

Insights on Managed Aquifer Recharge and Optimization Strategies using a Hydrogeophysical Approach

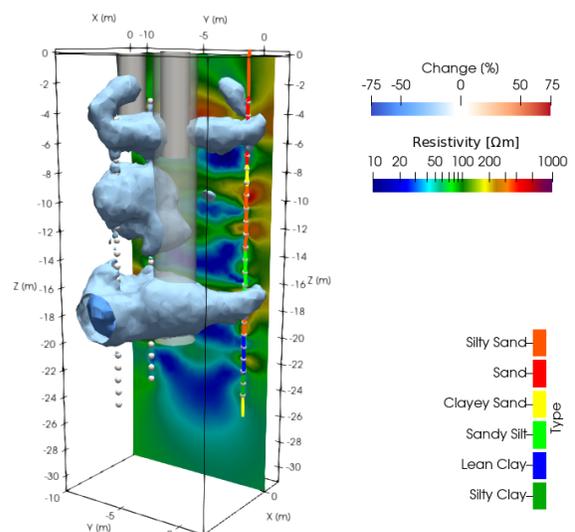
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Abstract: Managed Aquifer Recharge (MAR) is increasingly employed as a sustainable strategy to enhance groundwater resources in response to finite clean water availability and growing future water stress. Hydrogeophysics—the application of geophysical methods to hydrological problems—offers powerful, non-invasive tools to characterize subsurface properties, track recharge dynamics, and assess MAR efficiency over space and time. Techniques such as time-lapse electrical resistivity tomography (ERT) enable 4D monitoring of infiltration rates, storage changes, and preferential flow pathways, thereby improving understanding of recharge processes and identifying factors that limit MAR performance. By integrating hydrogeophysical data with hydrological modeling, water managers can optimize site selection, operational strategies, and long-term sustainability of MAR systems, ensuring more resilient groundwater supplies under increasing climatic and anthropogenic



pressures. Here, we demonstrate the application of this hydrogeophysical approach across multiple MAR scales, encompassing small-scale urban recharge sites, intermediate-scale agency-operated recharge basins, and large-scale agricultural fields recharged through flooding.



Mr. Craig Ulrich is a Research Geophysicist and Program Lead of the Sustainable Groundwater Management Program at Berkeley Lab. He received his M.Sc. in Environmental Geology from Rutgers University in 2005. His research centers on understanding subsurface dynamic processes related to fluid movement using hydrogeophysical monitoring.

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