Permitting and Wellfield Design Support for Gunnison Mine

Near Benson and Wilcox, Arizona

CLIENT

Excelsior Mining Company

HIGHLIGHTS

- Prepared APP and UIC permits
- Participated in planning meetings with ADEQ and EPA
- Participated in development of FEFLOW operations model
- Developed and coordinated extensive vetting process for driller selection

Clear Creek was retained by Excelsior Mining Company (Excelsior) to assist with the preparation of an Aquifer Protection Permit (APP) and an Underground Injection Control (UIC) permit for their Gunnison In-situ Recovery (ISR) project.

The entire wellfield is expected to eventually cover an area of 9,560 acres and will include as many as 1,500 injection and recovery wells.

The ISR process involves injecting leach solutions acidified with sulfuric acid into the oxidized mineralization to get soluble copper into solution. Recovery wells pump the copper-bearing pregnant leach solution ("PLS") to the surface for copper recovery by SX-EW into salable copper cathodes. The oxide copper is hosted primarily in Paleozoic sedimentary rocks adjacent to a large pluton of quartz monzonite. Intensive fracturing associated with several tectonic events has provided ideal conditions for the circulation of acid mining solutions through the ore body using injection and recovery wells. The entire wellfield is expected to eventually cover an area of 9,560 acres and will include as many as 1,500 injection and recovery wells. To minimize risk, the Project will be developed in three production "stages" with capacities of 25 million pounds per annum ("mppa") in Stage 1, 75 mppa in Stage 2, and 125 mppa in Stage 3.

Over a three-year period, Clear Creek participated in planning meetings and attended numerous meetings with the Arizona Department of Environmental Quality (ADEQ) who administer the APP and the Environmental Protection Agency (EPA) who administer UIC permit. A groundwater model simulating the operation of a groundwater containment system to prevent excursions of mining solutions away from mine operations was needed for both permits. Clear Creek oversaw the collection of fracture gradient testing data required for the UIC permit issued in 2018 prior to development of mine infrastructure. In addition to the permit modeling, Clear Creek participated in the development of an operations model using the finite element code FEFLOW. The model simulates operations of injection and recovery wells and is being used to optimize operation of the well field.

To meet state and federal regulatory mandates, a mechanical integrity test of the intermediate casing is required for each well, so sulfate-resistant cement will be pressure-grouted through a float shoe to thoroughly seal each intermediate casing in place. Due to the close spacing (70-foot offset) of the wells, strict plumbness and alignment requirements were also incorporated into the technical specifications.

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Clear Creek also developed and coordinated an extensive vetting process for driller selection. The selection of the driller(s) for this project involved a thorough and methodical selection process that included a requirement for all seven candidate drilling companies to provide: their Arizona Drillers License; references from recent clients; resumes of supervisors, drillers, and safety personnel; maintenance records; the make/model/modifications for each rig; the rig mast capacity; descriptions of pipe handling equipment, drilling fluid control equipment, and air compressor equipment; and safety records (e.g., EMOD and TRIR). Clear Creek and Excelsior personnel conducted a two-hour interview with each drilling company, from which they were ranked on the categories: credentials and credibility, health and safety, planning and implementation, technical capability, and overall impression. Clear Creek provided support during wellfield construction and aquifer testing.