

SUSTAINABILITY | QUALITY | RELIABILITY

Groundwater Management Solutions

geiconsultants.com

About GEI

GEI Consultants, Inc. (GEI) is a consulting engineering firm that delivers value-laden professional services that improve our world's built and natural environment. With more than 900 staff and 42 offices throughout North America, GEI is a leader in providing multidisciplined engineering and technical services to a range of private and public sector clients, both domestically and abroad.

As an employee-owned firm, we foster personal relationships with our clients and support our staff in a partnership model, which is underpinned by continuous learning and sharing of knowledge. We retain proven, recognized experts and attract the best young minds to deliver to our clients a refreshing blend of technical expertise, collaborative spirit, and innovation that is rare in our profession.

GEI is consistently ranked among the top 100 engineering firms in Engineering News-Record's (ENR) annual rankings.

GEI's Groundwater Practice

Over the last 50 years, GEI established itself as the go-to groundwater firm with experience in groundwater management planning, hydrogeology and aquifer characterization, groundwater modeling, well design, construction and management of groundwater data.

GEI is a leader in groundwater science, technology, and policy, and was a pioneer in groundwater recharge, conjunctive use, and water banking.

WITH YOU AT EVERY STEP

GEI offers a full range of services for groundwater management. From program and project planning through permitting, design, and construction, our expert team is available to partner with you from start-to-finish. To support your groundwater management goals, our team is available to assist with grant pursuits and community outreach.

OUR MULTI-BENEFIT APPROACH

GEI takes a multi-benefit approach to groundwater management. We work with clients to optimize the use of their resources by considering water supply, flood protection, water quality, water use, land use, and environmental benefits in the context of an integrated framework.

Groundwater Management Planning

GEI helps clients in all aspects of groundwater management planning, including facilitating the planning process, defining project purposes and needs, establishing goals and objectives, developing project concepts and designs, evaluating alternatives, and producing groundwater management plans to ensure a sustainable high-quality groundwater supply. We often assist clients in acquiring grant funding to support planning efforts.



California's Sustainable Groundwater Management Act (SGMA) requires local development of Groundwater Sustainability Plans (GSPs) to bring groundwater basins into balance. GEI's team has a thorough understanding of SGMA resulting from our time consulting to the California Department of Water Resources (DWR) during development and communication of the legislation and regulations and our experience on more than two dozen GSPs and related efforts for local agency clients. While SGMA is California-specific, the principles involved can be applied anywhere to support effective groundwater management.

GEI helps local agencies comply with SGMA through the development of GSPs that include characterization of aquifer and basin conditions, development of water budgets, identification of sustainable yield, development of projects and programs to avoid undesirable results, and design of monitoring and operations to manage and report on groundwater sustainability. GEI's groundwater management professionals develop and apply integrated hydrologic and hydrogeologic databases, information management systems, groundwater models, and decision support systems to help clients develop a plan appropriate to the size and complexity of the basin.

Water Allocation

Bringing a groundwater basin into balance to achieve sustainability may require both developing projects to expand supplies and allocating the use of the available sustainable yield. GEI professionals have considerable experience considering the needs of groundwater users and assisting in the development of banking programs and water accounting systems. We specialize in developing collaborative solutions that satisfy the interests of all stakeholders.

Data Management

As the volume of data and project-related information grows, effective management of engineering and scientific information is becoming critically important for decision making. The GEI team is experienced in crafting solutions to complex information management needs. As leaders in the engineering and scientific field, we are uniquely qualified to apply our information management expertise to your projects and programs. We maintain a reputation for providing cutting-edge and superior solutions for complex information management problems and successfully delivering tailored solutions for private, as well as federal, state, and local agency clients.



FEATURED PROJECT: GROUNDWATER SUSTAINABILITY PLAN DEVELOPMENT

GEI serves as the lead consultant for Mid-Kaweah GSA GSP development; working with a diverse group of stakeholders, GSAs, and the public to produce a draft GSP, which was released for public comment in August 2019.

During development of the GSP the GEI team exercised its technical expertise, including:

- Conducted a basin-scale study
- Evaluated basin conditions
- Reviewed, updated and applied numerical groundwater models
- Developed a hydrogeologic conceptual model
- Developed a water budget (referenced basinwide by all GSAs)
- Created a data management system (implemented basin-wide by GSAs)

FEATURED PROJECT: SGMA PORTAL

To facilitate implementation and administration of the SGMA, a web-based data management system was designed and deployed by GEI for DWR. The SGMA Portal stores, retrieves, and reports groundwater data such as agency information, groundwater levels, groundwater quality, precipitation, well construction, stream flows, and more.

The portal is designed to expand as DWR moves through stages of SGMA implementation. The first five modules are complete and in use. They include GSA Formation, GSP Initial Notification, Alternative Submittal, Adjudicated Area Annual Reporting, and Basin Modification Request.

COMMUNICATION AND ENGAGEMENT

GEI is assisting dozens of local agencies with the preparation of GSPs to comply with California law. The GSPs outline how each basin will reach sustainability and are informed by local needs, values, and interests. Farmers, municipal water suppliers, industrial users, domestic well owners, environmentalists and others all have a keen interest in the management of groundwater. Therefore, community engagement is a key to success. GEI assists with the development of Communication and Engagement (C&E) Plans, web-based outreach portals, and stakeholder workshops to help our clients ensure all interested parties have the opportunity to participate in GSP development.

Our team is adept at translating complex technical information into terms that are readily understandable by the public and decision makers.

In addition to supporting planning at the local level, GEI's experts are assisting the State of California with the development of tools, data sets and guidance document that support the local planning process.



Investigation and Characterization

Groundwater evaluations and infrastructure improvements have been an integral part of GEI services for years, supporting efforts to develop groundwater production and recharge to make groundwater more sustainable. Investigations have ranged from small isolated groundwater basins to large regional aquifers, and from locating individual wells to wellfields. Across these projects, the fundamental elements remain the same: groundwater geology, occurrence and movement of groundwater, and groundwater quality. It is this understanding that gives GEI the insight necessary to develop innovative groundwater projects.



Feasibility Studies

Developing new water projects is a complex task that faces a number of hurdles ranging from regulatory constraints to financing. Identifying issues early on and developing a clear path forward are key to moving from project concept to completion. GEI's history of developing groundwater banking and storage projects, its track record of securing grant funding, combined with its experience can support water agencies to evaluate virtually all aspects of a project's feasibility, from water supply yield and cost-benefit analysis, to identifying regulatory constraints and approval processes, water rights issues, environmental and land use issues, and developing project design.

Monitoring Wells and Networks

An important component of groundwater management is the monitoring and analysis of groundwater data. GEI has developed numerous groundwater monitoring programs which include the evaluation of existing monitoring programs and identification of additional data needed to more fully monitor groundwater levels and quality. GEI experts have designed and installed thousands of monitoring wells and stream gauging stations, many equipped with automated monitoring capability.

Water Quality Sampling and Analysis

As state and federal oversight of water quality becomes more complex, it is increasingly important for water suppliers and dischargers to have cost-effective approaches for compliance with water quality regulations. It is vital that these approaches be tailored to fit the governing regulations and the operations of the discharger. It is also vital that the selected approach offers full regulatory compliance without exposing the supplier to unnecessary costs, risks, or delays. GEI's approach to regulatory compliance rests on a firm understanding of regulatory requirements; developing a comprehensive, scientifically sound understanding of the discharger's facilities and operations; formulating a compliance program that satisfies regulatory objectives; and maintaining clear communications with the discharger and the regulating agency.

Groundwater Modeling

GEI's modelers apply analytical tools, numerical models, and data management and geographic information systems to define hydrogeologic conditions, assess surface and groundwater interactions, evaluate the effect of land use patterns, and estimate current and future agricultural, urban, and environmental demands. Our modelers develop a variety of pre- and post-processing utilities to facilitate data manipulation, formatting, and result viewing. They have intimate knowledge of both MODFLOW and IGSM/IWFM modeling platforms, as well as a host of other tools, experience modifying the core codes for these platforms, and the ability to explain modeling approaches and results so they are useful to decision makers.



FEATURED PROJECT: HENDERSON REMEDIATION

GEI was retained by Titanium Metals Corporation (TIMET) to assist with groundwater remediation at their facility in southern Nevada. GEI completed site investigations, water and soil testing, remediation system design, and regulatory submittals for multiple sites.

The facility is part of a much larger industrial manufacturing complex that includes a long history of regulatory involvement from local, state, and federal agencies. In partnership with TIMET, GEI engaged with each regulatory agency to obtain permits, design reviews, approvals, and completion reports on an accelerated schedule to achieve compliance with all regulatory deadlines.



FEATURED PROJECT: GROUNDWATER RECHARGE FEASIBILITY PILOT STUDY

This pilot project for Sacramento County used the Triangle Rock mine pits to characterize geology, hydrology, and lithology and determine current infiltration rates and methods to optimize infiltration. GEI developed a hydrogeologic conceptual model and strategies to manage the recharge facilities and evaluate whether to incorporate the recharge using expended gravel mines as part of the comprehensive water management plan for the basin. Preliminary estimates suggest it may be possible to recharge up to 60,000 acre-feet of groundwater each year, using numerous active and proposed gravel pits in the eastern portion of Sacramento County once they have been mined and are available for alternative use.

GROUNDWATER REMEDIATION

GEI employs a risk-based approach and works with clients to provide environmentally friendly remediation solutions that reduce costs and accelerate project delivery. For the protection of human health, our strategies rely on both local standards and the U.S. Environmental Protection Agency, enabling us to tailor the use of innovative technologies that provide complaint results.

GEI has a number of scientists and engineers throughout the U.S. dedicated to groundwater remediation. For more information on GEI's remediation capabilities, visit our website at geiconsultants.com.

Groundwater Resource Development

When additional sources of groundwater are needed to serve growth, mitigate for changes in water availability, such as during drought, or replace aging infrastructure, efficiency in design and operation of production wells grows increasingly important. GEI's groundwater practice assists communities, industry, and agricultural users with assessing current conditions to rehabilitate or abandon existing wells, improve well and pump efficiency, and design and construct new wells.

Engineering and Design

All projects need engineering and design work, from production well design to design of distribution systems. GEI's team provides the range of expertise needed to get projects designed and ready for construction. GEI's services include land surveying; grading, site design, and rights-of-way; soils, hydrogeological, and geotechnical analysis; water infrastructure design including canals, pipelines, reservoirs, roads, pumping stations, wells, water treatment plants; and hydraulic and surge analysis.

Drilling Oversight and Construction Management

GEI has managed the construction of many large water projects across the state. Our work includes all aspects of construction management; including preparation of plans and specifications, engineer's estimates, bid documents, advertising for bid, and preparation of construction contracts. We ensure the job is done safely by developing and implementing field safety plans, conducting field safety training, and monitoring for compliance with all State and federal worker safety laws.

During construction, we conduct field inspections and supervision, prepare regular progress reports, and monitor contractor expenditures and bills to ensure the project stays within budget. We have the expertise to complete projects cost-effectively, safely, and on-time.



FEATURED PROJECT: WELL SITING ASSESSMENT, SPECIFICATION, DESIGN, CONSTRUCTION AND TESTING

GEI provided assistance in response to the historic drought of 2012 through 2016 that resulted in many shallow domestic wells in the community of East Porterville, California, going dry. In addition to expansion of the Porterville water distribution system, GEI's work included well siting assessment, specification and bidding documents, and the construction of a new well. GEI was on-site providing construction management, field engineering, and hydrogeological services to DWR during the drilling, construction and final testing of the well. Completion of this project provide a reliable water supply to residents that were dependent on bottled water that was trucked in during the drought.

GEI WELL EXPERIENCE IN CALIFORNIA



WELL REHABILITATION

Drilling a new groundwater well isn't always the right approach. GEI has the expertise to evaluate the construction and condition of existing wells that may be experiencing declining yield or deteriorating water quality. Using downhole video surveys, a variety of geophysical tools, and depth specific water quality sampling, we can often cost effectively improve the utility of existing infrastructure, by redeveloping a well, treating a well to rid it of fouling by bacteria, or sealing off zones of poor water quality.

GEI has assisted many clients with well rehabilitation across California, including the City of Tracy with three of their production wells: Lincoln Well, Well #1 and Well #5.

GEI evaluated the conditions at each well and defined the permitting and rehabilitation approach in conjunction with City personnel experienced with these wells. Out team selected two different rehabilitation methods to meet the well construction materials and nature of plugging.

Expanding Supplies

As the demand for water increases, the value and competition for this vital resource also increases. Expanding groundwater supply in a sustainable manner is at the root of concepts such as groundwater banking and managed aquifer recharge.

Water managers need a high level of expertise to make the best decisions that will provide long-term, reliable, and costeffective water supplies for their customers. GEI's knowledge and experience provide clients with exceptional opportunities to expand their groundwater supplies to meet growing demands.



Conjunctive Use

Conjunctive use is the coordinated use of available surface water and groundwater supplies to meet water demands and increase water supply reliability. A successful conjunctive use program consists of using surface water when supply is plentiful, and saving groundwater for the periods when surface water supplies are short.

GEI is a pioneer in the development and implementation of conjunctive use projects. With experience in surface and groundwater hydrology, water demand analyses, water quality, storage, and conveyance, GEI engineers help their clients develop and implement effective conjunctive use projects.

Groundwater Recharge and Aquifer Storage and Recovery (ASR)

GEI's groundwater practice has the breadth of experience to help clients investigate and understand the potential for recharge and ASR based on local conditions. We quantify the amount of available water and interpret regional geology to identify and rank recharge options. When appropriate, existing wells are evaluated for potential suitability for ASR. GEI's extensive experience with state, federal, and local flood management clients, give us an advantage in helping groundwater managers pursue FloodMAR projects.

Groundwater Banking

GEI works with agencies responsible for groundwater management to evaluate the viability of groundwater banking programs based on hydrogoelogic conditions, existing facilities, and institutional, legal, permitting, environmental, and financial factors.



FEATURED PROJECT: WILLOW SPRINGS WATER BANK

GEI has been serving as the Consulting Engineers to the Willow Springs Water Bank since 2008. The Bank, operated by the CIM Group, 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. GEI effectively prepared an American Recovery and Reinvestment Act grant application that allowed the Bank to construct \$10.8M in improvements. GEI has performed a wide variety of assignments in support of the Bank's operation and development, including everything from program management and planning to design and construction management.

FEATURED PROJECT: ASR PROGRAM DEVELOPMENT

The City of Roseville initiated their ASR Program



to store surplus drinking water in the underlying aquifer during periods of normal and above-normal precipitation. This stored water is then extracted and served to meet peak demands, and as water supply during extended dry periods. GEI's initial program activities included development of a feasibility study and work plan, followed by pursuit of grant funding, permitting, GSP well construction, and pilot testing. In 2018, GEI worked with the City to develop a Groundwater Strategic Plan to serve as a master plan for groundwater development through the next 50 years.



FEATURED PROJECT: COLUSA SUBBASIN MULTI-BENEFIT MANAGED AQUIFER RECHARGE

GEI is supporting The Nature Conservancy in implementing a two-year pilot project to establish temporary recharge basins on annual cropland with soil conditions suitable for groundwater recharge. Data will be collected on managed aquifer recharge (MAR) activities to demonstrate and quantify recharge and the multiple benefits of MAR practices to support groundwater planning efforts of the Colusa Groundwater Authority. The pilot project will be conducted over a two-year period using existing water conveyance infrastructure and agricultural operations. The pilot project is anticipated to recharge up to 6,600 acre-feet on up to 5,400 acres of farmland.

MANAGED AQUIFER RECHARGE

MAR is the practice of intentionally infiltrating water into an aquifer and storing it for subsequent recovery. MAR has the potential to provide benefits beyond supply reliability – such as flood risk reduction, ecosystem enhancement, water quality improvement, subsidence reduction, and more.

GEI's groundwater practice assists with the development of MAR programs as well as variations such as Flood-MAR, which utilizes flood waters for recharge, and ASR which involves injecting drinking water into aquifers for domestic and municipal uses.

An example of the flexibility of MAR is GEI's work supporting Inland Empire Utilities Agency (IEUA) to implement the Chino Basin Environmental Water Storage and Exchange Program. The program will construct an advanced water treatment facility and distribution system to treat and recharge recycled water, making water available for environmental benefits in the Feather River watershed. GEI worked closely with IEUA to prepare the successful application for a \$206.9M grant from the State of California in 2018 and continues to support IEUA with management, coordination, and outreach for the program.



Partnering for Client Success

GEI partners with clients who understand the value that innovative approaches to planning, investigation, design and construction can provide.

We partner with our clients to ensure a rapid and successful start to your project, while keeping the final product in mind. We can provide services to support the client from project concept, through investigation and design, permitting, construction, and operation.

We want to hear from you.



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