

GEI'S CAPABILITIES

# Managed Aquifer Recharge

# What is Managed Aquifer Recharge?

## *Integrated Surface Water and Groundwater Management Solution*

Managed Aquifer Recharge (MAR) is a water resource management tool available to agencies looking to augment and stabilize groundwater supplies in their basins. MAR is a voluntary resource management strategy of intentionally infiltrating water into an aquifer and storing it for subsequent recovery and achieving the other benefits while the water is in storage. Most recently driven by the 2014 Sustainable Groundwater Management Act's comprehensive groundwater management requirements, MAR fits into multiple planning processes that already exist for agencies to achieve groundwater sustainability.

Variations on MAR include Flood-MAR which involves using flood waters for recharge, and Aquifer Storage and Recovery which involves injecting drinking water into aquifers primarily for domestic and municipal uses. MAR has increasingly become a recognized element of an integrated surface water and groundwater management solution due to the multitude of benefits it provides. In addition to water supply reliability and aquifer replenishment, MAR projects have the potential to provide flood risk reduction, drought preparedness, ecosystem enhancement, subsidence mitigation, water quality improvement, climate change adaptation, and recreation. Additional benefits to the agencies that implement these types of projects include effectively managing excess flows, wastewater, and stormwater.



MAR helps to fulfill management objectives identified through multiple planning processes.

Developing sustainable MAR programs or projects requires a phased approach that links and integrates surface water and groundwater management and planning, technical studies and modeling, information management, and permitting and project implementation. GEI Consultants, Inc. (GEI) provides services for every phase of MAR implementation. Our team, led by seasoned senior professionals with specialized strategic planning experience, is able to assist agencies with their programs and projects using their extensive groundwater management, planning and engineering, and project implementation experience and expertise.

## GEI's services cover all phases of MAR implementation



# The GEI Approach to MAR

## Interdisciplinary Implementation

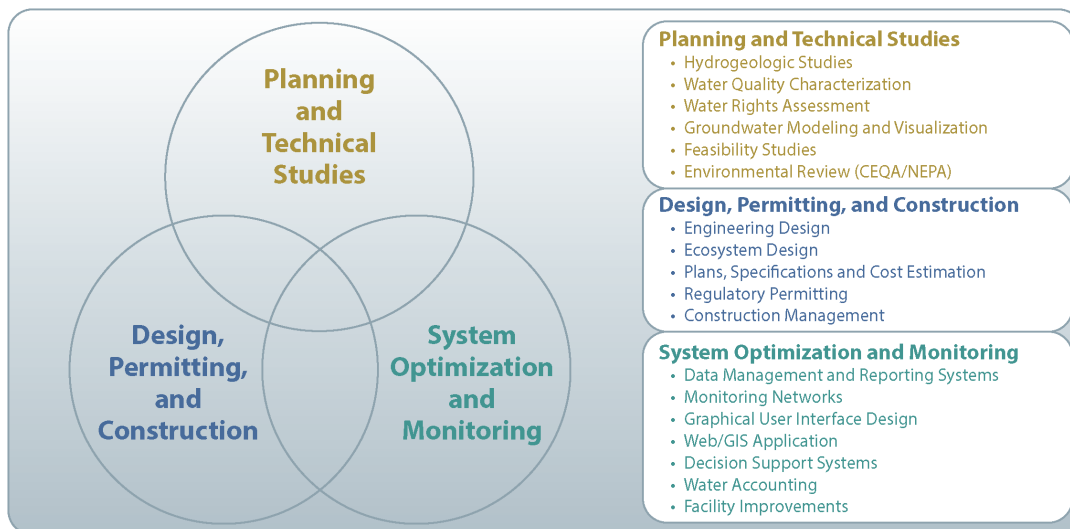
The planning and implementation of MAR projects presents complex technical, legal, and institutional barriers and challenges that require an integrated approach. GEI is a multi-disciplinary firm of engineers and scientists that delivers cohesive groundwater, water resources, environmental, flood management and geotechnical solutions for a diverse water resource clientele. Over the last 50 years, GEI has established itself as the go-to groundwater firm with many years of experience in groundwater management planning, hydrogeology and aquifer characterization, groundwater modeling, groundwater science, technology, and policy. GEI pioneered groundwater recharge, conjunctive use, and water banking in California.

GEI staff has unique expertise in MAR related project development and implementation. We have unparalleled experience in designing and implementing groundwater management and recharge projects in California. GEI combines this experience with our understanding of water policy and funding to help our clients successfully implement MAR programs and projects.

The GEI Team believes that the success of MAR projects depends on a holistic approach to planning and implementation. Because of our extensive experience, our team understands and is prepared to assist agencies with the range of integrated services necessary for success.

GEI'S GRANT FUNDING SUCCESS FOR CLIENT PROJECT IMPLEMENTATION

TYPE OF PROGRAM	GRANTS AWARDED	GRANT FUNDS AWARDED (USD)
Integrated Regional Water Management	24	\$82,883,097
Conjunctive Use	15	\$332,838,676
Water Use Efficiency	54	\$38,398,433
Groundwater Management	27	\$16,780,526
Flood Control	24	\$102,851,572
Water Storage Investment Program	2	\$302,306,000
Other	11	\$19,073,304
<b>Total</b>	<b>157</b>	<b>\$895,131,608</b>

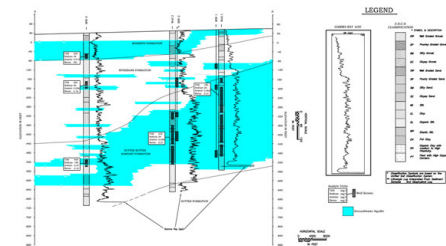


*GEI's services cover all phases of MAR implementation*

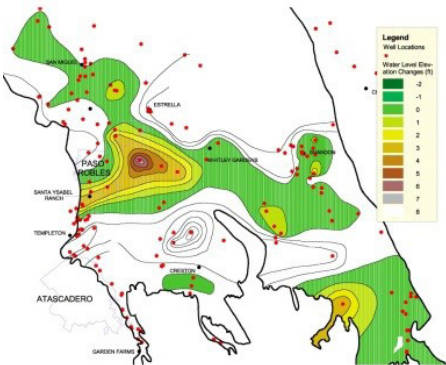
# A History of Integrated Surface Water and



1. 50 Years of Water Resources Planning and Management, *Semitropic Water Storage District*.



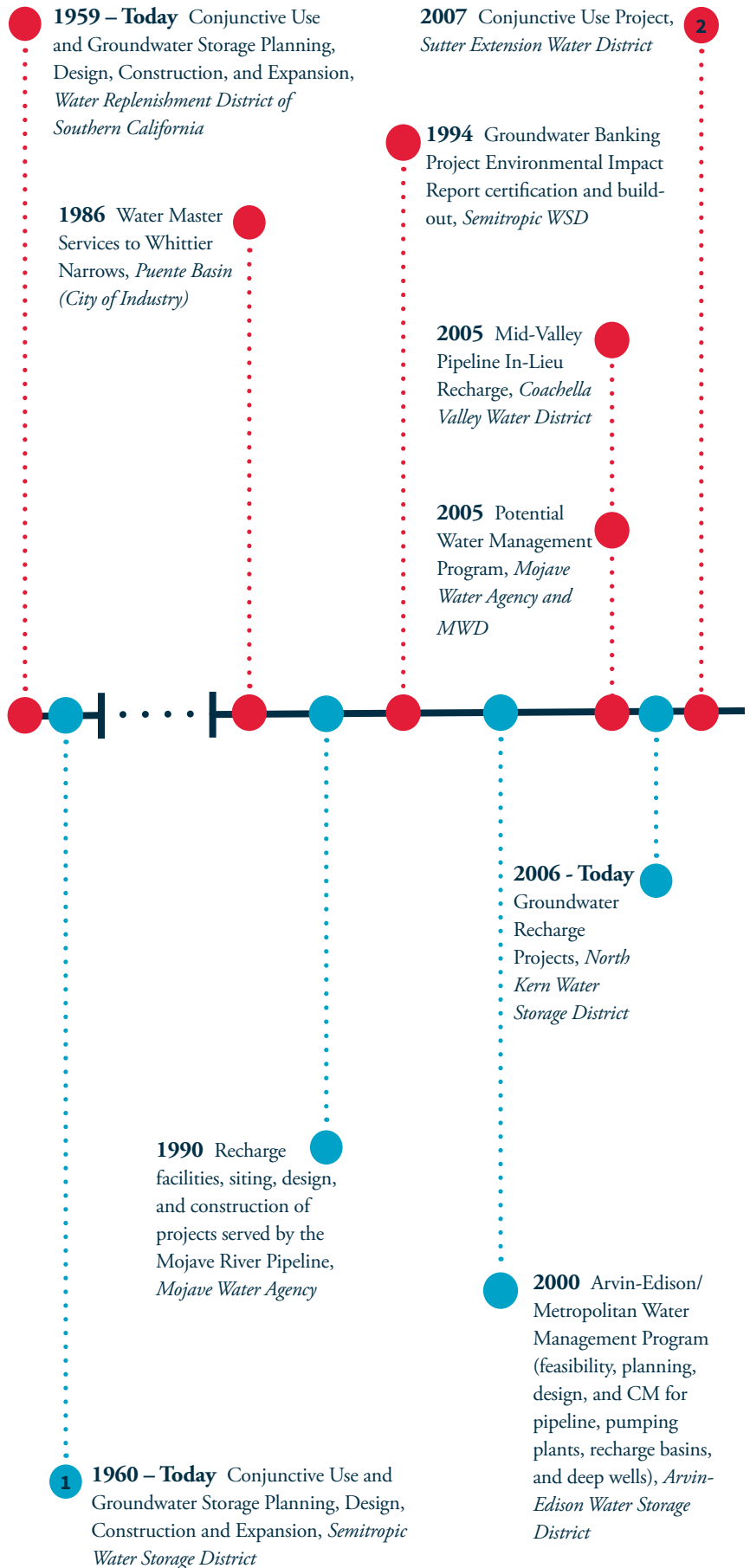
2. Conjunctive Use Program, *Sutter Extension Water District*.



3. Paso Robles Groundwater Basin Study, *San Luis Obispo County*.



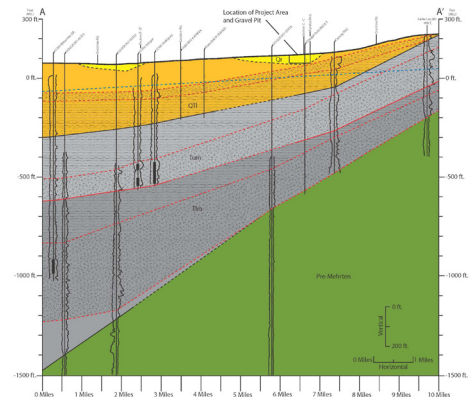
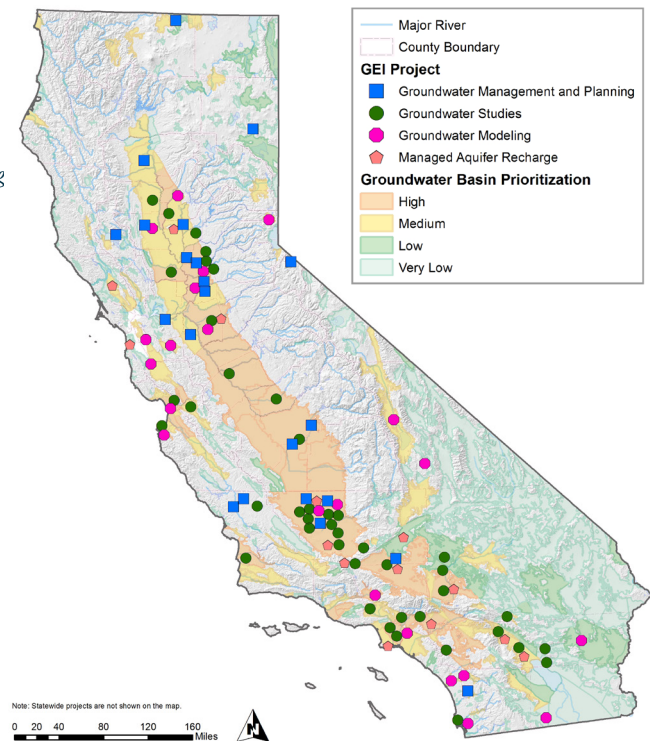
4. Thomas E. Levy Groundwater Replenishment Facility, *Coachella Valley Water District*.



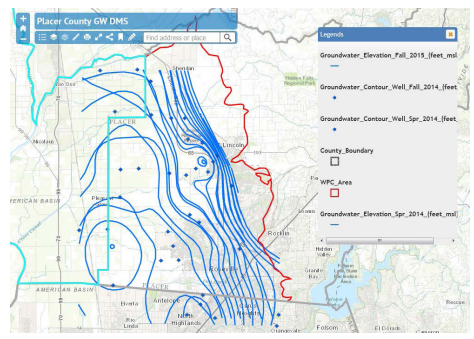
# Groundwater Management Projects with GEI



## GEI GROUNDWATER AND MAR PROJECT EXPERIENCE IN CALIFORNIA



5. Groundwater Recharge Feasibility Pilot Study, Sacramento County Water Agency.



6. Western Placer County Groundwater Data Management System, California.

# Project Highlights



## **Groundwater Banking Program-Initial Recharge and Recovery Facilities Improvement Project - Semitropic-Rosamond Water Bank Authority**

This large-scale banking project has a storage capacity of 500,000 acre-feet with 100,000 acre-feet of annual recharge and recovery capacity. Water is recharged in basins and recovered through existing and new wells. GEI planned, designed, acquired rights-of-way, and provided construction management for the Initial Recharge and Recovery Facility Improvement Project (a direct recharge project), which was Phase 1 of the Semitropic-Rosamond Water Bank. This phase of the work included: 3.75 miles of distribution and well field collection pipeline ranging in diameter from 18 inches to 54 inches, 6 Recovery Wells, 160 acres of recharge basins, 5 turnouts, instrumentation, and a tie-in connection to Antelope Valley East Kern Water Agency.



## **Willow Springs Water Bank - CIM Group**

Since 2008 GEI has been serving as the Consulting Engineers to the Willow Springs Water Bank (Bank). The Bank, located in Antelope Valley, California has a storage capacity of 500,000 acre-feet with 100,000 acre-feet per year recharge and recovery capacity using basins and existing and new wells. In 2009, GEI effectively prepared an American Recovery and Reinvestment Act grant application that allowed the project to construct \$10.8 million in improvements. GEI has performed a wide variety of assignments in support of the bank operation and development, including everything from program management and planning to design to construction management.



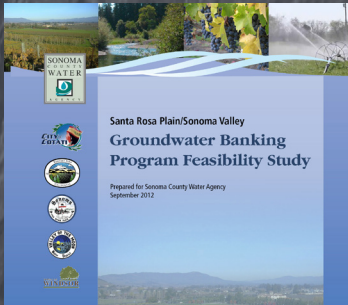
## **Conjunctive Use Water Distribution System and Water Bank - Semitropic Water Storage District**

Semitropic Water Storage District (SWSD) encompasses approximately 225,000 acres, of which 140,000 acres are irrigated agriculture. Included within the overall district are two improvement districts. GEI engineers planned, designed, and supervised the construction of a conjunctive use water distribution system for each. Engineering services included developing and implementing a groundwater banking and exchange program for SWSD that increases the yield of the California State Water Project. An 11,000 foot-long, 78-inch pipeline supplied by a 5,000-horsepower pumping plant returns banked water to the California Aqueduct.



## **Poso Creek Integrated Regional Water Management Plan - Poso Creek Regional Water Management Group**

GEI is responsible for developing and implementing the Integrated Regional Water Management (IRWM) Plan for the Poso Creek Regional Water Management Group (RWMG). The RWMG has implemented \$144 million in programs and projects utilizing \$61 million in State and Federal grant funds. The focus of the RWMG is to plan and implement projects to increase the conjunctive use of available groundwater and surface water supplies by using the groundwater basin as a large regulating reservoir to store surplus surface water supplies in wet years for use in dry years when surface water supply availability is reduced. Improvements under the IRWM Program included recharge basins, interties, groundwater recovery capacity, habitat improvements, and environmental compliance for groundwater banking.



## Feasibility Study for a Groundwater Banking Program - Sonoma Water

GEI is assisting Sonoma Water and its project partners, the cities of Cotati, Rohnert Park, and Sonoma; Valley of the Moon Water District, and the Town of Windsor, by performing a Feasibility Study for a Groundwater Banking Program. The goals of the study are to identify primary regional considerations that will frame and guide a groundwater banking program; evaluate and rank potential methods and locations for conducting groundwater recharge pilot programs; and develop detailed work plans for implementing pilot-scale programs in favorable areas. The study focuses on the technical issues related to the hydrogeologic and engineering feasibility of various groundwater banking opportunities, taking into account institutional, legal, permitting, environmental, and financial factors.



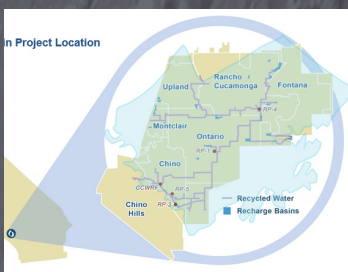
## Potential Water Management Program - Mojave Water Agency and MWD

This project consolidates several recharge and extraction projects included in the Regional Water Management Plan into a larger project now known as the Regional Recharge and Recovery Project. GEI identified the upper Mojave River floodplain aquifer as having the greatest potential for groundwater recharge, while the greatest need for new water supplies is in the tighter, less transmissive regional aquifer. The study included initial alternatives and screening to consider all possible projects. It also included engineering and hydrogeology assessment of groundwater storage and recovery, groundwater storage locations. In addition, it looked at local water use alternatives to State Water Project water, facilities cost estimate, and environmental and adjudication screening.



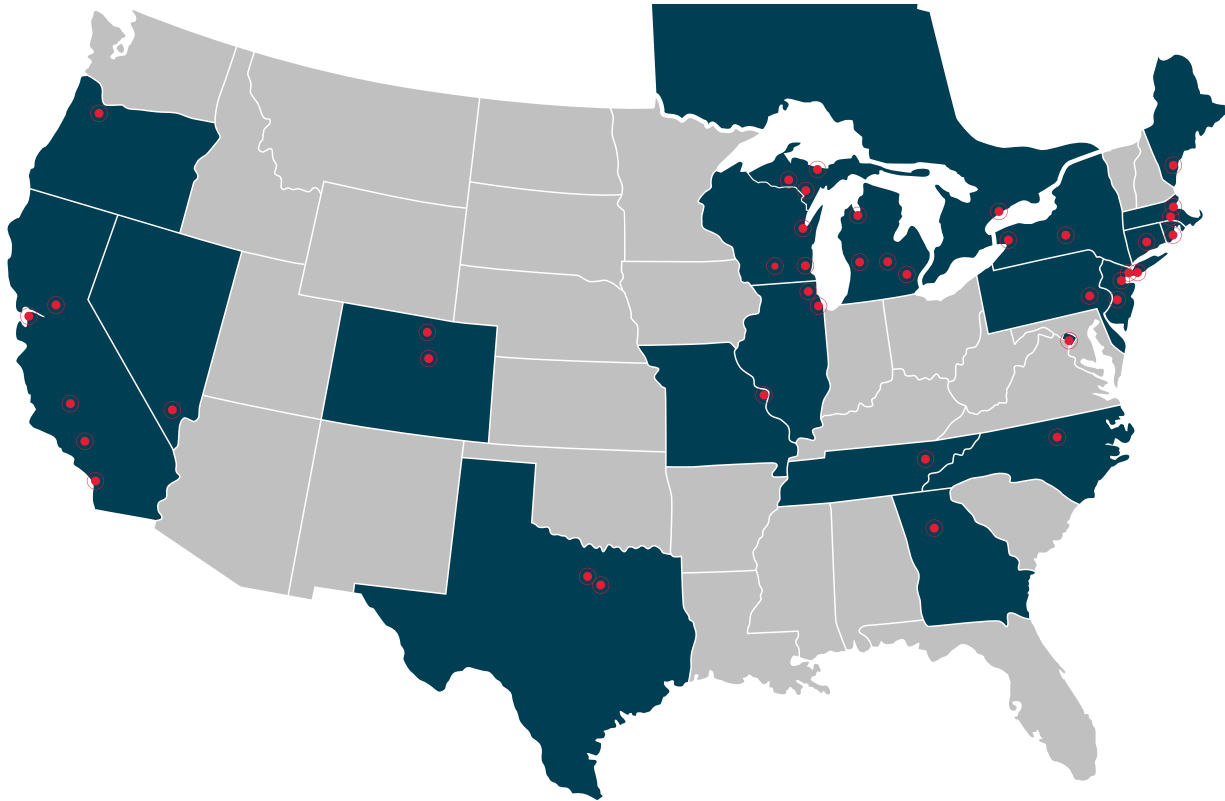
## Groundwater Recharge Projects - North Kern Water Storage District

For over 25 years, GEI has had the privilege of working with the District to maintain and enhance its conjunctive use operations. During that time, GEI has prepared a groundwater management plan that documented the District's extensive groundwater management activities. GEI also studied a proposed water banking project between the district and the State of California as a local element of the Kern Water Bank. The proposed project was based on in-lieu recharge and included an evaluation of the accomplishments of expanding the District's conjunctive use operations. Most recently, GEI prepared CEQA documentation for a pilot water banking program with the Metropolitan Water District of Southern California to store up to 60,000 acre-feet in the North Kern groundwater basin.



## Chino Basin Environmental Water Storage/Exchange Program - Inland Empire Utilities Agency (IEUA)

GEI worked closely with IEUA to prepare a successful application for the Proposition 1 Water Storage Investment Program funding for the Chino Basin Conjunctive Use Environmental Water Storage/Exchange Program (CBP). The California Water Commission approved funding of \$206.9 million to the program in 2018. The CPB would construct an advanced water treatment facility and distribution system that will treat and recharge recycled water. The CPB, in partnership with a State Water Project (SWP) Contractor, will then use the locally stored water and provide water from the Chino Basin for ecosystem benefits in the Feather River below Lake Oroville. GEI staff's extensive knowledge of integrated water management, regional planning and feasibility analysis, ecosystem and natural resource systems, and SWP operations was critical to evaluate the program's multiple operational and institutional elements and assess various configurations to develop the most cost-effective program.



GEI is a multi-discipline engineering and scientific consultancy that employs over 900 professionals in offices located throughout North America. For more information about Managed Aquifer Recharge, please contact:



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