



## Mark R. Palumbo Principal, Hydrologist

### Education

- M.Sc., Hydrology, New Mexico Institute of Mining & Technology, 1983
- B.A., Sociology, St. Bonaventure University, 1975

### Registrations/Affiliations

- Colorado Ground Water Association (past President 1988-1989)
- National Ground Water Association
- Association of Ground Water Scientists and Engineers

### Contact Information

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### Experience Overview

Mr. Palumbo has over thirty-five years of hydrological experience. He has been involved in numerous ground water and surface water projects. His areas of expertise are hydrogeology, ground water hydrology, water resources, computer modeling, and well hydraulics. Within Colorado, he has constructed aquifer models, supervised the installation of municipal water wells, and conducted hydrogeologic and surface water projects. He is an expert on the technical aspects of Colorado water law. He has been involved in numerous ground water applications, surface water transfers, plans for augmentation, and water resource valuations. As an international consultant, he has supplied technical supervision and management to overseas governments.

Mr. Palumbo provides water rights protection and hydrogeologic consulting services for Cottonwood Water & Sanitation District, Inverness Water & Sanitation District, The Pinery Water & Wastewater District, The City of Idaho Springs, The Denver County Club, Academy Water & Sanitation District, The Town of Fraser, The TH Ranch, LLC, and Beebe Draw Gun Club, Magness Land Holdings, LLC, and the Upper Black Squirrel Creek Ground Water Management District on a regular basis.

### Representative Experience

- Augmentation plan work for Denver Southeast Suburban Water & Sanitation District, Cottonwood Water & Sanitation District, and other clients.
- Cherry Creek Alluvial Aquifer Modeling Project – HRS is responsible for the database and GIS portions of this project and collectively working on the ground water modeling portions of this project with other Cherry Creek consultants.
- Project manager for the Denver Water Board Lawn Irrigation Return Flow Project. The groundwater portion of this project quantifies subsurface lawn irrigation return flow timing and location within Denver Water service area. The project includes hydrogeologic fieldwork, test hole installations, monitor well installations, fieldwork to obtain aquifer properties, pumping tests, and analytical groundwater modeling.
- Groundwater modeling project manager for the Rio Grande Decision Support System for the Colorado State Engineer's Office and the Colorado Water Conservation Board. The groundwater modeling work includes the development and calibration of multi-layer steady state and transient groundwater models of the San Luis Valley, Colorado.
- The South Metro Water Supply Study Board completed an investigation of groundwater and surface water conjunctive use water supply alternatives in Douglas County, Colorado. Douglas County water suppliers, Denver Water, and the Colorado River District support this project. Mr. Palumbo is the project manager for the HRS portion of the work that includes work related to individual well production rates, data gathering, and analysis of drawdown in multi-completed Denver Basin wells in response to anticipated municipal demands.
- Denver Basin aquifer well installations, pumping test analyses, and bore hole geophysical analyses have been or are being performed for Inverness Water and Sanitation District, Denver Southeast Suburban Water and Sanitation District, the City of Colorado Springs, Denver Country Club, and Colorado State Parks. These projects include the preparation of technical specifications, contracts and bid documents.

- Conjunctive use and ground water recharge work for the Metro Water Supply Investigation Study funded by the Colorado Water Conservation Board. Work on this study included evaluation of the recharge potential in the Denver Basin aquifers, and design and cost analysis for Denver Basin aquifer conjunctive use wellfields.
- Augmentation plan analysis and report for Academy Water and Sanitation District. The District required an augmentation plan for their alluvial and bedrock aquifer wells. The augmentation plan included depletion analysis, accounting and quantification of return flows from the domestic and irrigation use.
- Design, installation, testing, and depletion analyses on five South Platte alluvial wells for Centennial Water and Sanitation District. The wells are 24 inches in diameter. The pumping rate from the wellfield exceeds 6,000 gpm. The wells are used in conjunction with Centennial's augmentation plan.
- Design and implementation of a field study to evaluate the effect of alluvial well withdrawals on a wetland area. This project included the installation of 27 test holes and monitoring wells, near surface investigations of hydraulic head and vertical hydraulic conductivity, pumping tests, and ground water flow modeling.
- Their well field simulations and flow net analysis to determine ground water flow patterns to an alluvial well field from two adjacent streams. This analysis determined the amount of water flowing to the wellfield from each stream.
- Glover depletion modeling to determine stream depletions from South Platte River and Cherry Creek alluvial wells. Depletions analyses have been performed for several clients.
- Colorado Water Law: The review of decrees for ground water and surface-water appropriations in addition to plans of augmentation. Expert knowledge of Colorado ground water laws and the rules and regulations associated with these laws.
- Ground water availability studies: The evaluation of the aquifers beneath parcels of property to determine available appropriations under the law. The studies required the analysis of borehole geophysical logs and the correlation of aquifers beneath the property.
- Project manager for the Colorado Springs Utilities Denver Basin Well Installation Project that was completed in 2004. HRS completed site selection, technical specifications, contracting, well permitting, well installation, and well testing work for seven wells. Three wells were completed in the Arapahoe aquifer, three wells were completed in the Denver aquifer, and one well was completed in the Laramie-Fox Hills aquifer.
- Project manager for the groundwater portion of the Centennial Water and Sanitation District Cline Ranch Transfer Project. This project includes the transfer of agricultural water rights in South Park, Colorado for municipal use. HRS work on the groundwater portions of this project included hydrogeologic fieldwork, monitor well installations, field tests, laboratory analysis, and groundwater flow modeling.
- Nebraska v. Wyoming North Platte River litigation. HRS represented the State of Wyoming Attorney General's Office and State Engineer. Work on this project included surface water depletion analyses from well pumping, hydrogeologic analyses, analysis of groundwater flow, consumptive use analyses from groundwater pumping, and review of Nebraska's groundwater reports. Mr. Palumbo was the HRS project manager.
- Conjunctive use and project feasibility studies at Eagle Park, Colorado for the Cities of Aurora and Colorado Springs. This work is in conjunction with two Water Court applications and includes groundwater withdrawal and recharge from a deep glacial-alluvial aquifer. The work includes: production and monitoring well installations, pumping tests, evaluation of surface recharge potential, evaluation of deep injection, analysis of stream-aquifer interactions, augmentation plan accounting, and groundwater flow modeling to evaluate groundwater production, aquifer recharge and stream depletion timing.
- A study of the Economic Life of the Denver Basin Aquifers was performed for the Colorado Water Conservation Board in conjunction with the Colorado State Engineer's Office as authorized under Senate Bill 96-153. This project included the evaluation of production and drawdown over a 50-year period in the Dawson, Denver, and Arapahoe aquifer wells in the Denver Basin. Capital, operational, and maintenance costs of groundwater production were developed over the project period.
- Final evaluation of the ORT International Lake Chad Agricultural Development and Farmer Training Project, a member of a five-person evaluation team responsible for evaluating the hydrologic aspect of the program which included tube wells, open wells, centrifugal pumps, and irrigation design.

- As an international consultant, the installation and maintenance of over 100 low-yield wells in the African countries of Chad and the Central African Republic. These wells were used as primary drinking water supplies. Additional responsibilities included project management and implementation.
- Investigations and analysis of the effects of ground water production on a spring in the Piceance Basin. Hydrogeologic and water quality investigations were performed which demonstrated that ground water pumping was not affecting quantity and quality of spring flows.
- Ground water modeling: Developed a ground water flow model for the State of New Mexico to determine the effects of proposed City of El Paso, Texas municipal wells on the ground water aquifers of the Mesilla Bolson, New Mexico.

## Presentations and Papers

- “How Alluvial Aquifers Can Be Used to Reduce Water Shortages for Municipal and Metropolitan Water Users”, Panel Discussion, American Ground Water Trust, December, 2013.
- “Stream Depletion/Accretion Development and Use of Unit Response Functions”, Palumbo, M.R., Presented to Continuing Legal Education in Colorado, Inc., Colorado Bar Association CLE, November, 2010.
- “Analytical Stream Accretion and Depletion”, Palumbo, M.R., Presented to Continuing Legal Education in Colorado, Inc., Colorado Bar Association CLE, November, 2010.
- “Fundamentals of Ground Water Modeling - Choosing the Appropriate Ground Water Model -Setting Up the Operating Model Framework”, Palumbo, M.R., Presented to: Ground Water Modeling for Lawyers Colorado Bar Association CLE, April 2007.

## Water Court Experience

- Meridian Service Metropolitan District, Case No. 13CV31263, representing the Upper Black Squirrel Creek Ground Water Management District, deposition and testimony, 2014.
- Meridian Service Metropolitan district, Case No. 12GW10, representing the Upper Black Squirrel Creek Ground Water Management District, testimony, 2013.
- Castle Pines Metropolitan District and Castle Pines North Metropolitan District, Case No. 09CW275 representing Centennial Water and Sanitation District, deposition, 2012.
- Farmers Reservoir & Irrigation Company, United Water and Sanitation District, Sand Creek Metropolitan District, and East Cherry Creek Valley Water and Sanitation District Activity Enterprise, Inc., Case Nos. 02CW404 and 03CW442, representing TH Ranch, LLC, deposition, 2011.
- In the Matter of the Petition for Nontributary Determination for Produced Water from coal Bed Methane Well in the Central Raton Basin, Raton and Vermejo Formations, testimony, 2010.
- In the Matter of the Petition of the Nontributary Determination of Produced Ground Water in the Piceance Basin, Dakota, Morrison and Mancos Formations, testimony, 2010.
- Pioneer Irrigation District and Laird Ditch, Case No. 05GW14, representing Stulp Investment Co., LLC and Five Rivers Cattle Feeding, LLC, deposition, 2008.
- Parker Water and Sanitation District, Case No. 01CW60, representing Cottonwood Water and Sanitation District, deposition, 2006.