

The high stakes game



Dan Gleeson speaks to five companies confronted with the complexities of designing and engineering mines of the future, today

Any contractor that comes into a mining project nowadays is aware they must meet more than just client expectations; they need to walk a line where all stakeholders are aware of and content with their work.

This effectively sees specialist firms in the mining engineering, procurement and construction management (EPCM) space treated as a proxy for the mine developer/operator by those with a vested interest in the project.

IM spoke to a selection of companies from this group willing to address today's long list of stakeholder pressures.

Addressing community concerns

"Broadly speaking, we're working more with clients as a team to produce more integrated solutions that meet the demands from a wider range of stakeholders," Steve Rusk, Vice President, Mining Minerals and Metals for Stantec, told **IM**.

For years, **Stantec** has been seeing increasing pressures around permitting issues and social licence to operate, with a client and contractor partnership being one way of addressing this.

Rusk offered up an example here, where Resolution Copper (the owner of the Resolution copper project in Arizona) and Stantec recently partnered with White Mountain Apache community members to install renewable drinking water technology at the Fort Apache Reservation near Superior. This saw the two companies provide 64 "hydropanels" on the Fort

Apache Reservation, while supporting hydropanel installation programs in other Native American communities.

Hydropanels, Stantec says, are a one-of-a-kind renewable water technology that use solar energy to provide a safe and consistent supply of drinking water by drawing pure, constantly replenished water vapour out of the sky. The self-contained system converts water molecules in the air into liquid water, which is collected and mineralised in a reservoir inside the panel, creating high-quality drinking water that can be delivered directly to homes, businesses and community-distribution centres.

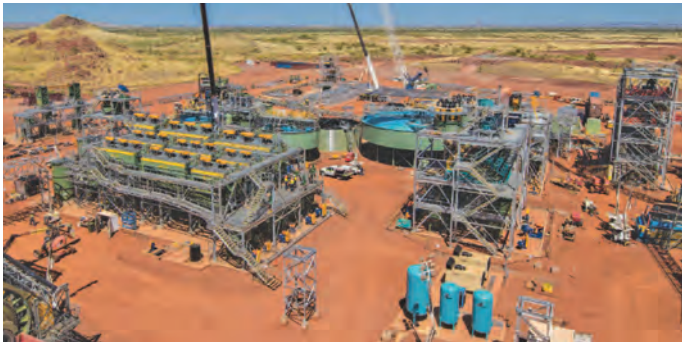
In Sodankylä, Finland, at Anglo American's Sakatti copper-nickel-PGE project, there is heightened environmental awareness due to the asset's location in a Natura 2000-protected zone, AFRY's Janne Tikka says (credit: Anglo American)

Rusk added: "Community involvement and support is an important part of what is a much broader project participation than in the past, and for the better."

Adrian Chapman, Executive General Manager, Calibre, a member of **WSP**, says his company takes a similar community-led approach with its work in Australia on behalf of mining clients.



ESG trends have become primary drivers on major projects, even surpassing technical issues and challenges, according to Stantec's Steve Rusk



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Calibre recently completed work on Rio Tinto's Robe Valley Sustaining (RVS) project in the Pilbara region of Western Australia. This major expansion included the development of three new mining deposits and the construction of supporting infrastructure to continue operations of the two existing operational hubs at Mesa A and Mesa J. The contractor was engaged throughout the RVS project from prefeasibility to the implementation phase including the preliminary and definitive engineering studies and, from early 2019, EPCM delivery partner.

Chapman said the project faced several challenges including completion during the height of COVID, recent heritage issues outside the project and navigating long environmental approval timeframes.

"Our emphasis on the importance of cultural awareness and maintaining consistent engagement with the Traditional Owners was critical to the success of the project," he told **IM**. "We have taken a leading role in identifying opportunities for community engagement, stakeholders and local business opportunities that provided short- and long-term prospects for these communities to help them thrive."

Chapman said the Calibre team is passionate about contributing to a more positive future, where people and the environment are at the core of big decisions.

"Calibre and WSP's teams are stronger together in interpreting challenges and gathering community and stakeholder input to support better decision making with our social performance approach."

AFRY, as a mining EPC/EPCM provider, is subject to these same stakeholder pressures, with Janne Tikka, Head of Global Mining & Metals, acknowledging the focus changes from project to project and from region to region.

In Sodankylä, Finland, at Anglo American's Sakatti copper-nickel-PGE project, for instance, there is heightened environmental awareness due to the asset's location in a Natura 2000-protected zone – a network of nature protection areas in the territory of the European Union.

AFRY, having been engaged by Anglo American for several years, has carefully considered all environmental and water system related questions as part of this demanding project.

This saw the company conduct comprehensive watershed modelling on the project, with the results used in the Environmental Impact Assessment report and in the environmental permit process for the Sakatti.

"Long-term effects have also been taken into account in the modelling of water emissions, where climate change is an essential part of the analysis and can significantly affect emissions," Tikka told **IM**. Climate change impacts were accounted for by using scenarios provided by the Finnish Environment Institute, making it possible to predict the effects of emissions in the receiving water body in the long term.

"The created data enabled Anglo American to communicate and clarify the project details with local stakeholders," he said.



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DRA Global also acknowledges this diversity of requirements, with Thys de Bruin, Vice President: Projects, and George Annandale, Senior Vice President: Origination, saying the company does a lot of work in places like Ghana, where it looks to upskill the local community or local country resources.

“Many of our clients are heavily dependent on close community relationships within their operating regions,” they told *IM*. “For many of our clients, procurement is localised to the region in which they operate, which has always been the case, as too has the upskilling of local workforces.

“Contractors/consultants are expected to provide the necessary skills and support as much as possible.”

Simulating the benefits

Other tools allowing mining companies to communicate their project plans include simulation and modelling – technology areas EPCM firms are embracing as they look to assist clients with their net-zero mining ambitions.

“The adoption of BIM (Building Information Modelling) together with expanded content PIM (Plant Information Modelling) and digital twinning can be a valuable part of this transition, but it also requires an approach that involves considering both the production technology and sustainable practices,” Tikka said.

PIM and digital twins can be analysed to make informed decisions to improve processes and their efficiency, which then have a positive impact on sustainability and net-zero ambitions, according to Tikka.

Calibre’s Chapman sees an opportunity in leveraging technology to support and unlock mining decarbonisation opportunities, with clients increasingly seeking out optimal ways to develop data-rich models that not only help through the project stage but lead to a fully integrated and demand response approach used for effective asset management.

“Through the use of digital twins, clients can test these designs in virtual scenarios that allow them to make critical decisions around plant performance versus energy use,” he said. “We are seeing clients challenge their traditional around-the-clock plant running and, rather, they are seeking options to optimise plant production during hours where renewable energy is at its peak.”

Mohammad Molavi, Vice President, Head of Global Business Development & Strategy – Mining & Metals at **Fluor**, says the ability to ‘future proof’ projects with such modelling is dependent on being able to design facilities that, while optimally designed initially, are flexible enough to be readily adaptable to changing grades, markets, conditions, regulatory environments and the introduction of new

technologies.

“Sophisticated modelling tools are invaluable in helping to conceptualise what such changes might mean during the facility’s initial design so that appropriate flexibility can be incorporated in the initial design,” he told *IM*. “Modular construction techniques, remote operation centres (ROCs) and automation are all methodologies that can support future flexibility and ‘future proofing’.”

ROCs and automation help in adjusting the control of the facility in line with various unanticipated circumstances, while modular construction techniques simplify potential future physical modifications to the facility, if necessary, he added.

de Bruin and Annandale say the use of artificial intelligence (AI) and automation continue to gain widespread popularity, with many of these elements in the development stage and looking to address resourcing issues.

“One of the things that we’re looking at is to use automation in elements of our procurement processes to alleviate pressure on our engineers, due to skills shortages within the disciplines, as well as other engineering enhancing tools,” they said. “Our focus is to take away mundane tasks from highly skilled resources to ensure that we apply our resources the important elements of our work.”

Rusk says advances in technology and simulation can result in higher precision outcomes, but this can only be achieved if the technology is set up to measure or simulate the right elements.

“For example, anyone could use AI, but if you don’t adjust it to what you need, it might not be helpful for you,” he said. “So, as we grow and adapt technology, we also need to confirm that the technology is being applied in a way that makes sense. We need to go through a robust validation process to make sure it is adding value.”

Impacts on the ground

Many of the ESG trends being spoken of at a high level in the mining industry are being actioned on the ground with the help of EPCM companies.

According to Rusk, ESG trends have become primary drivers on major projects, even surpassing technical issues and challenges.

“The whole mining industry has to adapt to the current ESG realities,” he said. “Similar to how the mining industry has been designing for safety in the last 25-plus years, we’re starting to see more social and environmental considerations in the design phase as well.”

Many of these considerations are covered by “value engineering”, a process that, at one time, was viewed as an accessory or add-on to the standard design process for many projects, Rusk explained.

“Now, especially in terms of sustainability and safety, it’s become the new baseline,” he said. “From the start of projects, we’re considering how to reduce emissions, build efficient power systems, use less water and plan for new technologies.”

Many aspects that come under the ESG and sustainability umbrella have been an important consideration in Fluor’s approach to minimise “externalities”, according to Molavi, who referenced highly efficient energy and water management in arid climates and remote/off-the-grid locations as examples.

“Fluor has a well-defined process in place to look at the entire mine to port process across a broad spectrum of opportunities,” he said. “This ranges from availability of water resources, energy and transportation infrastructure, selective processing, and waste repurposing, to a comparison of the carbon footprint derived from flowsheet options and process configuration.”

Fluor’s cross-disciplinary team of subject matter experts, for instance, have developed the ‘Fluor Grind Concept’ which led to energy savings of 12% and a significant amount of CO₂ emission reductions in a recent case study.

On the downstream side, its metals arm is executing several green steel projects building on electric arc furnace and direct reduced iron technology. It is also engaged in green steel projects advancing hydrogen-based technologies in steelmaking. “Likewise, we are currently building one of the largest low carbon aluminium facilities in the US and have been working with a promising technology start-up in the aluminium space,” Molavi added.

In terms of decarbonisation, EPCM firms’ mine-to-port focus also includes non-processing infrastructure, according to Chapman.

“We are advising clients on electrification of their rail and heavy haul trucks,” he explained. “Electrification of mining transport is really bringing the transport, energy and mining sectors together in new ways, and we’re really seeing that in our project work.”

This is also true for AFRY, with Tikka saying most of the mining sector’s carbon dioxide emissions are produced within the Scope 3 boundary, where downstream operators reduce ore into metal.

“AFRY’s home base in the Nordic countries is characterised by several publicly announced green steel projects,” he said. “These projects are based on EU carbon dioxide emission taxing that will be implemented in full in 2034, when free carbon emission certificates are eliminated.”

When realised, these green steel projects will dramatically reduce the carbon dioxide emissions from the Nordic steel industry, with hydrogen – not metallurgical coal – due to be used for reduction of iron ore.

And DRA's de Bruin and Annandale say the company continues to work on projects beyond its core 'plant' focus, whether that be with mining support services, or ongoing, stay-in-business project-related work.

"Investor expectations and demands related to ESG often add to project capital needs, however the trend is growing for the need to comply and be seen as a responsible miner," they said. "The need for decarbonisation will continue to feature in mining project development and become more prevalent."

Technology ties

Just as the mining companies themselves are realising they cannot achieve all their goals alone, the EPCM community is, too, opening to external collaborators.

Cody Ryckman, Innovation & Technology Lead, Mining, Minerals and Metals at Stantec, says: "Working closely with technology suppliers allows us to infuse emergent technology considerations throughout early design phases. This collaboration fosters creativity, which, in turn, supports ideation and results in the innovations necessary for the mine designs of today to adequately address project risk and meet the sustainability commitments of the future."

Ryckman says Stantec has a long history of successful collaboration with the emerging

technology community, and it continues to actively scale its partnering ecosystem, comprised of commercially available and emerging technologies, to better serve clients.

"We're excited about ongoing collaborations with our emerging technology partners in the areas of zero-emission haulage, tailings valorisation, remote sensing for performance monitoring of earthen structures, fleet electrification, steady-state ion exchange and surgical mining – to name a few," he said.

More specifically, Stantec has been working with a company targeting resin extraction technology in tailings recovery, with plans to not only recover gold, but also cyanide – both a hazardous chemical and a necessary reagent in the gold production space.

Rusk added: "Once the technology is proven, successful and implemented, it has the potential to be one of the biggest advances in gold recovery I've seen in my lifetime."

Fluor's technology-agnostic position has not prohibited the company from continuously working with a network of partners across the mining industry and beyond, with the company's Business Incubation team having supported many start-ups in their journey towards "techno-economic maturity, scalability and full commercialisation", Molavi said.

And, when it comes to the performance of its services, Fluor collaborates closely with


technology providers and makes significant investments, such as the close collaboration in the development of EPC Project Health Diagnostics.


Molavi explained: "Our most recent collaboration with a leading multinational information technology, digital technology and AI provider provides us with a deep reach into digital technology and AI across industries on a global scale."

Calibre has collaborated with FutureAim – a digital support services company – and Datum360 – an engineering information and asset data company – in developing its digital asset platform for project delivery.

"This approach allows us to be agnostic when it comes to design tools but provides our clients with a fully integrated digital asset to be uploaded to their preferred asset management platform such as AVEVA or SmartPlant Enterprise for Owners Operations," Chapman said.

AFRY, meanwhile, has a long history of collaborating with technology suppliers where its specialists have participated in the development of applications and products in mining, for example with Sandvik and Metso.

Recently – perhaps due to increasing demand for green transition innovations – AFRY has carried out many feasibility studies based on novel production technologies, with many of these tied to its involvement in battery mineral development projects. 



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