil sampling, analysis interpretation and site suitability appraisal for agricultural production. Clients: Various ranches and farms.
- 1974-82      Quality Monitoring of Irrigation Water and Return Flows. A project to monitor the water quality of irrigation diversion and surface return flows from selected sites in the Carson Valley of Nevada. Client: State of NV.

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**SELECTED PUBLICATIONS**

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# **Mahannah & ASSOCIATES, LLC**

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## **SELECTED PUBLICATIONS**

### **Engineering**

Mahannah, C.C., 1992. Engineered Groundwater Well Construction: A Key to Increased Profits. Nevada Alfalfa Symposium Proceedings, February 5-6, 1992.

Guerrant, D.G., W.W. Miller, C.N. Mahannah and R. Narayanan. 1990. Infiltration Evaluation of Four Mechanical Rainfall Simulation Techniques in Sierra Nevada Watersheds. Water Resources Bulletin, Vol. 26, No. 1, p127-134.

Guerrant, D.G., W.W. Miller, C.N. Mahannah and R. Narayanan. 1990. Erosivity Evaluation of a Selected Tahoe Basin Soil. Journal of Environmental Quality. (Accepted with revision).

Miller, W.W., C.N. Mahannah, C.C. Mahannah, D.G. Guerrant and E.A. Naphan. 199\_. Practical Methodology for Erosion and Runoff Control on Individual Parcels in the Lake Tahoe Basin. p.000-000 in S. Lobe, L. Lewopold, L. Poppoff and C. Goldman (ed). Proceedings of the International Watershed Symposium, University of California, Berkeley, Univ. Press (Accepted).

Miller, W.W., C.N. Mahannah, R.L. Shane, E.H. Jensen and W.W. Finke. 1990. Evaluation of a Subsurface "Pop-Up" Sprinkler. J. Applied Agric. Research 5(1): 56-62.

Miller, W.W. 1989. Dry Valley Creek Reno/Sparks Sludge Application Project Proposal -- Review Comments and Interpretive Assessment. Soil and Water Resources Consulting. Reno, NV 25p.

Guerrant, D.G., W.W. Miller, C.N. Mahannah and R. Narayanan. 1989. Infiltration, Runoff and Erosion from Tahoe Basin Watersheds. Abstract. Agronomy Abstracts, ASA, CSSA, SSA. p.36. October 15-20, Las Vegas, NV.

Miller, W.W., C.N. Mahannah, C.N., C.C. Mahannah, D.G. Guerrant and E.A. Naphan. 1988. Practical Methodology for Erosion and Runoff Control on Individual Parcels in the Lake Tahoe Basin. Abstract. International Mountain Watershed Symposium, Lake Tahoe. July 1988.

Miller, W.W. and C.N. Mahannah. 1987. 1986 CDB Wastewater Land Application Monitoring Report. Tech. Rpt. Washoe County. Water Research & Development, Inc., Reno, NV. 8p., 1 Appendix.

Miller, W.W., C.N. Mahannah and C.C. Mahannah. 1986 CDB Wastewater Land Application System: Part I -- Application and Monitoring. Water Research & Development, Inc., Reno, NV. 100p.



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Mahannah, C.N., W.W. Miller and C.C. Mahannah. 1986. CDB Waste-Water Land Application System: Part II - Irrigation design. Water Research & Development, Inc., Reno, NV. 100p.

Mahannah, C.N., W.W. Miller, B.D. Thyre, E.H. Jensen and M.K. Kimbell. 1985. Rehabilitation of the US Bureau of Reclamation Service Oldest Project. 10th Technical Conference on Irrigation, Drainage, and Flood Control, USCID, Reno, Nv. 14p.

Mahannah, C.N. and W.W. Miller. 1984. Mesquite Wastewater Land Application System. URS Engineering/Water Research & Development, Inc., Reno, NV. 60p.

Mahannah, C.N. and W.W. Miller. 1984. Adaptation of a Buried Solid-Set Retractable Low Pressure Sprinkler Irrigation System for Commercial Agriculture. Proc. Western Regional Extension Agricultural Engineers and Irrigation Specialists Conference, Kimberly, Idaho.

Mahannah, C.N. and W.W. Miller. 1982. Four-mile Canyon Wastewater Land Application System. Chilton Engineering/Water Research & Development, Inc., Reno, NV. 132p.

Mahannah, C.N. and W.W. Miller. 1982. The Development of an Underground Solid-Set Retractable Sprinkler System for Production Agriculture. Agronomy Abstracts, Amer. Soc. Agro. Mtgs., Anaheim, CA. 252p.

Miller, W.W. and C.N. Mahannah. 1982. Use of Municipal Effluents and Sludges on Agricultural Land. In: Symposium Proceedings on the Effects of Sewage on the Truckee River. Coll. of Ag., University of Nevada-Reno, Ext. Sta. Rpt. R-147, p.13-20.

Miller, W.W. and C.N. Mahannah. 1979. Use of Municipal Effluents and Sludges on Agricultural Lands. In: Proc. Symp. of the Effects of Sewage on the Truckee River, College of Agric., Exp. Sta. Rpt. R-147. University of Nevada-Reno, p13-20.

Miller, W.W. 1979. Wastewater Treatment Systems -- Land application Component. Coll. of Ag., University of Nevada-Reno, Ext. Resource Info. Series 79-1.

Miller, W.W., C.T.K. Chiang and G.N. Benesch. 1978. Framework for Making Resource Use Decisions - An application to Subdivision Development. J. Soc. Long Range Planning 1:72-80.

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## **Hydrology**

Mahannah, C.C. and Mahannah, C.N. 1993. Streamflow Depletions Resulting From Groundwater Transfers. American Society of Civil Engineers, Irrigation and Drainage Conference, Proceedings, July 21-23, 1993.

Panian, T., W.W. Miller and G.F. Gifford (No senior authorship assigned). 1987. Salinity Contribution to the Colorado River from Nevada Basin Components. Technical Report #BLMNVPT87077200, Bureau of Land Management. Max C. Fleischman College of Agriculture, University of Nevada, Reno, NV.

Mahannah, C.N., W.W. Miller, B.D. Thyr and E.H. Jensen. 1985. Irrigation Requirements for the Truckee/Carson Irrigation District Water Right Transfer Applications. Technical Report: Hearings of the State Engineer, Fallon, NV. 44p.

Guitjens, J.C. and W.W. Miller. 1980. Irrigation Water and Surface Runoff Quality and Quantity in Carson Valley, Nevada. Water Resource Bull. 16:459-462.

Guitjens, J.C. and W.W. Miller. 1978. Quality and Quantity of Irrigation Water and Surface Runoff in the Carson Valley, Nevada. Trans. AGU 59(12):1070.

Bishop, A.B. and R. Narayanan. 1977. Seasonal and Stochastic Factors in Water Planning. ASCE J. Hydraulic Division. 103(HY10).

Mahannah, C.N., J.C. Guitjens and C.R. York. 1975. Western Nevada Water Controversy. College of Agric., Extn. Bull. B-34. 27p.

Bishop, A.B., B.C. Jensen and R. Narayanan. 1975. Economic Assessment of an Activity Analysis Model for Water Supply Planning. Water Resources Research. 11(6).

Guitjens, J.C. and C.N. Mahannah. 1972 & 1975. Upper Carson River Water Study - Water Years 1972 & 1973. College of Agric., Exp. Sta. Rpts., R-94 & R-113, 51p. & 30p.

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## **Agriculture**

Mahannah, C.N. 1992. Retrofit Irrigation Systems Result in Decreased Power Cost. Nevada Alfalfa Symposium Proceedings, February 5-6, 1992.

Mahannah, C.N., Engle, M. 1992. Alfalfa Growing Case Study: RO Livestock Gravity Pipeline of Groundwater Well Irrigation System. Nevada Alfalfa Symposium Proceedings, February 5-6, 1992.

Kimbell, M.K., W.W. Miller, C.N. Mahannah and E.H. Jensen. 1990. Applied Water Requirements for Sprinkler Irrigated Alfalfa in Western Nevada. J. Applied Agric. Research. IN PRESS.

W.W. Miller. 1990. Growing the Crop: Water Management for Production. p.63-69. In: G. Munk (ed), 1990 Alfalfa Symposium Proceedings -- Alfalfa: From Seed to Market. Nevada Cooperative Extension, Max C. Fleischman College of Agriculture, University of Nevada, Reno. Feb. 7-8, Sparks, NV.

Mahannah, C.N., W.W. Miller and C.C. Mahannah. 1989. CDB Wastewater Land Application System -- Operations and Management Manual. Water Research & Development, Inc., Reno, NV. 24p.

Miller, W.W. 1988. Dixie Valley Agronomic Soil Suitability Investigation. Appendix B. In: C.N. Mahannah. Dixie Valley Water Right Valuation. Water Research & Development, Inc., Reno, NV, 22p., 4 Appendices.

W.W. Miller, C.N. Mahannah, C.C. Mahannah and R. Pennington. 1989. CDB Wastewater Land Application System -- 1988 Monitoring Report. Water Research & Development, Inc., Reno, NV. 14p.

Jensen, E.H., W.W. Miller, C.N. Mahannah, J.J. Read and M.K. Kimbell (No senior authorship assigned). 1988. Effect of Water Supply on Performance of Alfalfa. J. Production Agriculture 1(2):152-155.

Miller, W.W., E.H. Jensen, C.N. Mahannah, T.R. Knous and B.D. Thyr. 1988. Evaluating Applied Water Requirements of Alfalfa: Yield, Forage Quality, Alfalfa Disease. P.71-83. In: E.H. Jensen (ed). Proceedings of the 1989 Alfalfa Symposium. SP-89-1 College of Agriculture, University of Nevada-Reno.

W.W. Miller, C.N. Mahannah, C.C. Mahannah and R. Pennington. 1989. CDB Wastewater Land Application System -- 1987 Monitoring report. Water Research & Development, Inc., Reno, NV. 17p.

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Leedy, C.D., W.W. Miller and G.D. Robison (No senior authorship assigned). 1987. Effect of Nutrient Source on Alfalfa Yield and Water Use Efficiency in Southern Nevada. *J. Fertilizer Issues* 4(4):138-142.

Mahannah, C.N., E.A. Naphan, W.W. Miller and C.C. Mahannah (No senior authorship assigned). 1987. Review of the 1987 BOR Bench/Bottomland Designations and Summary of 1987 WRD Criteria and Designations for the Newlands Project. US District Court, Federal Government vs. Alpine Water Users. Water Research & Development, Inc., Reno, NV. 15p., 7 maps, 4 Appendices.

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**RESUMES**

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**CHRIS C. MAHANNAH, P.E.**

## **Education**

BS 1986      University of Nevada, Reno -- **Civil Engineering**  
1988      University of California, Davis - **Civil Engineering**  
1991      Cornell Pump Hydraulics Seminar  
1992      National Groundwater Association: MODFLOW Simulation of Groundwater Flow and Advective Transport.  
2000      Water Distribution Modeling featuring Water CAD®

## **Registration**

**Professional Civil Engineer (P.E.)** -- State of Nevada.  
**Water Right Surveyor** - State of Nevada

## **Experience**

8/06-present      **Mahannah & Associates, LLC, Reno, NV**  
**Principal & Owner**  
Water resource engineering and consulting firm specializing in water rights, surface and ground water hydrologic investigations, agriculture, litigation support and expert witness testimony

1979 – 8/06      **Water Research & Development Inc., Reno, NV**  
**Principal Engineer**  
Oversaw and coordinated field investigations in the collection of hydrologic data and preparation of engineering reports. Gained field and design experience in surface and groundwater resources, water rights, irrigation systems, water systems, aquifer testing, pump testing and well design/efficiency, pipeline and distribution system design, pumping plant design, irrigation management, and surface and groundwater modeling and artificial recharge. Inspection and construction project management associated with well drilling and development, pipeline installations, pumps and controls, and water systems.

1988      **S.S. Papadopoulos & Associates Inc., Davis, CA**  
**Staff Hydrologist**  
Assisted in the development of a groundwater flow and heat model for the Long Valley Caldera, CA to predict the effects of a proposed geothermal development. Collection and interpretation of data and publications in regard to the causes of water quality degradation at Lake Tahoe, CA/NV.

1985      **U.S. Geological Survey, Carson City, NV**  
**Staff Hydrologist**  
Data collection for a groundwater study in the carbonate aquifer, southeastern Nevada which included: surveying, gravity surveys, and seismic testing.

1984      **Nevada Dept. of Transportation, Carson City, NV**  
**Student Engineer - Summer Cooperative Program**  
Worked in the Materials and Testing Lab performing ASTM tests on highway construction materials.

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1971 - 1981

**National Oceanic Atmospheric Admin. (NOAA), Reno, NV**

**Weather Station Observer**

Daily maintenance and collection of meteorologic data from two weather stations located on Mt. Rose, NV.

## **Computer Skills**

Software Experience: Windows, Word, Excel, Powerpoint, Access, AutoCAD, ESRI ArcGIS, MODFLOW & WaterCAD®.

## **Affiliations**

National Water Well Association (NWWA)

National Water Works Association (NWWA)

American Society of Civil Engineers (ASCE)

American Society of Mechanical Engineers (ASME)

Tau Beta Pi Engineering Honor Society

National Society of Professional Engineers (NSPE)

National Groundwater Association (NGWA)

Nevada Water Resource Association (NWRA)

Nevada Cattlemen's Association