



Mining and resources

↳ Capability and experience



→ The Power of Commitment



Acknowledgement of country

GHD acknowledges Aboriginal and Torres Strait Islander peoples as the Traditional Custodians of the land, water and sky throughout Australia on which we do business. We recognise their strength, diversity, resilience and deep connections to Country. We pay our respects to Elders of the past, present and future, as they hold the memories, knowledges and spirit of Australia. GHD is committed to learning from Aboriginal and Torres Strait Islander peoples in the work we do.

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Industry trends and key drivers

Our industry has proven to be resilient in times of significant challenge and uncertainty and remains highly innovative through the application of new techniques and technologies. There are emerging risks and opportunities linked to ESG drivers, geopolitical uncertainty, broader economic trends and costs (both OPEX and CAPEX) as well as supply chain issues in the current climate and for the foreseeable future.

Responsible and effective resource development, operations and mine closure/asset transition remain critical to the sector. Energy and water in mining form increasingly important considerations throughout the mining lifecycle. Holistic decarbonisation solutions are essential at asset-group-enterprise levels and we must apply more sophisticated approaches and technologies to better manage water (in terms of recycling, re-utilising and repurposing).

The mining and resources sector remains core to the future and continues to play an essential role in supporting the global transition to clean energy through a combination of:

- Emissions reduction initiatives / accelerated decarbonisation commitments associated with current mining operations and future projects
- Sourcing and supply / processing (including downstream value adding) of Critical Minerals to enable this just transition to occur

The Critical Minerals surging demand cuts across a suite of future energy commodities and is by way of example, highlighted by the World Bank's projections that by 2050 the world is going to need to produce a 500% increase on outputs of cobalt and other minerals, and a 4000% increase from present levels of lithium and graphite.

Royalties, taxes and export revenues from mining significantly contributes to essential services including schools, emergency services, transportation and community infrastructure.

Commitment to safety, quality and sustainability

Safety is one of GHD's **Core values** in that **"we intrinsically value the safety of ourselves, and others affected by our operations and services"**.

Leaders, both formal and informal, all play a part in GHD's Safety Culture development. Positive reinforcement helps people move from a mindset of "I have to do safety" to "I want to do this safely". GHD's efforts to reduce the rate of harm to our own people, our clients' people and the environment is focused on understanding hazards / risks and positively influencing those items we can affect and measuring performance using leading indicators.

GHD is a signatory of the UN Global Compact (UNGC) and reports annually on HSE and ESG performance against the Global Compact and the Sustainable Development Goals via our [ESG Report](#) and [Annual Review](#). Our strategy is directly aligned to the United Nations Sustainable Development Goals (SDGs), the ambitious goals that aim to tackle the world's most urgent challenges and improve the wellbeing of present and future generations by 2030.

We are committed to implementing continual improvement strategies and allocating resources in our drive towards sustainable business practices and lasting HSE benefits to our stakeholders.

Our HSE policy complies with International Standards ISO 14001 and OHSAS 18001. GHD's HSE Management Systems are internationally certified to ISO 14001 (Environment) and ISO 45001 (Health and Safety).

Quality management in GHD is the act of overseeing all activities and tasks needed to maintain a desired level of excellence and consistency of service to GHD's clients. Our Quality Management System is certified to the ISO 9001 international standard.



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GHD HSE policy and management system:

GHD's Health Safety and Environment (HSE) Policy is the foundation of our comprehensive HSE management system, which facilitates the systematic management of risk, innovation, and opportunity to achieve leading-edge performance.

GHD's Core Values of safety, teamwork, respect, and integrity guide everything we do as a company, and our people are expected to act consistently within these values. The GHD SMART Behaviours Standard Operating Procedure (SOP) considers behavioural management and provides the foundation for continuous improvement in our safety performance, while serving as a vehicle by which we sustain the importance of health and safety management in our daily activities.

0.06

**Total Recordable Incident Rate (TRIR)
per 200,000 hours worked**

GHD recognises the safety, health and psychological wellbeing of those working in the mining and resources industry is a fundamental priority. The minerals industry has achieved important safety-related improvements over the years, however must continue to commit to and achieve fatality elimination, further reductions in occupational illnesses and building respectful workplaces.

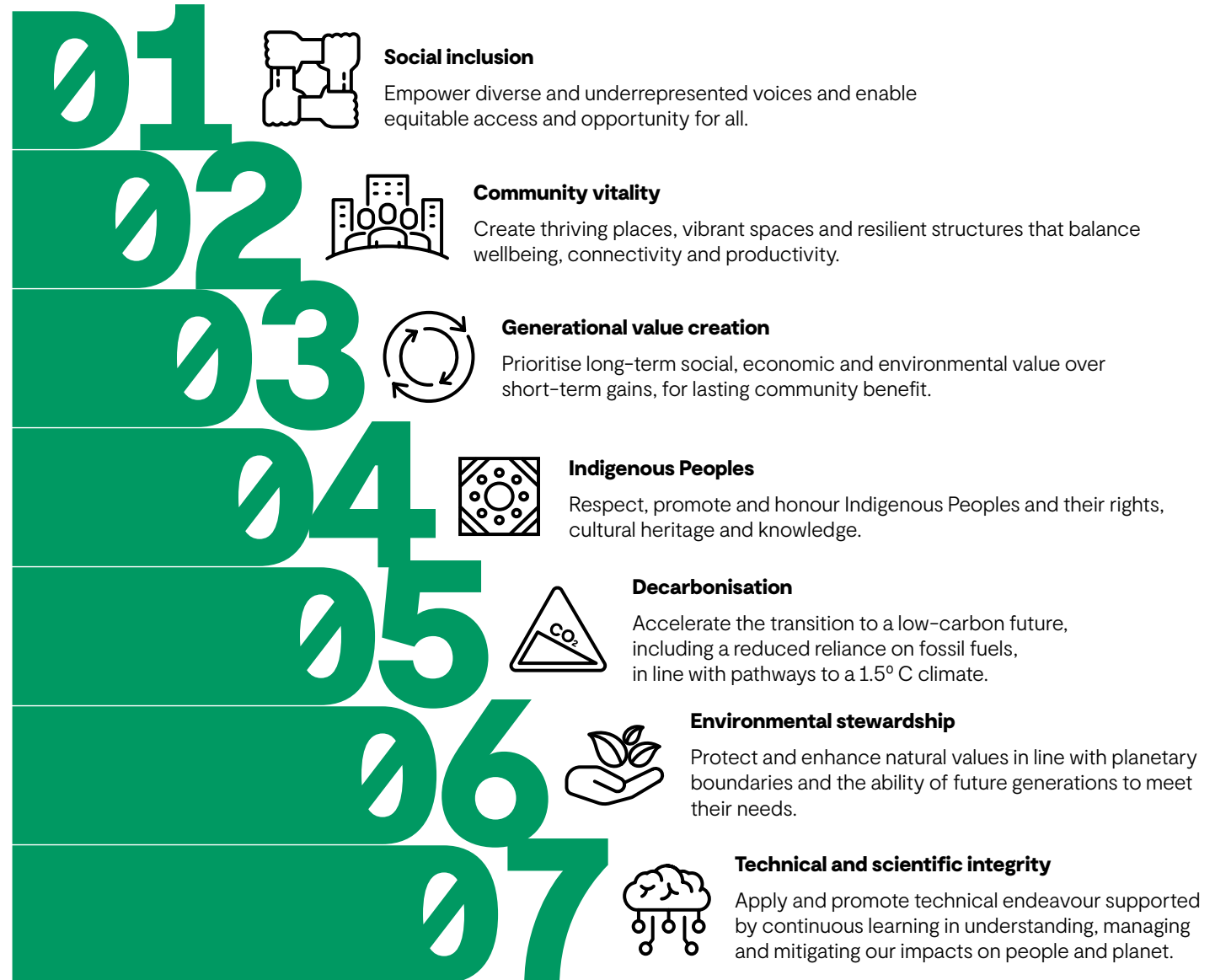
Fatalities in the industry, which continue to be dominated by hazards associated with mobile equipment interactions, fall of ground, working at heights and energy isolation must be addressed through successful implementation of critical control measures.



GHD Sustainability Way

GHD have committed to embedding seven principals into our operations, supply chain and philanthropic efforts as part of a sustainable business that respects human rights and encourages our clients to support these through our project work

↳ See our
2022
ESG report



Sustainability, Resilience and ESG

The mining and resource sectors have a fundamental role to play in overcoming some of the world's most profound challenges. The transition to a decarbonised future and the efficient use of our finite natural resources requires continued contribution and evolution from established practices. However, as an industry this sector is perhaps, more than any other, facing growing scrutiny from its broad group of stakeholders due to its significant impact on the environment and communities in which it operates.

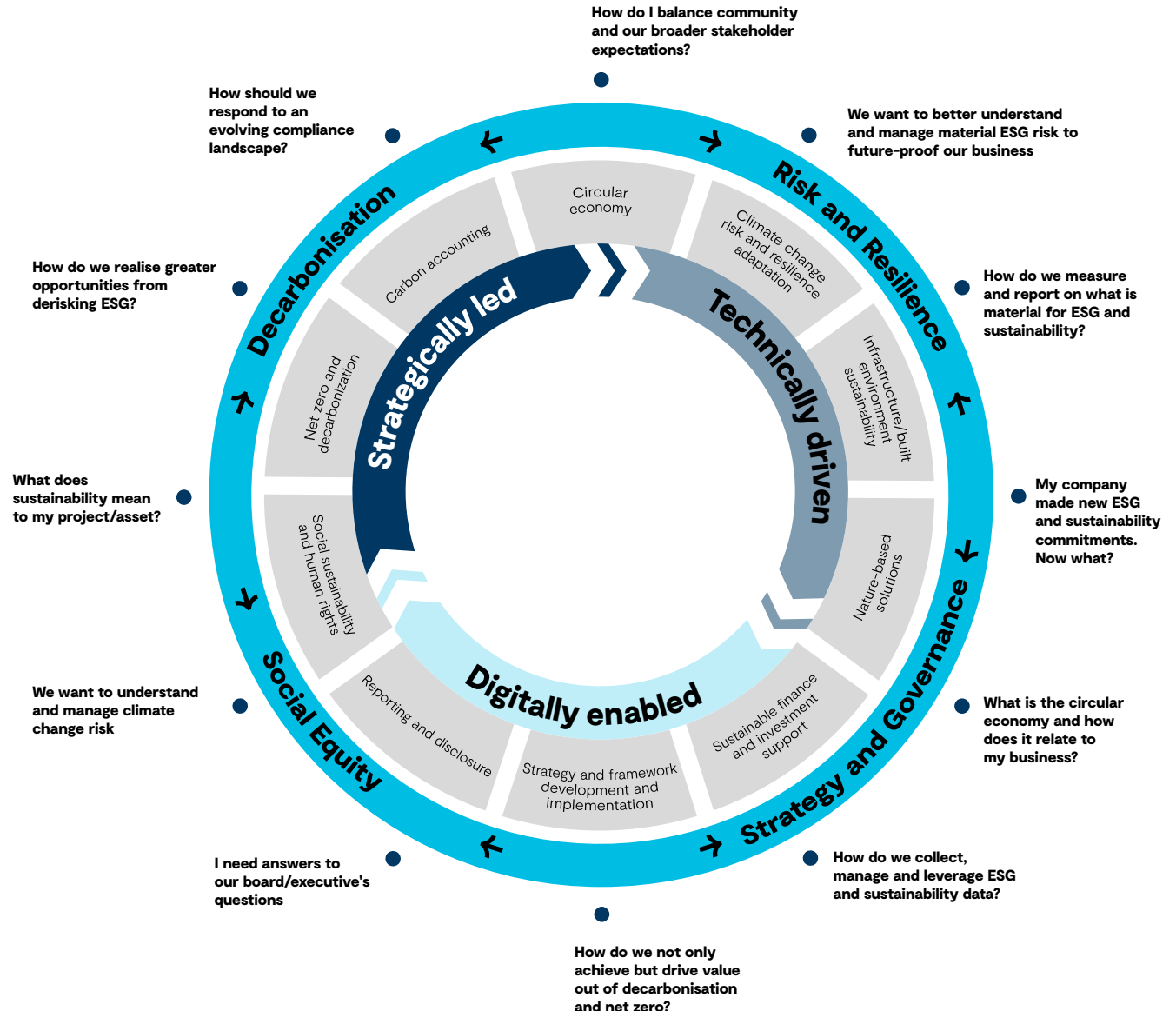
As a result, companies in the mining sector are increasingly focusing on environmental, social, and governance (ESG) considerations to deliver against sustainable practices and maintain their social license to operate, while also needing to understand the impact of climate change on their operations to build in resilience.

The focus of these efforts changes dependent on the region in which operations are being undertaken, and range in form from environmental and compliance concerns, to labour issues, to anti-corruption and bribery, to name but a few. As the industry seeks to address the social and environmental impacts of their operations and pressure mounts from regulators and financiers, companies that prioritise ESG issues are likely to be more successful in attracting investment, managing risk, and maintaining their reputation.

The Sustainability, Resilience and ESG services wheel to the right speaks to many of the challenges facing the mining industry today and identifies the broad service areas that GHD can support you. Importantly, we recognise the complexity and fluidity of the sustainability challenges of a modern mining company, and we will work with you to address both strategic and tactical challenges.

At GHD, we strive to consider sustainability and resilience from an holistic perspective, being able to draw from our advisory, technical and digital businesses to deliver bespoke outcomes for our clients that consider their unique perspectives and drivers.

Starting point
→ find your question here



Our commitment to the energy transition

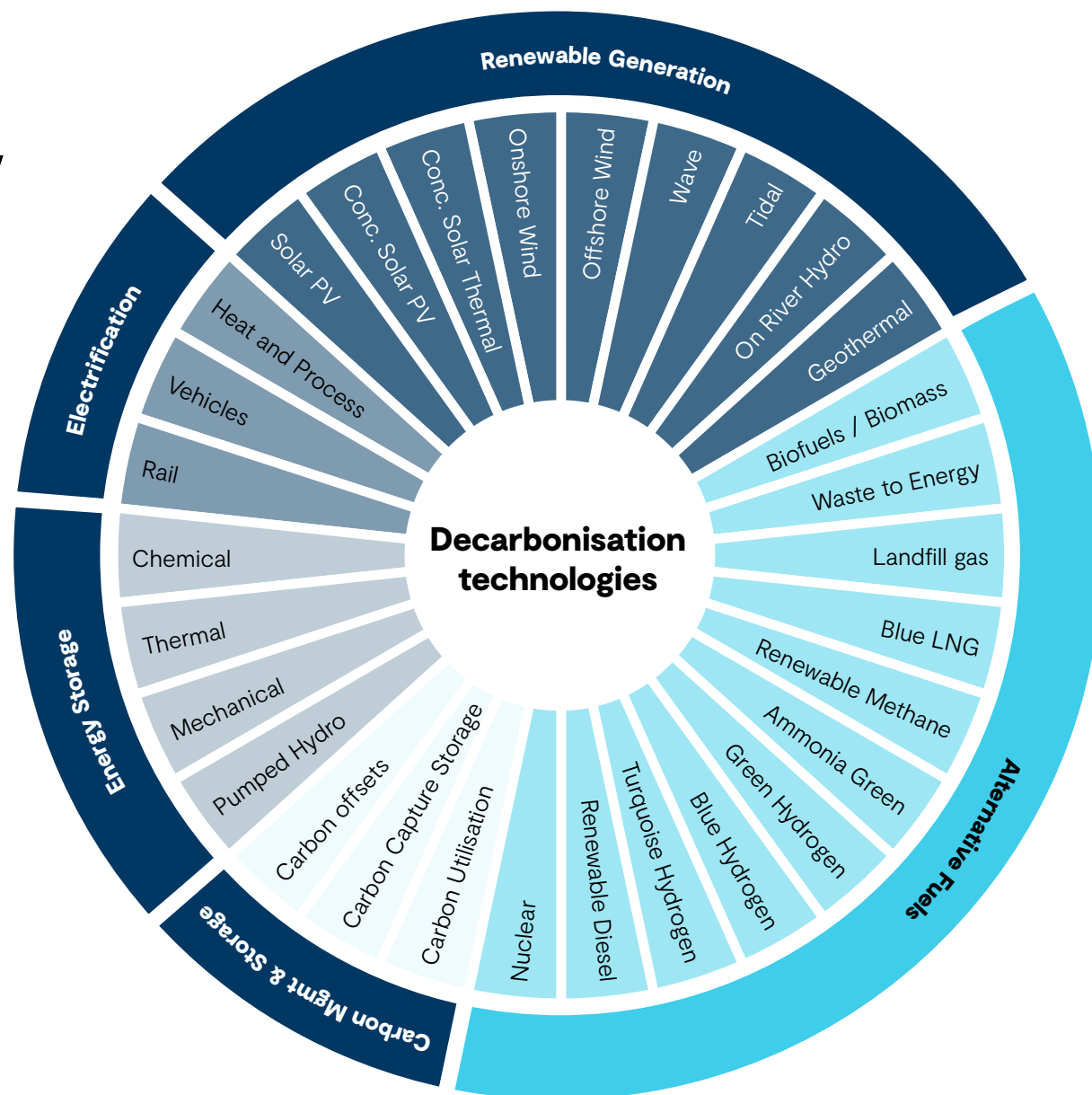
GHD has long recognised the need to shift to a more sustainable energy landscape. We have accepted this necessary transition as more than an intellectual or technical challenge; it is also our professional responsibility.

As a connected team of advisors and engineers who work across the value chain, we are uniquely placed to make a positive difference. By offering end-to-end expertise from origination through to delivery, we have the right balance of industry knowledge and technical skills to help clients progress with confidence down the decarbonisation path.

Bridging the gap to a low-carbon future

Our people are inspired by challenges great and small. Whether our clients are early in their decarbonisation journey, exploring a range of options, or looking at innovative solutions to take a bold step forward, our purpose is to partner with leadership and technical teams to help navigate the energy transition.

At GHD, we recognise that every business is different, and no two energy solutions are the same. That's why we provide integrated environmental, engineering and construction services across the value chain to meet our clients' diverse needs.

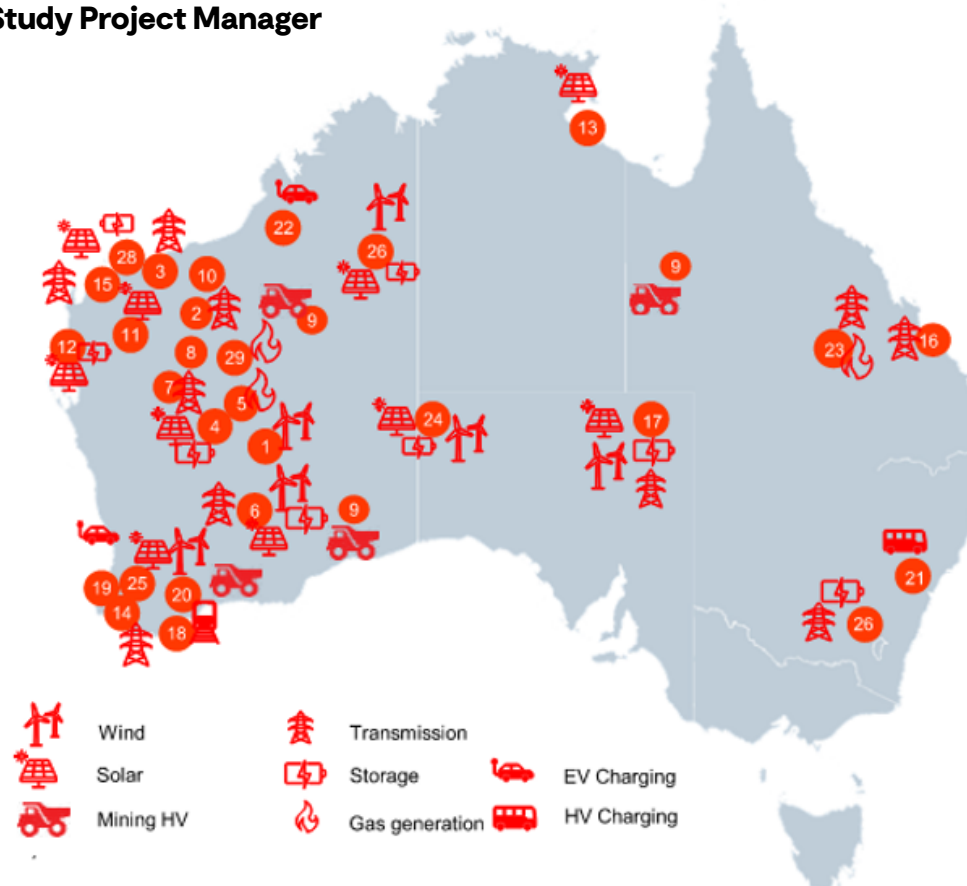


Decarbonisation and the energy transition

The global energy sector is transforming at pace. The way we generate, move, store and use energy is rapidly changing and the mining industry has made significant commitments to urgently develop clean energy solutions as part of decarbonisation processes.

The transition towards a future of affordable, reliable, secure and low-carbon energy has never been more important. We work with clients and communities across the globe in a shared commitment to achieve lasting, positive change.

GHD has extensive experience, having been involved in the study and execution of over +3GW of solar PV, +4GW of hybrid generation as either Technical Advisor, Designer, Owners Engineer or Study Project Manager



GHD's Projects - Australia

- | | | | |
|----|--|----|---|
| 1 | WAIO Wind Development OA
BHP | 16 | Curtis Island Electrification Study
Powerlink |
| 2 | Mining Area C Switchboard Replacement
BHP | 17 | Cooper Basin Electrification
Santos |
| 3 | Port Hedland Wedgefield Transmission Line IPS
BHP | 18 | South Hedland Terminal and associated Transmission
Horizon Power |
| 4 | Inland Solar PV SPS and now DPS
BHP | 19 | Electric Highway
Synergy |
| 5 | Inland (Firm) Generation OA, IPS and SPS
BHP | 20 | Fleet and Rail Decarbonisation Trialing
Fortescue Future Industries |
| 6 | Zero Emissions Electricity Opportunity Assessment
BHP | 21 | Zero Emissions Fleet
Keolis Downer |
| 7 | 132kV Transmission Line SPS, DPS and Execution
BHP | 22 | Electric Highway
Horizon Power |
| 8 | Central Pilbara Long Term Power Supply IPS
BHP | 23 | Fugitive Emissions
BMA |
| 9 | Process Facilitation and Consortia Development
Charge on Challenge | 24 | Electrification and Renewable Electricity
OzMinerals |
| 10 | North West Interconnected System Strategy
ANZ | 25 | Electrification for Decarbonisation Planning
Newmont |
| 11 | Emissions Reduction Studies
Rio Tinto | 26 | Electrification and Renewable Electricity
Newcrest |
| 12 | Onslow DER
Horizon Power | 27 | Port Hedland Power Precinct
Horizon Power & TransAlta |
| 13 | Reduced Emissions Electricity
Gemco – South32 | 28 | Woodside Power Project
Woodside |
| 14 | Zero Emissions Electricity
Worsley Alumina – South32 | 29 | Reciprocating Engine Augmentation of Newman Power Station
Alinta Energy |
| 15 | Dampier to Karratha Transmission Line
Horizon Power | | |

Critical Minerals

Across the globe and in particular within Australia, in part linked to the green energy transition, there is growing demand that will lead to a rapid increase in the supply of future energy (or critical) minerals. This spans the entire value chain from the exploration and origination stages (considering supply chain optimisation drivers), to responsible development, operations, down-stream processing and an increase in local value adding, through to the marketing / supply and ultimate mine asset transition.

Structural supply deficits will present in the event Critical Minerals (which in definition vary across international jurisdictions) are not produced at a much greater rate in the short-medium term. As part of this, strategic projects and coordinated resource development within regions / hubs need to be accelerated in order to establish trusted and reliable suppliers to meet the projected demand escalation.

Critical Minerals as well as other metals fundamental to the energy transition, such as lithium, graphite, cobalt, tungsten, vanadium, magnesium, copper, aluminium and nickel are essential to many of the technologies that are key to continued global prosperity and security, including renewable energy and storage, high-tech electronics, telecommunications, transport and defence. Australia and other jurisdictions possess recoverable resources for a broad suite of Critical Minerals necessary to respond to the increasing global need for reliable, secure and resilient critical mineral supply chains.



GHD has successfully delivered significant and diverse Critical Minerals commissions over recent years for both federal and state governments, as well as mining and resources companies across the value chain. This has included assessing strategic infrastructure support pathways, project-centric and regional infrastructure interventions to better integrate priority projects and regions into the Critical Minerals and high-tech metals supply chain. In delivering these programs, important lessons including the following have become apparent:

- The need for application of a structured methodology and multicriteria analysis to derive clear recommendations for public and private sector decision-making. This approach must be inclusive, collaborative and aimed to provide optimal value (considering ESG drivers) and outcomes
- Understanding the importance of the complete supply chain related to mineral recovery, import and export opportunities, and the role that ports and road, rail, pipeline and service corridors play in the effective movement of these commodities between points of origin and destination is critical
- There is an intrinsic conflict between prioritising the commercial viability and quantifying the resource economic potential / financial promise of specific deposits

GHD also provides thought leadership through our Critical Minerals conference program / commitments and contributes to the agenda as part of our Critical Minerals Association foundation membership.

GHD is supportive of the Australian Government's June 2023 Critical Minerals Strategy – particularly with focus on supporting and driving the enormous benefits new downstream industries that would also contribute to lowering emissions. Further to this, more needs to be done on recognition and targeted development of priority Critical Minerals regional hubs across several jurisdictions, as well as direct government investment in line with key GHD commissions.



The GHD difference

The global energy order is changing. The geopolitical drivers around energy security and the price of crude oil have the potential to change the 'energy order' forever.

The global energy transition is not just a transformation of energy systems. It's a transformation of communities and economics. We've reached an important tipping point in this journey with many industries making bold decisions to enable swift changes.

Thanks to unprecedented growth in low-emissions electricity generation, renewable power could significantly reduce global CO₂ emissions and underpin our future energy systems.

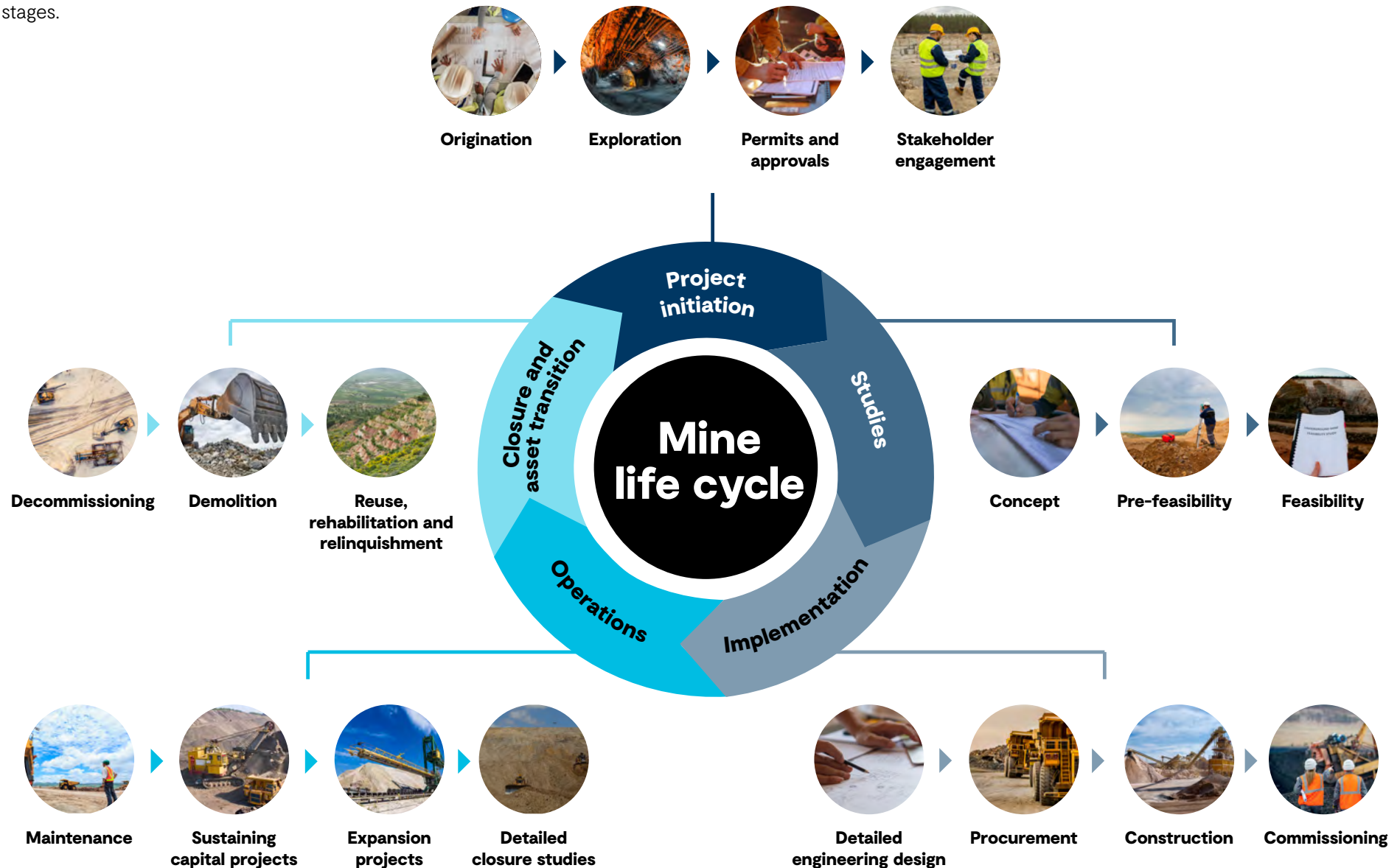
GHD offers extensive experience across all stages of the Future Energy lifecycle including the mining of Future Energy Minerals.

We understand the essential role Critical Minerals have in reaching climate ambitions and targets. We look for new ways to secure critical mineral demand by turning to solutions encompassing technology innovation and sustainable interaction of the natural, physical and social environments that support mining operations.

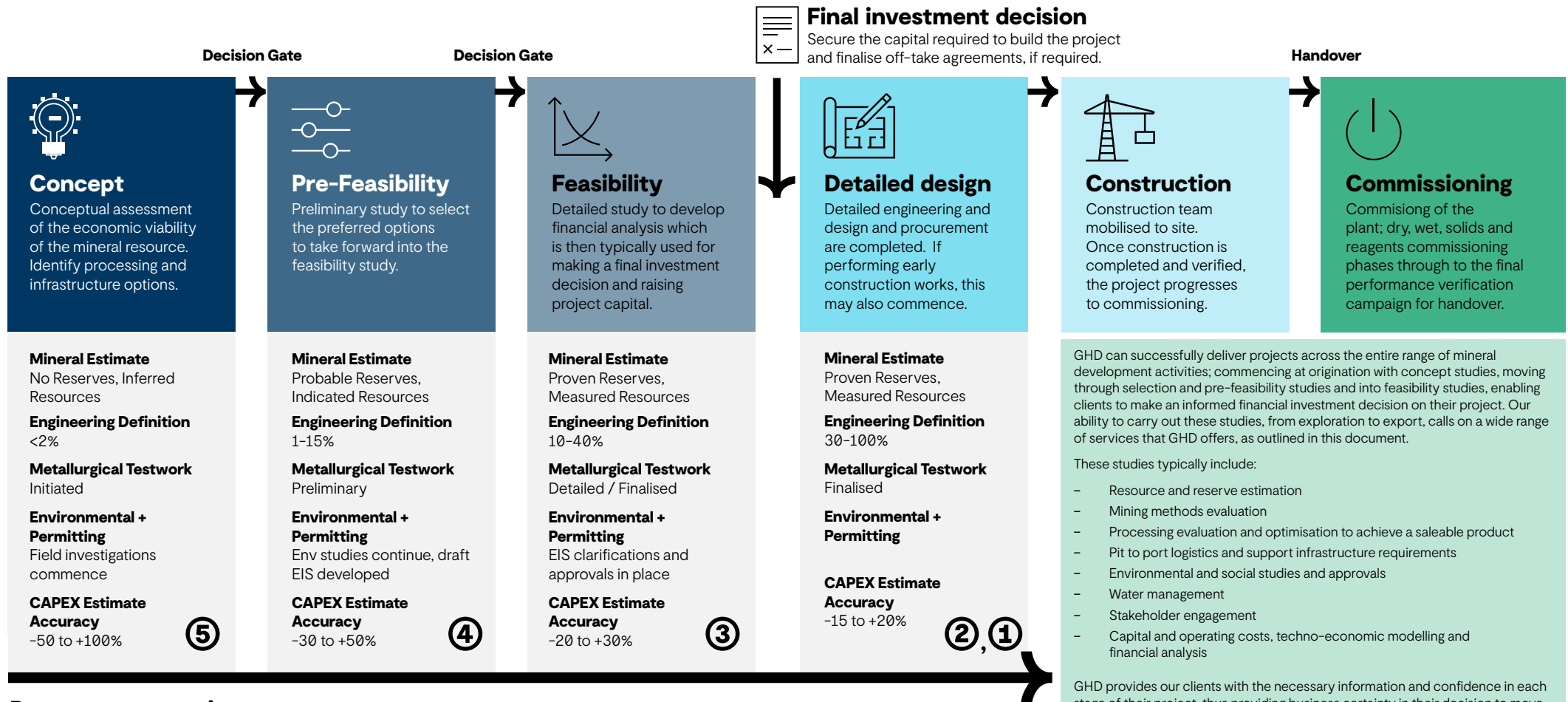


Mine life cycle

GHD recognises all phases within the mine life cycle and can assist with your project at any or all stages.




Origination, feasibility and execution



Progress progression

Increased level of resource definition and increased accuracy of infrastructure capital cost.

 AACI International Cost Estimate Classification

GHD can successfully deliver projects across the entire range of mineral development activities; commencing at origination with concept studies, moving through selection and pre-feasibility studies and into feasibility studies, enabling clients to make an informed financial investment decision on their project. Our ability to carry out these studies, from exploration to export, calls on a wide range of services that GHD offers, as outlined in this document.

These studies typically include:

- Resource and reserve estimation
- Mining methods evaluation
- Processing evaluation and optimisation to achieve a saleable product
- Pit to port logistics and support infrastructure requirements
- Environmental and social studies and approvals
- Water management
- Stakeholder engagement
- Capital and operating costs, techno-economic modelling and financial analysis

GHD provides our clients with the necessary information and confidence in each stage of their project, thus providing business certainty in their decision to move their project into the next phase and into production.

Our technical, delivery and commercial capabilities come together to support clients across all aspects of a mineral development, unlocking value at each phase of the project lifecycle. Our aptitude for delivering studies and executing projects ensures clients can be confident of a smooth transition as a project advances from study phase to execution, post its financial investment decision.

Dynamic simulation

We understand the challenges facing miners

- ⚡ Demand for Critical Minerals is predicted to grow in future years due to requirements of transition to renewable energy
- 🔁 The race is on to decarbonise and make operations efficient with new government CO2 reduction target of 43% below 2005 levels by 2030
- 📈 Large future demands for other key metals used in renewable energy infrastructure such as Copper and Zinc are anticipated
- 🏗️ These challenges require testing of different infrastructure and operational solutions across the mining value chain, to realise the right way forward

Developing the solution

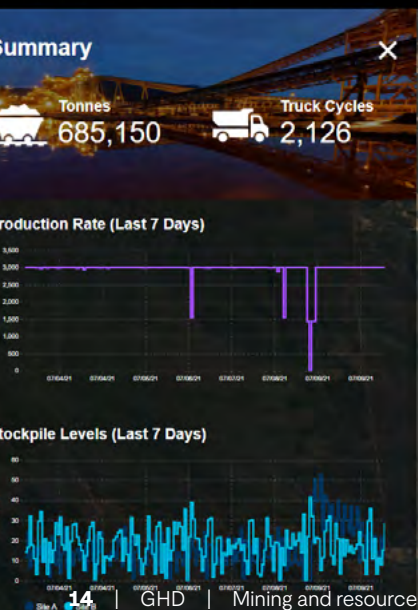
- Our expertise in using **dynamic simulation** can model and understand your operation – from **pit to port**
- Dynamic simulation models goes beyond the spreadsheet by playing out the **interactions and business rules**, whilst incorporating uncertainty
- Can interconnect components of the supply chain to gain a more **holistic view** of flow-on impacts 🚛 → 🏠 → 🚂

Benefits include

- **Optimise**
find efficiencies across existing operations in a *risk-free way*, ask and answer what-ifs with a *transparent and quantifiable* modelling methodology
- **Unlock**
the potential of your supply chain by *uncovering bottlenecks* and demonstrate the benefits of improvement to infrastructure.
- **Identify**
carbon impacts of trucking fleet through to the plant by simulating power and emissions associated with activities, target key areas for improvement
- **Robustness**
Measure the *resilience to risk* by incorporating equipment and operating uncertainties into the model.



Bauxite Mine Dynamic Simulation



Water in mining

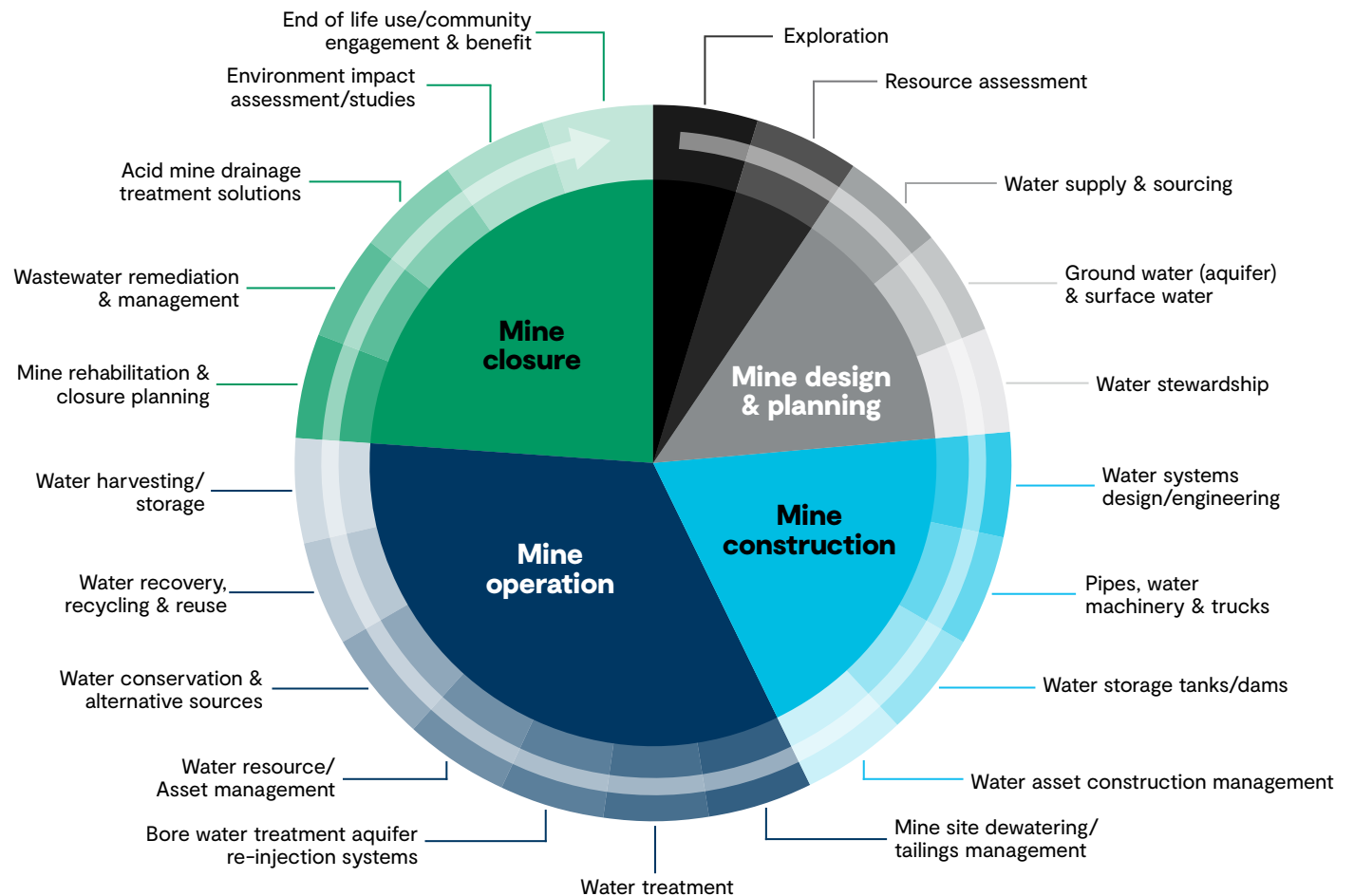


Water can be a critical resource but equally a significant hindrance to mining and construction projects and can be a pathway for contaminants or indispensable source of water for the environment.

Water industry leaders across the globe understand that to optimise water supply, water quality, flood protection, and sustainability, a more holistic approach to water management is required

GHD is a leader in helping clients implement innovative solutions to their water challenges especially for energy and resources projects. Our breadth of demonstrated experience across the water cycle helps our clients pursue regenerative water services that will achieve their water goals. This includes multi-disciplinary technical services as well as collaborative planning that brings multiple partners together to agree on best practices for a given project or location.

Mine Water Lifecycle





Mine waste management

We are recognised locally and international for our cost-effective, practical and innovative methods in mine waste management.

Through a strong understanding of the processes used in mining, milling and the chemical and physical properties of residues, including any time dependent changes, we approach mine waste management firstly by fully understanding the materials involved, our client's needs and community benefits. We determine rock type, geotechnical and geochemical properties, and the potential for any synergy between waste rock and tailings disposal. We consider key aspects for the potential for water quality impacts, Acid and Metalliferous Drainage (AMD), and the overall water balance of the mine site.

We approach each project by looking at scope for integrated mine waste management, where mine waste disposal might take advantage of synergies that may have an impact on either the cost, long term stability or environmental benefit.

Mine water management

- Providing mine water management solutions at the planning, operational and post closure stages.
- Involvement in mine water management in both metalliferous and coal environments.
- Embracing mine water challenges, the application of innovative technologies and provides solutions that result in long term benefits.

Mines have always had challenges with water management. With advancing technology our ability to overcome those challenges has increased. This also has increased the scale of the impacts and the ability to impact at a scale greater than ever before. The management of mine water, with these new possibilities in mind, presents our contemporary challenge.

The challenges multiply with increases in flow and or chemistry. Whether in relation to surface or ground water, when flows and chemistry are not well-understood or adequately modelled or anticipated, this compounds the uncertainties, complexity and associated risks.

Whether it is a legacy mine, existing operation or a proposed new mine, we can provide management solutions that result in benefits, both financial and environmental.

The mining industry is responsible for water stewardship. The industry has long-recognised water as a precious and shared resource with multiple social, cultural, environmental and economic values, important locally, nationally and internationally.



Mine water balance and hydrology

GHD supports the adoption of the Minerals Council of Australia (MCA) Water Accounting Framework (WAF). The sector-leading WAF is an innovative tool that provides a consistent approach to understanding, benchmarking and communicating operational, regional and corporate level water use, helping companies better manage water risks, harness opportunities and communicate water use to communities, investors and others.

Mine hydrogeology and groundwater modelling

Groundwater modelling for mine dewatering management is an important tool to aid management decisions to ensure that dewatering approaches are appropriately sized, funded and implemented. Management decisions include: the relative benefits of perimeter bores, in-pit bores and sump pumping, the scale of the predicted dewatering required based on different mining approaches and schedules (both underground and open pit); and the relative benefits of different underground dewatering strategies. Likewise, modelling can provide the justification for funding: appropriately engineered dewatering systems; recruiting and retaining appropriately skilled staff and resources relative to the scale and importance of the dewatering task.

GHD's groundwater modelling team has experience in numerical modelling of water supply borefields, mine inflows, underground coal gasification, brine re-injection, cut-off walls, tailings and water supply dam seepage, and the fate of leachate from waste stockpiles. Modelling capabilities include geochemical modelling to predict water chemistry changes, water resource modeling to predict impacts such as mine dewatering, borefield extraction and mine inflows. GHD uses several modelling packages including MODFLOW, FEMWATER, FEFLOW, PHREEQC, SOILCOVER, HYDRUS, SEEPW.



Development and operations

Our mining team can provide expertise in life cycle engineering works associated with mine development and mining operations across a range of commodities. We carry out strategic and operational mine planning as well as infrastructure design, mine governance and approvals and environmental assessments.

GHD offers a wide range of mining technical services delivered by professionals with extensive experience in successfully delivering major mining projects across the globe. We will work with your team to add value to your project by applying quality engineering and scientific practices across many disciplines. You can rely on our mining professionals to deliver unique, innovative solutions to your mining project.

We can work with your teams to help develop your mining project and then assist through operations undertaking sustaining capital as well as operating budget support services.

GHD can work with you on all aspects of your project, including:

Geology and resource management: Our geologists and geophysicists deliver innovative solutions in project generation, program design, program management, quality assurance and control, data management, geological interpretation and modelling, resource estimation and auditing.

Mine geotechnics: With over 25 years' experience in both soft and hard rock mining, GHD delivers the full range of geotechnical services for both open cut and underground mines.

Mine design: determining the physical layout of the mine. This may involve mining method selection and projects economics, as well as specialist areas such as rock mechanics and ventilation.

Mine scheduling and planning: understanding and testing the mining sequence. This often assesses the application of constraints on mine development. GHD have delivered mine plans over different planning horizons to meet client requirements.

Fleet selection and management: advice and assistance with equipment selection and determination of productivities for a given application.

Minerals processing: GHD's team of process engineers have extensive experience in minerals processing, supported by leading edge simulation software. We are committed to delivering practical engineering and management solutions in extractive metallurgy and process engineering.

Materials handling: If you are looking for proven yet innovative ways to overcome the challenges presented at your site, GHD can deliver. Our materials handling capability will provide you with efficient solutions that are flexible to take on future expansion, that meet the current needs of your systems and the required outcomes for your project.

Mine water: All mining projects and operations are susceptible to underestimating the impact that water can have on their viability, and the appropriate management of water issues often looms as the "elephant in the room", remaining a challenge to manage throughout the mine's life cycle. Water planning and management including Hydrogeology, hydrology and water treatment.

Regulation and compliance: Our team can work with you to ensure your internal and external obligations are tracked and met.

Financial modelling: we develop Capital Cost Estimates, both project capex and sustaining capex as well as operating cost estimates. These are initially equipment based, then non-equipment items and this service often includes the manning estimate.

Process improvement: looking at operational aspects or the real world application of the above areas to optimise performance eg- Why are we not meeting planned production?

Delivery Phase Services: Our team provides four services to our clients on projects or programs including: 1) Study Management 2) Project Services 3) Commercial Management and 4) Project Delivery. We do this by threading together services across the whole lifecycle of an asset. DPS commences with the Origination Phase, continues into pre-feasibility and feasibility, execution and construction and then extends through to when an asset needs to be renewed or closed.



Asset transition and mine closure

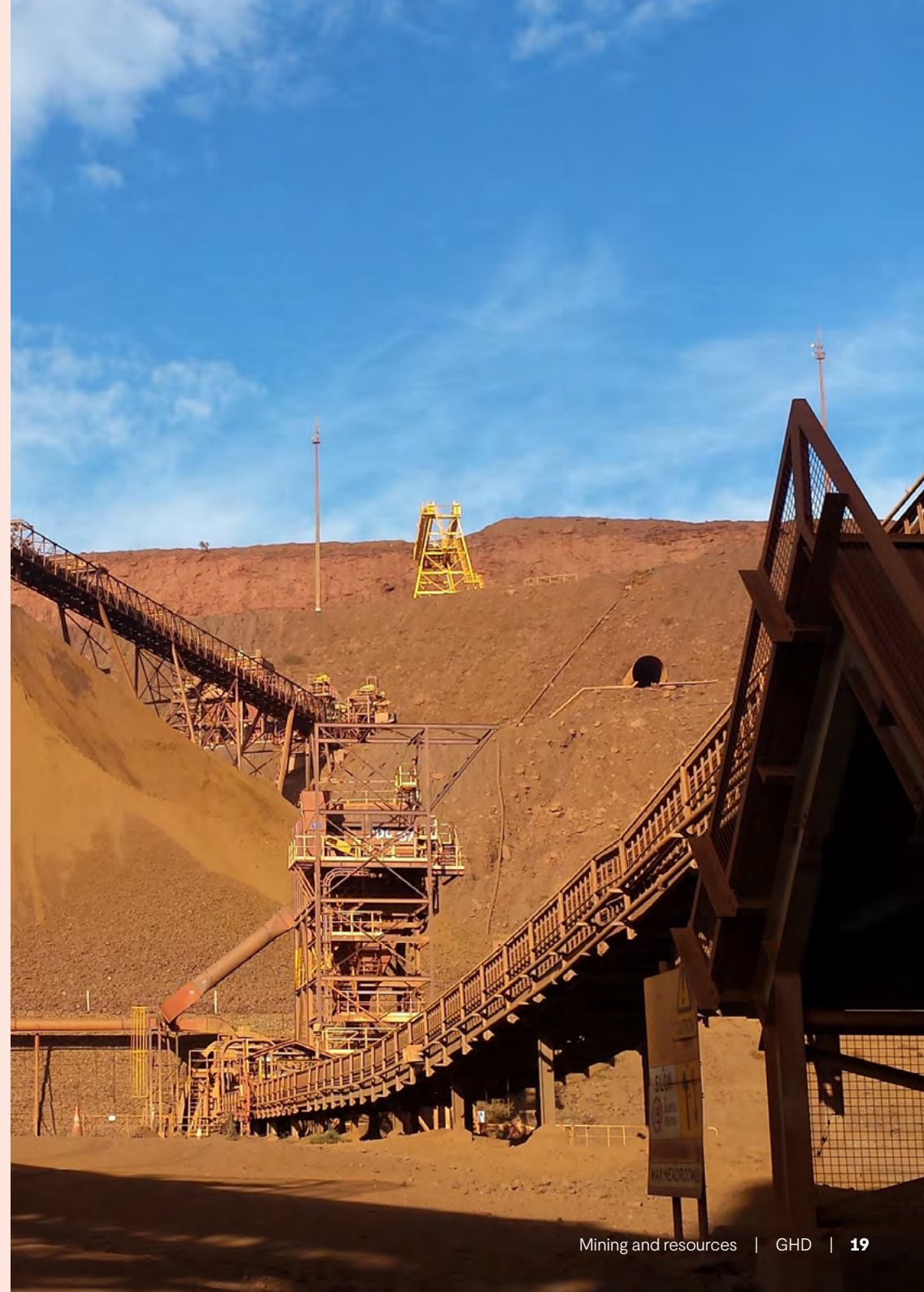
As an industry, we must avoid future legacy mine issues that have led to significant environmental, social and reputational impacts across the sector. Enhanced and earlier optioneering, decision-making and robust planning, managing operational interfaces and regulatory perspectives, including substantially improved progressive (or “operationalising”) rehabilitation and closure are all critical as part of these processes.

There is a continued disconnect between active mining and post-mining interface and any real opportunities for economic repurposing of sites, assets and value generation through closure are lost. There is a great opportunity and significant imperative to achieve a change.

GHD's integrated mine closure services form a key part of our overall asset transition consulting practice. We appreciate our client needs to effectively manage the way in which their portfolio of assets across all stages of the value chain (including multiple sites across the mining lifecycle) are responsibly and sustainably transitioned through to and beyond lifecycle end. This includes the earliest stages of initial mine closure planning and approvals, through to detailed landform design, contamination investigation, and to the optimal implementation of robust asset exit strategies.

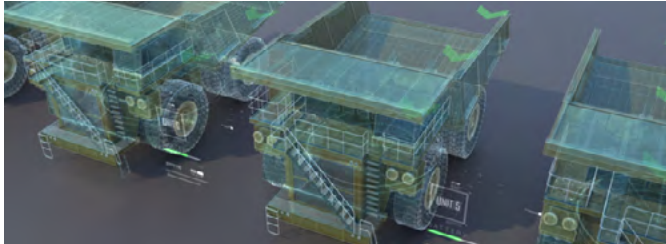
Opportunities to address closure and rehabilitation, site repurposing, transfer of assets and / or liabilities, as well as maintaining flexibility through an extended care and maintenance phase, legacy management programs and successful relinquishment are all significant activities. Environmental, Social and Governance (ESG) drivers are increasingly critical in association with corporate commitments, local communities, as well as investors around environmental and social responsibilities in order to manage risks and opportunities associated with business performance and organisational reputation. The ability to unlock and realise maximum value associated with assets, whilst meeting or exceeding community and stakeholder obligations are critical.

GHD is a proud and active participant member of CRC TIME (Transformations in Mining Economies) – in particular given the emphasis on closure being a valued cornerstone for post-mining economies and collaboratively building enduring benefit; with the opportunity to sustainably transform regions towards post-mining prosperity. The mission statement of CRC TIME, focussing on bringing together diverse stakeholders to help reimagine and dramatically transform Australian mine closure outcomes is reflected in GHD's forward-looking, innovative approaches to connect and sustain communities around the world.



Case studies

Charge on Challenge



Mission

Develop a strategy for industry-wide collaboration to standardise the interoperability of electrified mining haul truck fleets.

Clients

BHP, Rio Tinto and Vale

The challenge

Accelerating towards 2030 net zero emission targets, three leading mining companies – BHP, Rio Tinto and Vale initiated a market-led open innovation challenge to electrify haul truck operations for surface mining.

The Charge On Innovation Challenge (COIC) attracted innovative technology partners and broad support of mining companies and manufacturers, alongside investors, and the challenge resulted in eight winning ideas. It was however apparent that the ideas developed and electrification more broadly, require interoperability and standardisation in order to be universally effective and sustainable.

The three founding COIC patrons engaged GHD Digital to co-develop an interoperability framework and collaborative solution to accelerate the standardisation of haul truck electrification.

The impact

These bespoke innovation advisory and facilitation services resulted in the mining industry's endorsement of an Interoperability Framework. Relationships were strengthened in an environment of open collaboration,

externally managed by GHD Digital to acknowledge and protect intellectual property and commercial interests.

A pathway to accelerated interoperability was created as was a supporting governance and relationship model between CharIN and the International Council for Mining and Minerals to influence future ways of working, standardisation efforts and industry input and adoption.

From designing industry development initiatives to researching best practice approaches, managing innovation activities and encouraging open stakeholder collaboration, our unique versatility proved ideal for the breadth of expertise required.

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Kidston Pumped Hydro



Mission

Deliver the engineering services contract for the design and construction of the 250 MW Kidston Pumped Storage Hydro project in a joint venture with Mott MacDonald.

Client

Genex Power

The challenge

This world-first project repurposes an abandoned gold mine into a pumped storage facility.

The impact

Using the old gold mine pits as the upper and lower water reservoirs helps minimise the environmental impacts of a

new site design through the effective reappropriation of the former mine's assets. During the day, solar electricity generated from the adjacent solar plants will be used to pump water from the lower to the upper reservoir. This water will be released back to the lower reservoir during peak electricity demand periods, generating dispatchable electricity and capacity-firming.

The project consists of a six-kilometre-long dam on the upper storage, 235m deep shafts and tunnels forming the waterways, an underground powerhouse cavern housing two reversible pump turbines, and a surface switchyard. More than 25 billion litres of water will be pumped out of the lower storage to enable the underground works to be completed once the upper dam is complete. GHD has also designed a 1.6 km 275 kV transmission line as part of the connection to the national grid.

Detailed design has been completed across a range of services including:

- Detailed design of the dam and underground works
- Powerhouse design
- Oversight of dam construction and technical assistance for the tunnel development
- Cocreation and development with all stakeholders of a BIM model for the entire scheme
- Completion of electrical design for balance of plant.

When fully operational in 2024, the facility will have the potential to generate up to 250MW of rapid response, emissions-free flexible power for delivery into Australia's National Electricity Market.

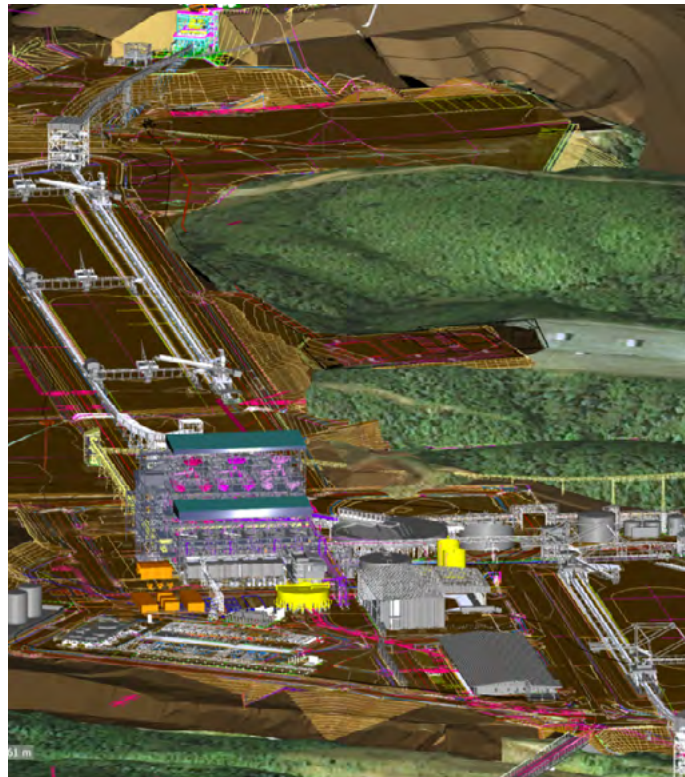
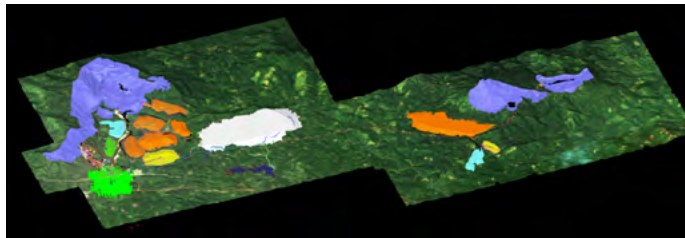
Kidston (250MW) will be the first of numerous large-scale pumped hydro and water infrastructure schemes planned in Australia and New Zealand.

“GHD involvement in innovative projects such as Kidston and the alignment of our core local and international service offering, provides an unrivalled platform to support our clients and communities in the transition to renewable energy across Queensland and Australia.”

- Craig Berry, Project Director Kidston, GHD

Liberia Western Range Iron Ore – PFS, FS. FS Optimisation Detailed Design & Documentation

May 2021 – July 2023



Mission

Upgrades across all project elements to increase capacity from 5 Mtpa to 15 Mtpa of >65% FE product for export.

Client

ArcelorMittal

Our response

GHD successfully completed all study phases and the detailed design and documentation of all project elements including materials handling, mining, processing, non-process infrastructure, ship loading and tailings in March 2023. GHD are providing ongoing support for the current Construction phase. The project included elements that required the same design skills and experience required for this project including 21 km of overland conveyors and a bypass conveyor to reject material similar to the emergency bypass required for this project.

McArthur River Mine

Mission

GHD has been involved with the McArthur River Mine (MRM) in the Northern Territory of Australia since 2014. The site is the third largest Zinc and Lead mine in the world.

Client

Glencore

The challenge

Numerous engineering and operational challenges, in consultation with the client.

Our response

Over a number of years, GHD has completed a wide range of technical services, including a collaborative Life of Mine plan for ongoing tailings and water management at the site.

Works completed by GHD include:

- Detailed design and construction of a range of new and upgraded larger water dams
- Detailed design and construction of TSF raises

- Engineer of Record services including gap analysis, quarterly annual reviews, and endorsement of designs and construction, operations reviews, emergency planning, preparedness and training, and a range of other supporting technical studies
- Annual inspections and safety reviews
- Geotechnical investigations ranging from low-disturbance geophysical techniques to conventional drilling and test pitting programs
- Complex geotechnical design for the dams including both static and dynamic FEA analysis of embankments with consideration of seismic and static induced liquefaction
- Instrumentation systems rationalization, installation and ongoing monitoring and review

The impact

MRM have now made fundamental improvements to operational tailings/water management practices at this site. Under this highly collaborative framework, GHD completed a wide range of engineering studies and remain the Engineer of Record (EoR) for a vast portfolio of large dams at the site. Similar to the Rio Tinto D5 Standard, Glencore introduced their FHP14 protocol in 2020 to standardise and achieve a high standard of dam safety management across their global assets. The EoR role is generally considered to be equivalent to the D5 Design Engineer Role.

Under the Engineer of Record role, GHD maintains a large pool of resources on the job that are outcome-driven and committed to ongoing safe management of the various assets while seeking continual improvement to find better ways to do things, enhance efficiency and drive value for money, for example:

- Championing the approach for self-performed construction of the dams and TSF raises which has resulting in the establishment of an experienced design and construction team onsite that are high-performing and consistently deliver the results needed.
- Risk-based approach to the design of the TSF resulting in a highly optimised design of the annual raises.
- The use of complex FEA analysis to optimise buttress design for the tailings dam.

Socio-economic impact assessment program

Mission

Undertake a socio-economic impact assessment (SEIA) and town modelling for two mine projects in Western Australia.

Client

Rio Tinto

The challenge

The purpose of the SEIA was to understand the life of mine planning implications on host communities and region, based on for multiple workforce scenarios. The SEIA informed the client's decision-making process in relation to mine development and community planning.

Our response

GHD assessed various life of mine scenarios which involved different proportions of work undertaken by autonomous drilling and haulage systems at the new mine developments. Using a data triangulation method, GHD assessed potential socioeconomic impacts to the nearby communities as a result of workforce and population change, based on a literature review, economic modelling, population modelling and outcomes of stakeholder consultation.

The impact

The SEIA report documented the potential impacts with a significance rating developed specifically for the project and provided recommended management and mitigation strategies to assist the client in making decisions for workforce planning, maximising benefits and minimising impacts to host communities and region.



Prospective Critical Minerals hubs and precincts

Mission

Deliver a study into prospective Critical Minerals hubs and logistic precincts across Australia.

Client

Department of Industry, Science, Energy and Resources (DISER)

The challenge

- Develop an understanding of what constitutes a hub, and the various features required for a functioning Critical Minerals regional hub (CMRH) and logistics precinct.
- Conduct stakeholder consultations (32 in total), including but not limited to:
 - States and Territory Agencies
 - Extractive industries
 - Tertiary institutions
 - Financial institutions
- Conduct quantitative analysis using a multicriteria analysis (MCA) to identify potential CMRH and logistic precinct locations.
- Conduct qualitative analysis to refine a preferred CMRH and logistic precincts shortlist.
- Consider potential Government intervention in supporting development of CMRHs and logistic precincts

Our response

- The establishment of the prospective hub shortlist: A detailed MCA and heat map to demonstrate locations that are considered quantitatively suited for critical mineral hubs and logistic precincts.



- Infrastructure requirements: The shortlisted CMRHs and logistics precincts assessed for infrastructure and processing requirements to guide understanding where key intervention and funding can assist in establishing these locations.
- Qualitative shortlist of CMRHs and logistic precincts and the concept of Cohorts: List of CMRHs and logistic precinct opportunities was prepared along with added locations and their potential additional development influence to qualitatively create a shortlist. These were then combined into focus “Cohorts”, or sequences of critical mineral hubs with key logistics precincts.
- Potential Government intervention: the study also highlighted other areas of potential Government intervention including but not limited to:
 - Engagement and collaboration with State and Territory Governments
 - Providing additional support mechanisms such as grants, loans, research and development, skills development, and more.

Kazzinc ground and strata failure catastrophic risk management portfolio

Mission

To improve the management of ground and strata failure risks at four underground mines to prevent fatalities and to address audit findings.

Client

Glencore

The challenge

Kazzinc's underground mines, some of which have been operating for more than 100 years, were experiencing some challenges in understanding, assessing and managing their ground and strata failure risks. Kazzinc's specialists had well-developed geotechnical and geological knowledge and Glencore was seeking a partner to support the sites in drawing on their expertise to apply a risk management approach to the challenges.

Our response

GHD led a program to improve the risk management of the ground and strata failure catastrophic hazards at four of Kazzinc's underground mines in Kazakhstan.

GHD worked with Kazzinc's specialists to develop bowtie diagrams, conduct risk assessments, identify critical controls and develop critical control performance standards & verification activities. GHD facilitation teams led and recorded more than 80 virtual workshops involving over 90 participants from Kazzinc. The workshops were conducted Russian via conversational translation, and GHD's team included Russian-speaking scribes for ease of communication and collaboration.



The impact

The project resulted in a substantial improvement in the knowledge, understanding and documentation of risk management at the mines, assisted them in meeting Glencore Zinc's Risk and Critical Control requirements and led to the successful close out of all related outstanding HSEC audit findings.

“The engagement and interactions couldn't have been handled more elegantly.

– Glencore Project Lead.

Mine lifecycle program management

Mission

GHD continues to work together with AGL Loy Yang as a major engineering service provider to the Loy Yang Mine site, after forming an alliance in 2002.

Client

AGL Loy Yang

Our challenge

AGL Loy Yang excavates some 31Mt of coal from various coal seams at the Loy Yang Mine, often separated by

interseam sediments up to 5m thick, and with overburden overlying the coal consisting of clay, silt and some sands. No stockpile and customer power stations require coal supply 24 hrs/day for 365 days per year.

Our response

With numerous GHD staff onsite on a permanent basis, GHD provides significant services in engineering, earth sciences, project management, dam surveillance, civil engineering and environmental management.

Works are undertaken to assist with the ongoing operations of the mine maintaining industry leading safe mine practices and management. GHD also help with strategic planning, compliance obligations and future capital programs that provide long term security and opportunity to the AGL Loy Yang project.

The impact

GHD continues to carry out strategic, long term and medium term mine planning for the client. Working together with Loy Yang Mine, GHD staff have developed an integrated strategic mine plan, based on average excavation rates and average availability rates of the coal, as a likely guide to the development of the mine over the next 10 years.

GHD has a long-term and strategic role in advising Loy Yang on mine closure matters and was recently engaged to facilitate and provide specialist technical input to a series of workshops to develop a strategic 5-year program of research. The program includes trialling rehabilitation solutions for the site. GHD also provides technical specialists as part of the research program steering committee.





Rio Tinto iron ore physical resilience to climate change risk assessment

Mission

Rio Tinto iron ore physical resilience to climate change risk assessment

Client

Rio Tinto

Our response

GHD led climate change risk assessment workshops for Rio Tinto Iron Ore operations (Dampier Salt, Coastal Operations, East & West Pilbara, townships, airports and the rail, road and power distribution networks) to assess the physical resilience to climate change.

Workshops were delivered using a hybrid digital/in-person facilitation model, MS Teams and MIRO digital whiteboard functionality to ensure key stakeholders unable to attend in-person were able to participate and contribute during and post workshops.

Risk registers were validated by GHD technical specialists in hydrology, tailings, rail and road infrastructure to identify gaps and confirm the suitability of identified controls.

The impact

GHD used findings from the stakeholder risk workshops were used to develop the Rio Tinto Iron Ore Climate Risk and Adaptation Plan.

Talk to us



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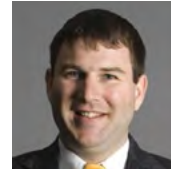
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90+ years in operation

135+ countries served

160+ offices worldwide

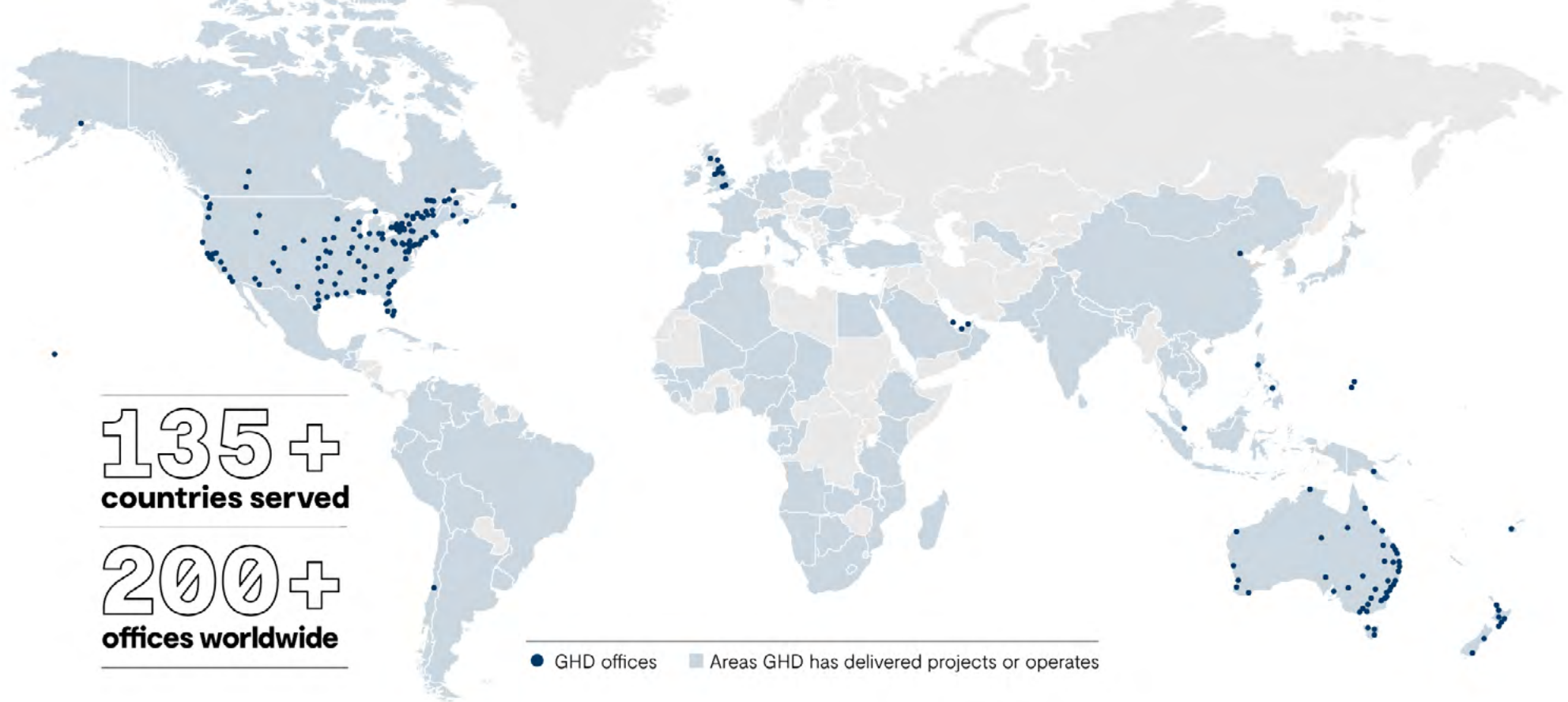
2.3[ⓑ] AUD revenue 2022

5 global markets

11[Ⓚ] people

45+ service lines

↳ **Providing engineering, environmental,
advisory, architecture, digital and
construction services**



About GHD

GHD recognises and understands the world is constantly changing. We are committed to solving the world's biggest challenges in the areas of water, energy and urbanisation.

We are a global professional services company that leads through engineering, construction and architectural expertise. Our forward-looking, innovative approaches connect and sustain communities around the world. Delivering extraordinary social and economic outcomes, we are focused on building lasting relationships with our partners and clients.

Established in 1928, we remain wholly owned by our people. We are 10,000+ diverse and skilled individuals connected by over 200 offices, across five continents – Asia, Australia, Europe, North and South America, and the Pacific region.

Find out more about us at ghd.com



→ The Power of Commitment