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"It is important to recognise that sustainable development is a shared responsibility among mining companies, government and communities."

Veronica Bolton Smith, CEO: CMAG

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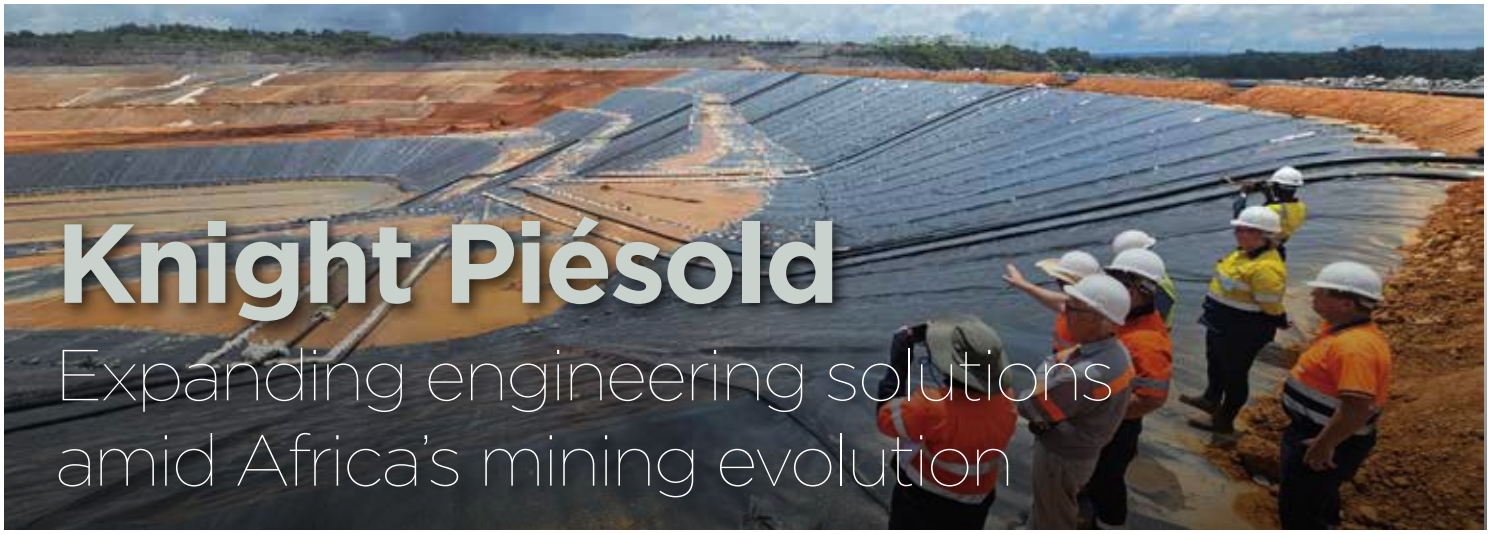
Knight Piésold CONSULTING



Knight Piésold

Expanding engineering solutions amid Africa's mining evolution

Africa's mining sector is entering a phase where technical excellence, sustainability, and cross-disciplinary collaboration are essential. As regulations tighten and ESG scrutiny increases, mines require engineering partners who deliver innovation and accountability. For more than a century, **Knight Piésold** has supported Africa through integrated mining, water, power, and infrastructure expertise. Technical directors **ANDREW COPELAND** (Mining), **ROBERT GREYLING** (Water and Power), and **ANDREW CLEGHORN** (Infrastructure) explain how responsible engineering and long-term sustainability are shaping the continent's mining future.

Recently, Knight Piésold expanded its local presence within Southern Africa, establishing offices in the Copperbelt in Zambia and the DRC, as well as in Namibia and Botswana. These offices enable deeper local capacity development and ensure the delivery of world-class services tailored to regional needs.

Mining: Tailings and water systems

Copeland notes that the mining division's core focus areas are tailings and waste-rock storage, heap-leach design, geotechnical stability, and water management, supporting clients from feasibility through closure. Key innovations include aligning Tailings Storage Facility (TSF) design with the Global Industry Standard on Tailings Management (GISTM), advanced deformation modelling, long-distance slurry pumping, and improved rheology testing. These respond to regulatory pressure and rising ESG expectations.

The division also plays a critical role in mine-closure planning, Emergency Preparedness and Response (EPR) plans, and community-focused water-management strategies that ensure operational safety and environmental compliance.

Water and Power: Hydropower and dams

Knight Piésold's Water and Power division focuses on hydropower, dam engineering, water-conveyance tunnels, large-diameter pipelines, surface-water management, and wastewater treatment. Greyling notes strong growth in large-scale water-transfer projects and private hydropower implementation in emerging markets. Demand is rising in Africa for renewable, reliable energy that supports mining operations and communities.

He highlights the urgent need for dam-safety improvements, particularly on ageing infrastructure facing increased flood risk and changing water-demand profiles driven by climate change. Repair and rehabilitation projects therefore require expanded spillway capacity and optimised reservoir operation.

To address these demands, Knight Piésold uses advanced hydrological and structural models to optimise dam size, spillway design, and reservoir performance. Finite Element Analysis (FEA) is applied under varied loading conditions to assess dam stability. For hydropower, systems are designed to match renewable-energy needs, while risk-based assessments ensure resilience and minimise failure risk. Greyling notes that although technology and modelling tools enhance data acquisition and design quality, experienced engineers remain essential for interpreting outputs to ensure cost and environmental optimisation.

Infrastructure: Roads and mine services

The infrastructure division delivers the full spectrum of built environment and transport systems required for mining. This includes roads and bridges, water and sewer networks, bulk earthworks, mine services, and project-management support through construction supervision. Advanced digital design tools and Building Information Modelling (BIM) improve coordination and minimise errors.

Cleghorn explains that a major innovation is the ability to package all mine-related infrastructure into an integrated delivery framework. For greenfield projects, haul roads, water-supply systems, power corridors, and camp infrastructure are designed as part of a unified master layout. BIM, hydraulic modelling, and geospatial data allow optimisation, reduced interface risks, and cost-efficient, resilient infrastructure.

Integration across divisions

Internal communication systems flag cross-disciplinary opportunities, while marketing is coordinated across divisions to maintain a consistent approach throughout the project lifecycle.

Partnerships with contractors, governments, and community stakeholders are common, as is collaboration with international Knight Piésold teams to facilitate skills transfer. Multi-disciplinary projects often involve other major consultants, creating shared technology transfer, state-of-the-art design implementation, exposure to updated modelling approaches, and attraction of top engineering talent.

Cleghorn reinforces that integration is intentional. Joint design reviews, shared risk registers, and unified deliverables ensure coordinated solutions. Environmental and social teams are embedded to design infrastructure that supports community wellbeing and aligns with regional development objectives.

Technology for sustainability

Digital tools underpin sustainability across all divisions:

Mining: satellite monitoring, digital twins, and real-time tailings-performance tracking.

Water and Power: terrain modelling, 3D structural design and detailing, hydrological-hydraulic simulation, and dam-safety monitoring.

Infrastructure: BIM, hydraulic modelling, and GIS analytics to reduce waste and environmental impact.

Knight Piésold is advancing technologies shaping modern engineering practice, including:

- 3D design tools and AI-driven predictive monitoring with automated data-acquisition systems for geotechnical and structural instrumentation
- High-resolution satellite imagery, LiDAR, drone and robotic scanning
- Cloud-based data-management platforms with shared client access
- Application of global standards such as ICOLD, CDA, GISTM, SANCOLD, and ANCOLD

Building communities

Community benefits are prioritised:

- Mining: safe closure, EPR plans, and rehabilitated landscapes
- Water and Power: hydropower, flood control, and water-supply systems
- Infrastructure: socially aligned roads, pipelines, and water networks supporting municipal development

Opportunities and challenges

Mining

Opportunities:

- Critical minerals are in high demand, driving new mine development.
- Growing focus on safe closure and legacy management (e.g., rehabilitating old TSFs).
- Increasingly seeing themselves as a multidisciplinary mining engineering firm.
- Copeland believes the growth opportunities over the next few years are exciting, particularly as they expand their capabilities across tailings, geotechnical, water, and mine infrastructure.

Challenges:

- Regulatory scrutiny, ESG expectations, and the technical complexity of tailings management.
- To adapt, the company is investing in research, in-house modelling tools, and capacity building to provide cutting-edge, risk-informed designs.

Water and Power

Opportunities:

- Renewable energy and hydropower development in emerging markets.
- Bulk water supply and conveyance projects driven by increasing demand for water security and resilient infrastructure.
- Rehabilitation and dam-raising projects.
- Clean/renewable energy and a growing focus on sustainable development.

Challenges:

- Repair and maintenance of ageing infrastructure.
- Environmental and social concerns towards new dam development.
- Financing water-power projects and investment risks.
- Skills shortages within the sector.

Infrastructure

Opportunities:

- With Africa's infrastructure push, there is enormous opportunity in roads, pipelines, and municipal water systems.
- Green infrastructure and climate-resilient designs are also growing.

Challenges:

- Funding constraints, permitting complexity, and balancing speed with sustainability.
- The company is preparing by building strong multidisciplinary teams, investing in digital tools, and cultivating local talent to support large-scale, socially aligned infrastructure programmes.

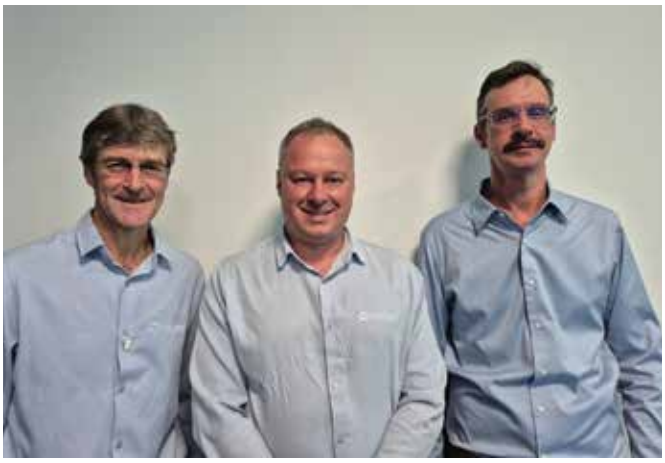
Developing future leaders

Copeland explains that at Knight Piésold, partnership goes beyond client-consultant relationships, reflecting shared commitment to safety, environmental stewardship, and community legacy.

"The most resilient mining operations are designed responsibly, operated transparently, and closed with care."

Greyling adds that team building is based on trust, competence, and accountability, with staff gaining global project exposure and advancing from junior roles to specialists.

Cleghorn emphasises building infrastructure for generations, focusing on smart, inclusive solutions aligned with client goals, community needs, and environmental realities, with collaboration central across disciplines and stakeholders. MRA



↑ **Knight Piésold technical directors: Andrew Cleghorn (Infrastructure),** Robert Greyling (Water and Power) Andrew Copeland (Mining)