



MINING INDUSTRY

More often than not, mining operations need water – and lots of it! The availability of adequate, sustainable and suitable water supplies is crucial, whether it be for drilling, ore processing or dust settlement. As mining operations are frequently located in isolated areas with little available surface water, mine managers and engineers are increasingly looking for ways to incorporate groundwater resources into their mining and ore-processing operations. In fact, sometimes the overall economic viability of a mine will be based solely on the availability of suitable groundwater.

On the other hand, activities associated with mining, including excavation of huge voids, dewatering, and contamination, can cause major disruptions to surface water and groundwater systems. Regulatory authorities often require the assessment of a mine's possible impacts upon groundwater systems. Information provided by such assessments will allow appropriate mitigation procedures to be employed, controlling the extent of any possible deleterious impacts upon the natural and human environment.

C. M. Jewell & Associates Pty Ltd (CMJA) has considerable depth of expertise in all facets of hydrogeological assessments related to mining activities. We use a range of innovative investigative tools, including electromagnetic, aeromagnetic and DC groundwater geophysics, aerial-photograph and remotely sensed image analysis, soil/subsoil surveys, drilling investigations and specialised water sampling methods. The analysis of field data is planned at a level appropriate to the project goals, but may include estimation of infiltration rates, calculation of groundwater velocities, calculation of contaminant mass balances, geographic analysis (using digital GIS technology), groundwater modelling or contaminant transport modelling.

Perhaps you require suitable groundwater resources to support mining operations; perhaps you need to assess the impact of mining/quarrying operations on underlying groundwater resources; perhaps you need someone to design a groundwater monitoring program. Whatever your need in this area, CMJA has the experience, knowledge and technology to help. Each project is tailored to the requirements of the client, and to the need to provide supporting information to regulatory authorities or operational planning.

Included below are some interesting examples of CMJA's hydrogeological investigations in the mining sector.

Identifying groundwater resources for mining prospects

The availability of suitable groundwater resources may be a significant factor in the decision to progress a mineral deposit from the prospect stage into an operating mine. CMJA has conducted hydrogeological investigations for Peak Hill Gold Mine, Golden Cross Resources NL (Cargo gold prospect and Kempfields silver/barite prospect) and David Mitchell-Melcann Pty Ltd (Attunga limestone quarry) to identify suitable groundwater resources for mining and ore-processing operations. This usually requires a multi-phase approach, involving review and assessment of existing geological and hydrogeological data sets, structural interpretation of aerial photographs and remotely sensed images, geophysical surveys (preferably using electromagnetic techniques), and good geological instinct.

Assessing the potential impact of mining operations upon groundwater resources

Before consenting to the development and/or expansion of a mining operation, the regulatory authority usually requires an assessment of that operation's impact on groundwater conditions and

resources. Frequently, when mining is to proceed below the water table, the assessment must take into account impacts of dewatering and depressurisation. Similarly, the potential impact of an open-cut or underground mine on natural surface water and groundwater flow systems must be assessed. Alternatively, risk-based assessments of the potential for aquifer contamination, or to identify contaminant migration pathways, may be required.

CMJA has conducted many such assessments. Our clients have included Enhance Place Pty Ltd (Enhance Place Colliery near Lithgow, NSW), David Mitchell Pty Ltd (Sulcor limestone mine and Attunga limestone quarry, both near Tamworth), Concrete Quarries Pty Ltd (Exeter Basalt Extraction Area, Southern Tablelands, NSW), ACI Industrial Minerals (silica sand mining at Tanilba Northern Dune, Port Stephens, NSW), Chadcole Pty Ltd (Kempsey Clay operations, north coast, NSW) and Calga Sands/Rocla (Calga, Central Coast, NSW).

Typically, we approach impact assessments in a staged fashion. First, potential aquifers that may be at risk must be identified by review and assessment of existing geological and hydrogeological data sets. Secondly, it is necessary to deduce or estimate the baseline hydrogeological properties of the aquifers and surrounding geological medium. These include hydraulic conductivity, porosity, lateral and vertical hydraulic gradients, and groundwater geochemistry. Finally, having reviewed and interpreted all relevant information sets, we can assess the impact of a particular mining operation. Such assessments can be qualitative and/or quantitative, depending upon the requirements of the client.

Acid generation at McKinnons Gold Mine, Cobar, NSW

In order to meet the requirements of regulatory authorities, Burdekin Resources NL commissioned CMJA to conduct a preliminary study to estimate the final open-pit water chemistry following closure of the mine. Hydrogeochemical speciation modelling using MODPHRQ, a development of the well-established code PHREEQC, was used to model the hydrogeochemical processes controlling the geochemical evolution of groundwater. This allowed predictions of the final open-pit water quality.

Development of a groundwater monitoring plan, Sulcor Limestone Mine, NSW

So that David Mitchell Pty Ltd could comply with licensing requirements, CMJA was commissioned to design a full groundwater monitoring plan. This plan included design and construction specifications for the required groundwater monitoring network in addition to a groundwater sampling and groundwater level measurement plan specifying monitoring schedules and analytical suites, standard operating procedures for collecting measurements, sampling, sample handling and documentation, quality assurance/quality control procedures and reporting schedules.

Development of a post-closure groundwater monitoring system, Kelian Gold Mine, East Kalimantan, Indonesia

CMJA reviewed all the hydrogeological and geotechnical data available for the site, identified key areas of potential impact, then designed and installed a monitoring network of 24 wells subsequently, reactive transport modelling to simulate metal transport to the nearby Kelian River was carried out.

How CMJA can help you

We have the expert capability to help you with groundwater issues related to the mining industry. Whether you need to unravel complicated hydrogeological settings, locate groundwater resources, make reliable predictions of water quality impacts, or assess the impact of mining operations on groundwater systems or vice versa, we can meet your needs. We also offer a full-service consultancy in this field, from water sampling to expert testimony.