Australasian Groundwater & Environmental Consultants

Mineral Exploration

Early hydrogeological data collection to support project feasibility

About AGE Consultants

We're Australia's groundwater specialists, providing groundwater and environmental advisory across Australasia for more than 25 years. We have a depth of experience and technical excellence borne out of more than 2,500 projects across major industries, agriculture, government and communities in Australasia and beyond.

We specialise in end-to-end groundwater services, from field work and modelling to analysis and reports, to expert advisory and peer review. Our expert team understands the commercial, regulatory, environmental and community challenges you face in planning your mining projects, from cradle to grave. We characterise the hydrogeological environment and determine environmental risk in your project to support your decision-making and the design of your water infrastructure.

Early groundwater characterisation

Understanding the hydrogeological environment is a critical component of getting a resource project up and running. It's important to quantify groundwater risks and opportunities to support early decision-making in your mining project. Key considerations include quantifying groundwater mine inflows, water supply requirements, geotechnical stability of excavations, and environmental approvals for aquifer interference and influence on groundwater-dependent receptors and nearby landholders.

The exploration phase offers opportunities to gather baseline hydrogeological data that supports the feasibility assessments and future development of your mining projects. It also helps you understand your project's potential impacts on the environment during the permitting process and supports proactive groundwater management, both at the beginning and throughout the life of the mine.

By conducting early hydrogeological characterisation during exploratory drilling, you maximise cost savings and efficiencies, and enable robust feasibility decisions on your project.

Our expertise

Our scientists have a broad range of groundwater and geochemical experience and can flexibly address project constraints and opportunities.

Early data collection

We help you understand the complex groundwater characteristics at an early stage, saving you time and resources during scoping and feasibility assessment phases of your project. By taking this opportunity when boreholes are open, you avoid the need for additional resources later on for re-drilling. We set up the scoping phase to identify key objectives, co-dependencies, logistics, risks and opportunities associated with your project's groundwater characteristics, taking into consideration the complexity and uncertainties presented by ground conditions and hard-to-control variables.

Early groundwater indicators can be identified through simple steps of data gathering and the integration of outputs including geological, geotechnical, hydrological, geochemical and hydrogeological studies. This baseline data becomes the foundation for understanding groundwater flow as mining continues. We provide field supervision and data collection services for multidisciplinary studies, including hydrocensus, geological logging, vibrating wire piezometer (VWP) installations, packer and aquifer testing, water quality sampling, waste characterisation, and isotope tracing.

Mineral exploration using hydrogeochemistry

The use of groundwater hydrogeochemistry for mineral exploration has been occurring for more than 20 years and is increasingly used to inform targeted drilling campaigns. This method exploits the nature of groundwater to integrate, both spatially and temporally, the chemical signatures imparted by interactions between groundwater and mineralised zones. We specialise in the design of catered analytical programs undertaking the required hydrogeochemical sampling methods and have significant experience with data interpretation. Interpretive methods include geochemical modelling to identify specific mechanisms of groundwater-ore body interactions. Recent clients have obtained additional exploration data through ultra-trace element, rare-earth element, and/or novel isotope analyses. These datasets and associated interpretations have helped to support exploration initiatives in several mining districts across Queensland and New South Wales.

Mine water management and planning

When you plan a new mine or investment project, our team of hydrogeologists and geochemists can provide a comprehensive, integrated approach to your feasibility studies, due diligence reviews, economic evaluations and risk assessments.

Through early investigations, we provide a comprehensive understanding of how water moves through your mine to foresee challenges and opportunities. Our team will help you identify the general areas and timing of future mine water seepage, assist in pit wall stability assessments, and plan future dewatering methods, infrastructure and groundwater supply options.



Early groundwater characterisation during mine feasibility studies helps you make informed decisions about your mine's design, planning, water supply and groundwater management





Our approach

Through our process of early data collection and modelling, we provide an iterative platform for feasibility decision-making on cost effectiveness, safety, impacts and risk management. We offer practical insights that consider a benefit/risk/cost analysis through the identification of trade-off scenarios.

Crucially, we support you in your decision-making process by early detection of fatal flaws, risks and opportunities. We decipher the science and ensure our advice is easily understood, adds value, and stands up to scrutiny.

Our tailored approach for your mine or exploration program may include elements of the process below.

01 Data gathering and planning

- Geographic Information System (GIS) and remote sensing
- Data gathering and review
- Integration of disciplines
- Fieldwork planning
- Community liaison

02 Field applications

• Hydrocensus • Technical drilling supervision and core interpretation • Aquifer tests • Groundwater monitoring and operating procedures • Groundwater resources exploration and geophysics • Geochemical sampling and laboratory analyses

03 Data integration and analyses

- Database development and maintenance
- Mapping
- Data interpretation

04 Conceptualisation

• Aquifer characterisation • Water and mass balance • Regional flow vectoring and cross-sections • Review source-pathway-receptor links • Assessment of water supply and storage • Hydrogeochemical assessment

05 Modelling and design

- Groundwater flow and mass transport modelling
- Geochemical modelling
- Mine dewatering and groundwater supply infrastructure design
- Uncertainty analysis

06 Support mine planning and environmental approval

- Impact assessment
- Groundwater monitoring and management plan
- Dewatering plan and program
- Mine closure planning
- Permitting and licensing assessment

Our experience

Over more than 25 years, our extensive experience has seen us help clients across underground, opencut, metalliferous, coal, quarries and sand operations. We have a significant track record in groundwater assessments for mining feasibility projects, with a reputation for robust and high-quality investigations and reports. We've added value to exploration projects in Australia, New Zealand, Papua New Guinea, Indonesia and throughout South-East Asia and Africa.

Our projects

Here are some of our exploration and mine feasibility projects:

Mt Isa South and Diamantina exploration areas

Mt Isa Region, QLD

Groundwater hydrogeochemistry data to assist with exploration activities in greenfield tenements, including development of sampling methods and analytical programs to determine ages of groundwater and potential interactions with ore bodies. Field methods involved standard analyses including alkalinity titrations to assist with laboratory isotopic interpretation. In addition to an extended suite of laboratory analytical data, ultra-trace analyses for metals/metalloids and analyses for carbon, chlorine, zinc and lead isotopes were undertaken. Data has been used to identify potential interactions (chemical weathering) between groundwater and metalliferous ore bodies located under deep cover.

Cadia Valley Operations

Orange, NSW

Groundwater modelling to support application to extend underground mining (gold and copper) as part of environmental impact statement (EIS) process. Modelling predicted potential changes in groundwater regime from dewatering activities, particularly in relation to existing groundwater users and nearby streams fed from baseflow. Model generation involved a balance between representing the highly complex geology and providing a useful and practical tool for making the assessments.

Twin Hills Gold Mine

Belyando, QLD

Assessment to understand the origins of ultra-basic, strongly reducing conditions atypical of groundwater systems beneath metalliferous mining sites. Hydrochemical and mineralogical observations were combined with geochemical modelling techniques to assess roles of various mine-related and or natural mechanisms. Observed conditions likely evolved naturally from chemical weathering of olivine and pyroxene group minerals associated with previously unidentified metalliferous ore bodies located under deep cover. Assessment highlighted importance of rigorous data collection and interpretation to identify causes and implications of groundwater quality beneath mine sites.

Senegal Sand Mine

Dakur/St Luis, Senegal

Groundwater management plan to support proposed dredge mining of a large sand deposit which required considerable supply of make-up water to the dredge pond. Included involvement in groundwater exploration of shallow and deep aquifers in the area, construction of the exploration and production bores, and analysis of the pumping tests. Required groundwater make-up rates were modelled under two scenarios: where the bunds were lined with impermeable material to limit loss of water to the base of the dry dock; and where there was no lining of the walls.





Northparkes Gold Project

Parkes, NSW

Groundwater impact assessment (GIA) as part of an EIS to support an application to develop a new satellite opencut mine (copper and gold). The assessment involved an environmental constraints/gap analysis, fieldwork program and numerical modelling. Monitoring bores were installed around the periphery of expansion areas for purposes of long-term monitoring and baseline data collection on aquifer properties.

Dargues Reef Gold Project

Canberra, ACT

GIA of a proposed 500-metre-deep underground mine on the hydrogeological regime of the Majors Creek gold fields as part of the environmental assessment for project approval. Assessment included field investigation, identification of site water demands and water supply sources, numerical groundwater modelling, impact assessment of dewatering required, and identification of mitigation and monitoring requirements. Inflow to the mine over time and development of a separate groundwater supply from old shafts in the fractured rock aquifer system were assessed together with the impacts on Majors Creek and the Araluen Town Water Supply, Shoalhaven River catchment and embargo water.

Eagle Downs Metallurgical Coal Project

Moranbah, QLD

Definitive feasibility study (DFS) as part of an EIS addressing potential impact of the proposed mine on groundwater resources and regime. Study reviewed existing data and installed a groundwater monitoring network across the greenfield site, development of conceptual and numerical models, and predictive modelling incorporating stopes, longwall panel sequences and goaf development.
Study report described the area's hydrogeological regime, assessed potential impacts, and identified risks and constraints, mitigation and/or containment strategies.

Kone Gold Project

Ivory Coast, West Africa

Groundwater level monitoring during early exploration, gathering valuable baseline data over three years including depth and geological information from each bore, identifying sensitive groundwater zones and confirming seasonal fluctuations. Groundwater recharge was also calculated for different geological units. By the feasibility stage, a robust database had been established, along with hydrogeological assessment based on more than three years of data collection. In turn, the number of test bores were limited resulting in significant cost savings. Numerical groundwater model was based on a strong conceptual model with valuable inputs for the project design.

Sanankoro Gold Project

Mali, West Africa

DFS using exploration data, delineating the geological layers for the numerical groundwater model. Approximately 40 packer tests from eight bores completed. This provided understanding of hydraulic properties and aquifer conditions and reduced the number of hydrogeological test bores required. Drilling and aquifer testing focused on key areas only with considerable cost savings. Precision drilling focused on the footwall shear zone where significant groundwater flow was observed, providing valuable data for the pit slope depressurisation program and wall designs.

Cobalt Blue

Broken Hill, NSW

Gap analysis, scoping assessment and development of a field investigation program before preparing the groundwater section of pre-feasibility documentation. Assessed need for in- and out-of-pit dewatering and pore pressure requirements for batter/high-wall stability/slope. Provided pit inflow estimates for three prospective open pits.

Our team

Bryce McKay

NSW Region Manager | Principal Hydrogeologist

Bryce's broad range of expertise includes undertaking and managing field programs, groundwater studies and impact assessments to support environmental approvals for a number of coal and hard rock mines, as well as sand and hard rock quarries in the Hunter Valley, Newcastle and Port Stephens areas. He specialises in writing and reviewing groundwater monitoring and modelling plans, water management plans, trigger assessments, designing and managing field work programs, geological modelling and conceptualisation, inflow estimation, and data interpretation and analysis (including pumping, packer and slug tests).

Dr Angela Bush

Principal Hydrogeologist

Angela specialises in integrated groundwater assessments, contaminant investigations and geochemical analyses, with more than 15 years' experience in consulting, research and education. One of her strengths is underpinning groundwater quality assessments with an understanding of groundwater evolution mechanisms. With detailed knowledge of groundwater systems in various settings, specifically focusing on the highly mineralised fractured rock groundwater flow systems of North Queensland, she has supported clients across metalliferous and coal mines, industrial operations, unconventional gas projects, state and federal governments, and agriculture bodies.

Keith Phillipson

Senior Principal Hydrogeologist

Keith specialises in the use of groundwater models to assess and manage the impacts of a broad range of developments on groundwater and surface water resources, with more than 25 years' experience working in jurisdictions including Queensland, New South Wales, Victoria and Europe.
In particular, Keith has undertaken many mine approvals, overseen and peer reviewed a wide variety of modelling studies focused on assessing the cumulative impacts of large-scale water supply, mineral and petroleum developments.

We empower informed water decisions that help our clients, communities and environment thrive.

If you're looking for an expert partner to support your exploration projects from cradle to grave, get in touch with us.

Pieter Labuschagne

Central South QLD Region Manager | Principal Hydrogeologist

Pieter has undertaken groundwater resource and mine feasibility assessments in Southern Africa, Africa, and South America since the 1990s. He has conducted remote sensing, overseeing ground and airborne geophysical surveys for groundwater exploration, coordinating drilling and testing programs for small, medium and large mine projects and developing groundwater management plans for international clients.

James Barratt

WA Region Manager | Principal Hydrogeologist

James has been involved with numerous groundwater resource and mine feasibility studies throughout Southern, Central and West Africa. He has conducted and managed field data collection services ranging from groundwater and geophysical surveys, drilling supervision and data collection, and packer and aquifer testing. James has also developed conceptual, analytical and numerical groundwater models to assess groundwater inflows into mining areas and simulated dewatering scenarios to optimise and inform mine dewatering planning and decision-making. He is well-versed at managing groundwater studies for large-scale planned and operational mines and the compilation of technical reports to comply with international standards.

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