



Mine Closure and Remediation

CORPORATE PROFILE

ABOUT US

With over 2,500 employees across Africa, Asia-Pacific, Europe, North America and South America, SLR has been delivering cutting-edge, creative business solutions for over 20 years. Our multidisciplinary consultancy has established a global reputation for providing high quality, specialist and responsive environmental solutions. We are focused on delivering superior technical services to our clients to add value, reduce environmental uncertainties, and minimize environmental-related expenditures. We advise our international client base around seven core sectors: Mining & Minerals, Industry, Infrastructure, Built Environment, Energy, Power and Financial.

Our “one team” culture is the foundation on which our company is built. We focus on providing high quality advice while being nimble, responsive and adaptable. We draw upon the best technical experts available to ensure a multidisciplinary approach to problem solving. We value and foster long term relationships with our clients and our project teams.

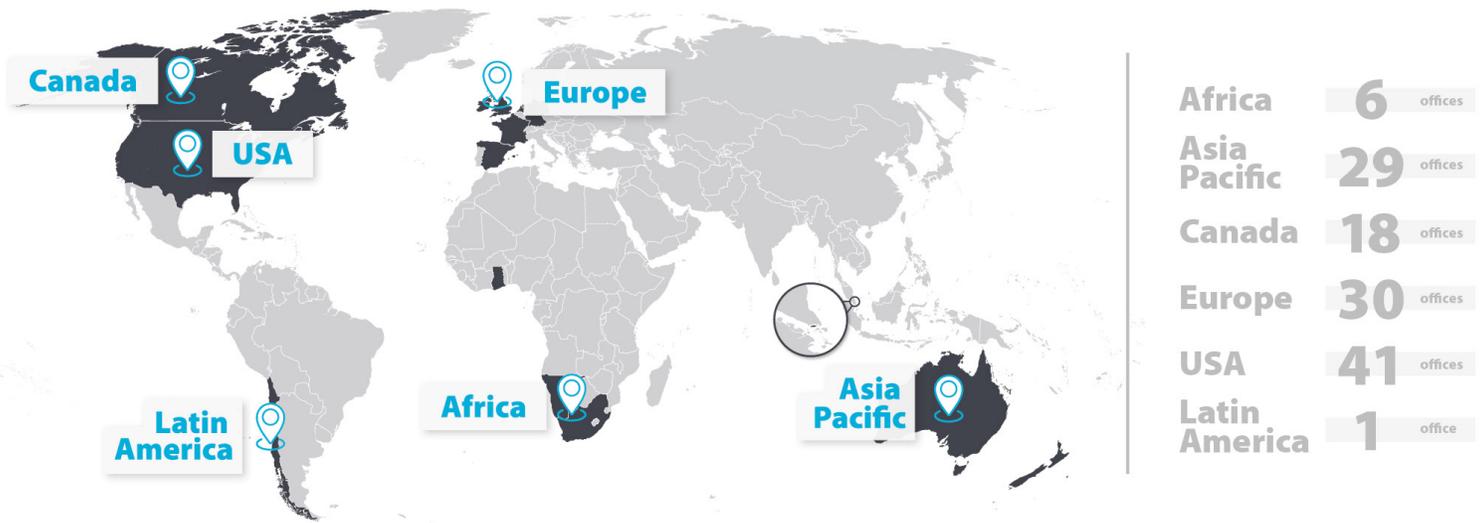
Sustainability

SLR is committed to environmental and socio-economic sustainability. As a leading environmental consultancy, healthy communities, environmental limits, and profitable markets are not competing interests; they are shared outcomes that closely align with one another. Sustainability services remain the core of our business and succinctly define what we do and who we are. We aspire to be a global leader in the provision of such services, with our overall company mission being “helping clients achieve their sustainability goals”

Health, Safety, and Environment

SLR is dedicated to achieving the highest quality in service delivery and Health Safety and Environmental (HSE) performance. SLR will not compromise when it comes to the safety of our personnel, subcontractors and others affected by our work and designs.

SLR continuously undergoes industry, regulatory, internal and client safety audits to verify that the HSE Management System meets all the requirements of the law respecting the safe performance of the work that we perform. SLR has maintained a membership in good standing with ISNetworld, Comply Works and with Avetta since 2007.



HOW WE CAN HELP - VALUE PROPOSITION

SLR is committed to providing our clients with bespoke optimised solutions. SLR brings a range of best practice services to our clients to build business value, ensure project success and minimise risk and cost. Customised tools and programs are aligned with our clients' strategic goals and are focused on driving the maximum return on their investment, environmental compliance and risk assessment.

SLR's commitment to technical excellence is reflected in our multidisciplinary team of social, environmental and engineering professionals who have firsthand experience in addressing some of the most complex challenges facing the industry today.

SLR offers over 70 technical services and our professionals offer a blend of experience incorporating engineering (civil, mine waste and mining), geology, hydrogeology, climate science, marine science, biology, chemistry, ecology, toxicology, land quality, regulatory and compliance specialisms; and social and environmental science.

Our broad and diverse range of social, environmental and engineering capabilities combined with our qualified team means that SLR is able to support the successful completion of your project.





Our Services

OUR GLOBAL MINING AND MINERALS SERVICES

SLR provides a broad range of social, environmental and engineering consulting services to the mining and minerals sector. Our sector focused approach services each phase of the mining lifecycle, from exploration, pre-feasibility and feasibility studies, financing, mine operations, mine closure and rehabilitation planning, design, closure execution and post-closure compliance.

With the global mining sector pivoting to recognises and support the importance of Environmental, Social and Governance (ESG) principles, mine closure and remediation has become one of the most important phases of the mining lifecycle. Sophisticated planning, design and implementation of mine closure and rehabilitation activities is key to optimising environmental, social and financial impacts.

With a number of SLR’s closure and rehabilitation leaders coming from operational and applied backgrounds, we truly understand the importance of minimising owners risk. SLR offers results-oriented fit-for-purpose management strategies for closure and rehabilitation to best represent the interests of all stakeholders.

As a flexible and responsive mid-sized international company, our world-class experts and senior staff are available throughout North America, South America, Europe, Africa, and Asia-Pacific. Our multi-disciplinary teams bring significant experience in mine closure and rehabilitation risk assessments, closure strategy development including financial planning and permitting, facility design and construction management, water resources management including treatment and post-closure operation and monitoring and, social transitioning to post-closure land use. SLR participates regularly in conferences, workshops, and courses to stay ahead of developing issues, social transitioning beyond mining, current guidance and regulations. As a result, our clients continually receive value-added services and the application of best practices to their needs.

<p>ESG Services</p>	<ul style="list-style-type: none"> • Identification and management of impacts and risks with social consequences • Stakeholder engagement management and advisory • Land access and displacement planning and support 	<ul style="list-style-type: none"> • Incident and grievance management planning and support • Social impact monitoring and review • Competent Person Reports
<p>Mining Advisory</p>	<ul style="list-style-type: none"> • M&A and Strategic Transaction Advisory Services • M&A Due Diligence Reviews of Mining/Exploration Projects • Reporting for Public Disclosure: NI43-101, SK 1300, JORC 2012, PERC, SAMREC 	<ul style="list-style-type: none"> • Preliminary Economic Assessment, Prefeasibility, & Feasibility Studies • Expert Witness Services • Persons Reports, & Mineral Expert Reports
<p>Mine Waste & Infrastructure Engineering</p>	<ul style="list-style-type: none"> • Siting, Planning, & Design: Tailings Storage Facility, Leach Pad, Waste Rock & Stockpile, Trade Off Studies • Geochemistry • Acid Rock Drainage Management 	<ul style="list-style-type: none"> • Seismic Analyses • Landform Engineering • Risk Assessment and FMEA
<p>Mine Water Management</p>	<ul style="list-style-type: none"> • Hydrologic and Hydrogeological Modeling • Integrated Water Balance • Water Quality Management Planning 	<ul style="list-style-type: none"> • Active & Passive Water Treatment • Operational Water Management Plans • Stormwater Controls & Plannings
<p>Mine Environmental Services</p>	<ul style="list-style-type: none"> • Aquifer & Groundwater Permitting • NPDES Permitting • Air Quality Permitting • Environmental Monitoring & Compliance 	<ul style="list-style-type: none"> • Regulatory & Stakeholder Engagement • Acoustic & Vibration Studies • Environmental Assessment
<p>Mine Technical</p>	<ul style="list-style-type: none"> • Mine Resource & Mineral Reserve Estimates & Audits • Resource Optimization 	<ul style="list-style-type: none"> • Design Planning & Optimization • Metallurgical Assessment, Process Design/Optimization
<p>Mine Closure</p>	<ul style="list-style-type: none"> • Engineering & Design, Procurement, Construction Management • Mine Waste & Closure Liability Reviews & Assessments • Mine Closure & Remediation Planning • Landform Evolution Modeling 	<ul style="list-style-type: none"> • Stakeholder Engagement • Cost Estimating & Trade Off Studies • Post-Closure Operation, Maintenance, & Management • Baseline Inventories & Studies • Care & Maintenance
<p>Social Performance Services</p>	<ul style="list-style-type: none"> • Identification and management of impacts and risks with social consequences • Stakeholder engagement management and advisory • Land access and displacement planning and support 	<ul style="list-style-type: none"> • Incident and grievance management planning and support • Social impact monitoring and review • Competent Person Reports



The extent to which a mining company is able to manage regulator, community and employee expectations as well as final closure outcomes has a major impact on investor, community and regulator sentiment from the outset.

Our mine closure experts provide strategic planning services to develop a closure vision, engage with stakeholders, and then develop and implement a closure strategy in a cost beneficial way, while reducing negative legacy risk.

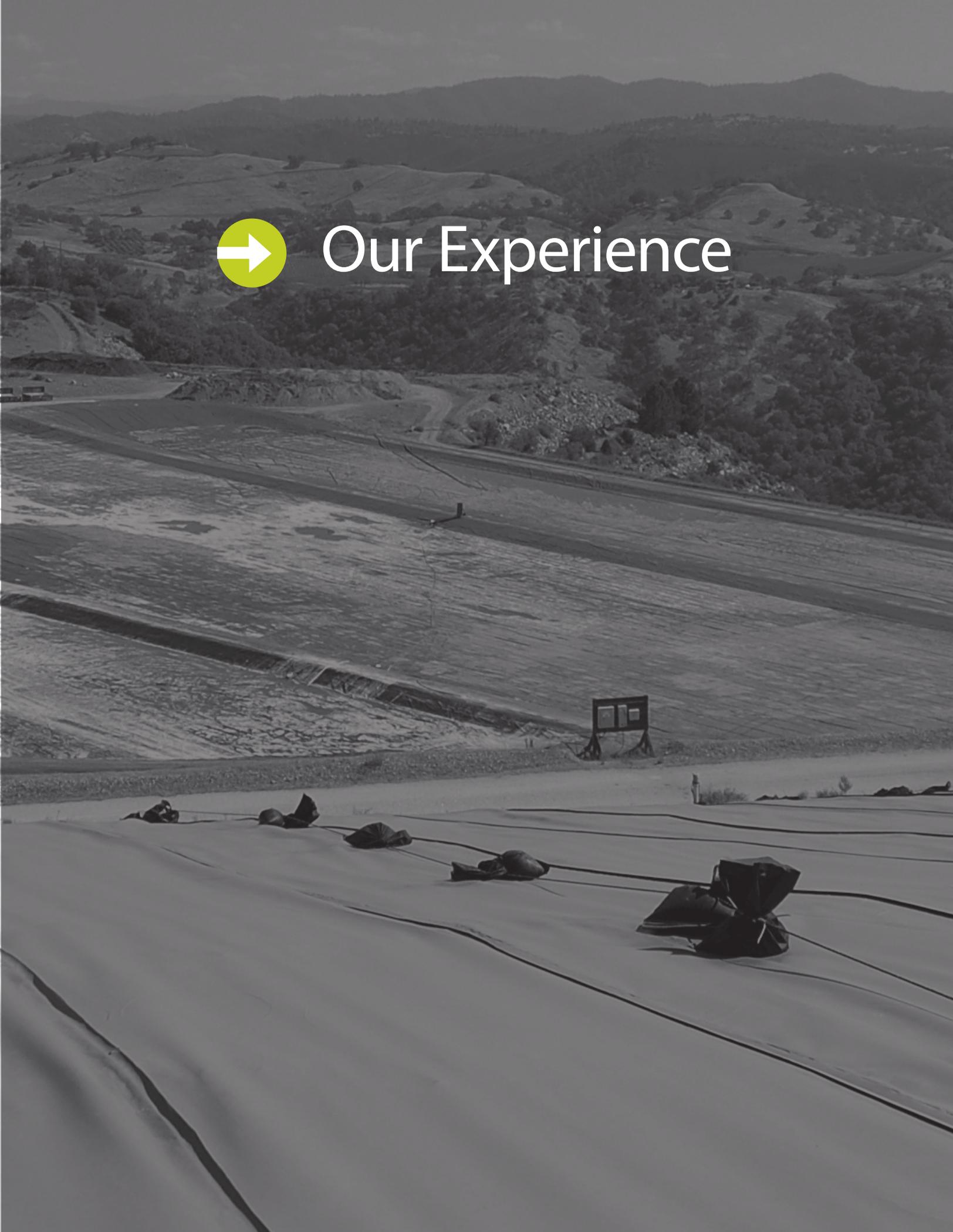
Our experts can assess existing closure strategy status and address knowledge gaps. We also have the skills and tools to provide scheduling, resource allocation and closure liability or budget assessments to assist with financial planning or provisioning.

How SLR can help

- Baseline Knowledge Gaps & Opportunities
- Stakeholder Engagement and Alignment of Closure and Post-closure Goals
- Risk Assessments and Liability Minimization
- Baseline Inventories and Studies
- Mine Closure & Remediation Planning
- Cost Estimation
- Trade-off Studies
- Mine Closure Execution Plans and Project Execution
- Post-closure operations, monitoring, and reporting
- Develop a socially aligned post-closure vision
- Align mine closure plans with existing social investment programmes
- Develop partnerships in support of social transitioning
- Mine Closure Design Planning to Maximise Opportunities and Minimise Risks and Costs.



Our Experience





USA PROJECTS

ELIZABETH MINE CQA AND FMEA

Vermont, USA

At the request of USEPA New England Region (Region 1), SLR was retained by Nobis Engineering, to provide third party review and senior review of CQA during construction, on behalf of the USEPA. SLR reviewed the construction drawings and technical specifications and proposed changes to the design, namely laying the slopes flatter to increase the stability of the soil cover over the geosynthetics and eliminating some complex design details such as in-cover drainage pipes which would slow down construction and impact costs. SLR attended the project progress meetings and conducted two-days site visit on a bi-weekly basis to monitor field construction activities and review on-site records. SLR staff also have undertaken Geologic and Geotechnical engineering by evaluating existing conditions, assessing hazards and evaluating the risks associated with potential failure modes. Project highlights include: Tiered air quality monitoring network; Extensive monitoring equipment network; Real-time data communications for remote monitoring location; Rapid equipment deployment and 24 hour data monitoring required.

ROYAL MOUNTAIN KING MINE SITE OM&M

California, USA

Meridian Gold Company is closing this former gold mine in the foothills of the Sierras. The mine is located in an area with difficult geology (fault zones, dikes) and poor natural water quality (TDS ranging from 500 to over 35,000 mg/L and naturally-occurring arsenic). Furthermore, it is difficult to differentiate the native water from the mining impacts. SLR designed and permitted closure of all the former mine waste management units (a flotation tailings pond, a leached concentrate tailings impoundment, the process water pond, and the waste rock piles), performed reclamation of the general site facilities, developed and implemented water management plans, obtained a discharge permit to dispose of excess salty water, designed and implemented an in situ arsenic treatment system for a pit lake, designed and permitted a dam to contain water in a pit lake, and worked with the regulator to de-designate some non-attainable beneficial uses that were applied to groundwater. SLR has been performing all OM&M of site facilities and water management systems, as well as continued optimization and refinement, since closure was completed in 2016.

BHP GLOBE-MIAMI LEGACY ASSETS CLOSURE PLANNING AND COST ESTIMATION

Arizona, USA

The Globe-Miami mining district is located approximately 100 miles east of Phoenix, Arizona and has seen more than 150 years of modern mining activity. BHP acquired these legacy copper assets from Magma Copper in 1996. The Globe-Miami Legacy Assets consists of the five mine sites and mine waste disposal areas and the numerous parcels throughout the area and include multiple tailings storage facilities, leach dumps, waste rock dumps, four open pits, and support facilities constructed to support the previous mining activities (i.e., mine workings, power transmission, water supply, roads, structures, etc.). SLR was retained by BHP to develop a cost model and conceptual closure cost estimate including a Basis of Estimate report that detailed the methodology, assumptions, and calculations used to develop a comprehensive and transparent conceptual closure cost estimate for the Globe-Miami Legacy Assets. SLR worked closely with BHP to develop a comprehensive and transparent closure cost model to be used for the evaluation of closure concepts, assess risk, and provide a basis for the planning of future activities. The model was developed by SLR to support decision-making process and to facilitate closure planning, stakeholder engagement, and evaluation of impacts as the program progresses through the planning stages to construction and transition to post-closure land use. The model is flexible to enable updates and track the changes as the program progresses.

CARSON HILL CLOSURE DESIGN AND GEOTECHNICAL EVALUATIONS

California, USA

SLR performs all the OM&M for this closed gold mine in the Sierra foothills, including operations of a reverse osmosis water treatment plant. SLR conducted a site inspection, reassessed the stability of all mine fills using the latest seismic design criteria, and issued a report for use by BHP and the California regulators. SLR also established a water and chemical mass balance model that tracks heap infiltration, leachate and seepage collection, evaporation, brine treatment and storage and which is used to refine routine water management plans, as well as those for potential extreme wet periods.



EUROPE PROJECTS

PASSIVE SULFATE TREATMENT SYSTEM

West Sussex, United Kingdom

SLR was appointed by St Gabain to investigate options to treat a leachate from their gypsum mine site in the UK. The study concluded a passive treatment option using biochemical reactors and reed beds would present a cost effective and natural solution at the site. SLR conducted a sequence of bench scale and pilot scale trials to evaluate and define a robust and reliable passive treatment approach. Following testing and remonstration of the treatment technology, SLR worked with St Gabain, stakeholders and regulators to gain approval of the unique treatment technology at the site. The full-scale system has been approved by the Environment Agency and SLR has designed the full-scale system, which is due for construction at the end of 2023.

BOULBY POTASH MINE, CONCEPTUAL CLOSURE PLANNING

England, United Kingdom

SLR prepared the desk-based concept closure plan for the Boulby Mine in support of the November 2019 planning application for extended mine life from 2023. This high-level plan was a risk-based approach to identifying information gaps within existing closure planning for the site and provided high level recommendations for progressive mine closure planning required to identify, manage and where possible reduce CPL's closure liabilities as operational plans develop.

FOSS MINE CLOSURE PLANNING, PERMITTING AND TECHNICAL STUDIES

Scotland, United Kingdom

SLR prepared the detailed mine closure plan for the Foss underground barites mine in Scotland. The scope of work included long term water management; landform engineering; long term stability of underground workings; landscaping; regulatory compliance and stakeholder engagement. Based on the detailed mine closure plan SLR prepared a detailed mine closure cost estimate for the client.

The mine closure plan was prepared in compliance with the requirements of the relevant EU Directives / BREF Guidelines.

LISHEEN MINE TSF, CLOSED MINE WASTE MANAGEMENT

Ireland, United Kingdom

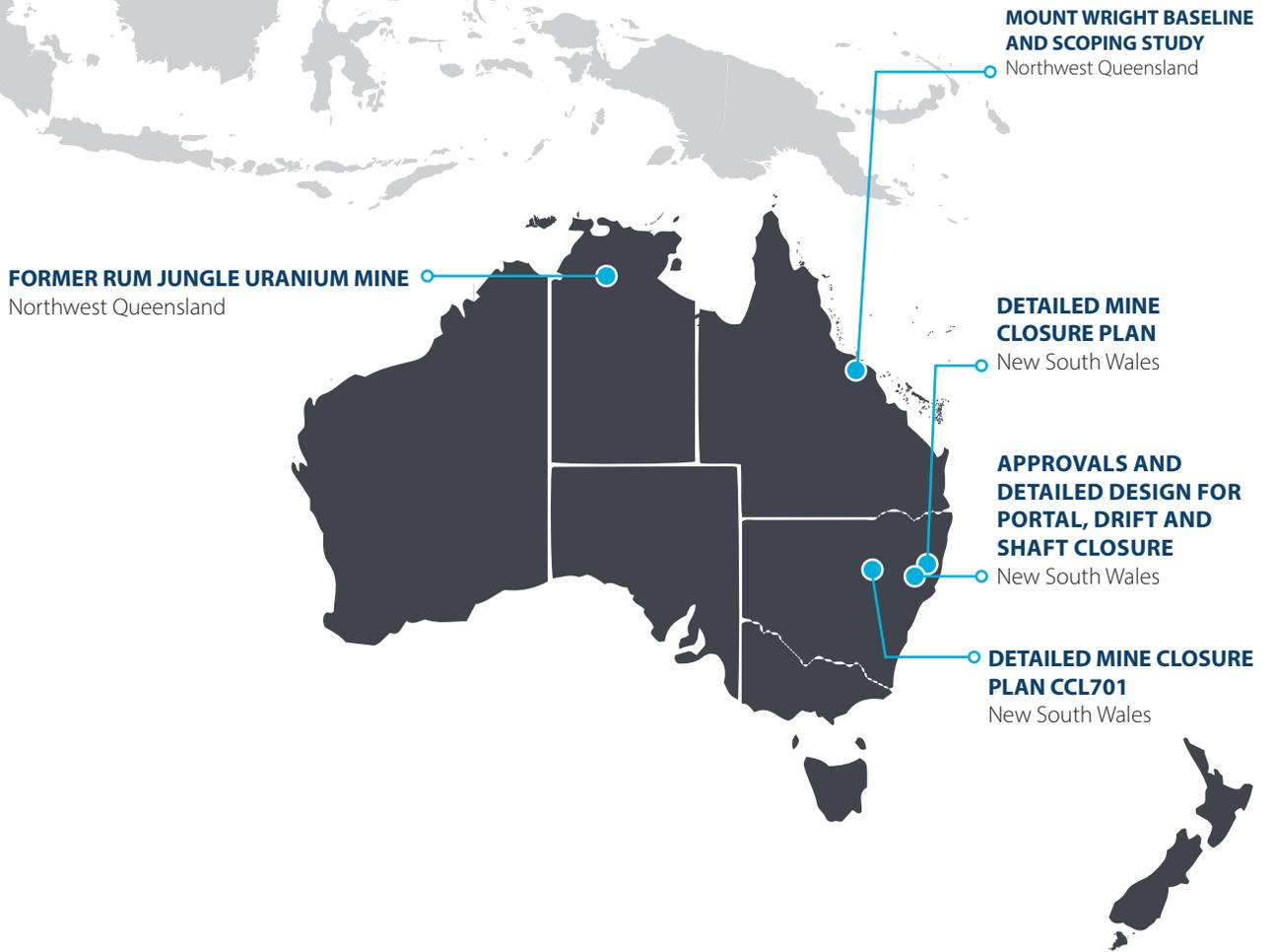
SLR was appointed by Vedanta to undertake a review of the closure process regarding the restoration of the Tailings Management Facility (TMF) at Lisheen Mine, Moyne, Thurles, County Tipperary. The Mine ceased operation at the end of 2015 and a Closure, Restoration and Aftercare Management Plan (CRAMP) has been developed to facilitate the safe and efficient Mine Closure.

EVALUATION OF ARMENIAN MINING SECTOR

Armenia

World Bank appointed SLR to provide advice on mine waste management within the context of Best Available Technology (BAT) and Best Applicable Practice (BAP) and within the region-specific context of high seismic hazard.

The assessment recommended that the Armenian government embarks on a process of elaboration of a national mining policy to ensure sound regulation of the sector. The policy should also provide an opportunity to build consensus among stakeholders, which is crucial to promoting a sustainable, transparent and successful industry.



ASIA-PACIFIC PROJECTS

DETAILED MINE CLOSURE PLAN CCL701

New South Wales, Australia

Develop and undertake a detailed mine closure planning process to facilitate relinquishment of the mining lease associated with historic operations. This scope of works includes investigations to prepare detailed rehabilitation completion criteria and address issues and deficiencies on the CCL701 legacy site as required by regulators for all environmental, physical and other aspects. The initial investigation was a baseline knowledge gap analysis and built

on a Pre-Feasibility Constraints Report developed by SLR previously. Works undertaken to date include studies/assessments on demolition, HAZMAT, methane and gases, geotechnical constraints, tailings rehabilitation, geochemistry and spontaneous combustion, biodiversity, archaeology, baseline scoping, boreholes, social impacts, groundwater, subsidence, contamination, surface water, closure obligations and preliminary mine sealing investigations.

MT WRIGHT BASELINE AND SCOPING STUDY

Northwest Queensland, Australia

Baseline and scoping works for the detailed closure planning for Mt Wright underground operations. This work required review of project specific information to determine the types of studies likely to be required and identification of constraints and opportunities for mine closure. Tasks included gap analysis, site visit and consultation and reporting on gaps and technical scopes of work.

DETAILED MINE CLOSURE PLAN

New South Wales, Australia

Develop a Detailed Mine Closure Plan for Oceanic Coal Australia Limited (OCAL) including Project Management

of all areas and technical studies, gap analysis, site geotechnical constraints analysis, geochemistry assessment, hydrogeological studies, surface water assessment and conceptual design, risk assessments, options analysis to develop closure strategies, development of Bill of Quantities with WBS and development of a Rehabilitation Plan and associated closure criteria. Key aspects of this DMCP were presented to the New South Wales government in the form of a Closure

Mining Operations Plan which was approved in January 2017.

FORMER RUM JUNGLE URANIUM MINE - STAGE 2A DETAILED ENGINEERING DESIGN

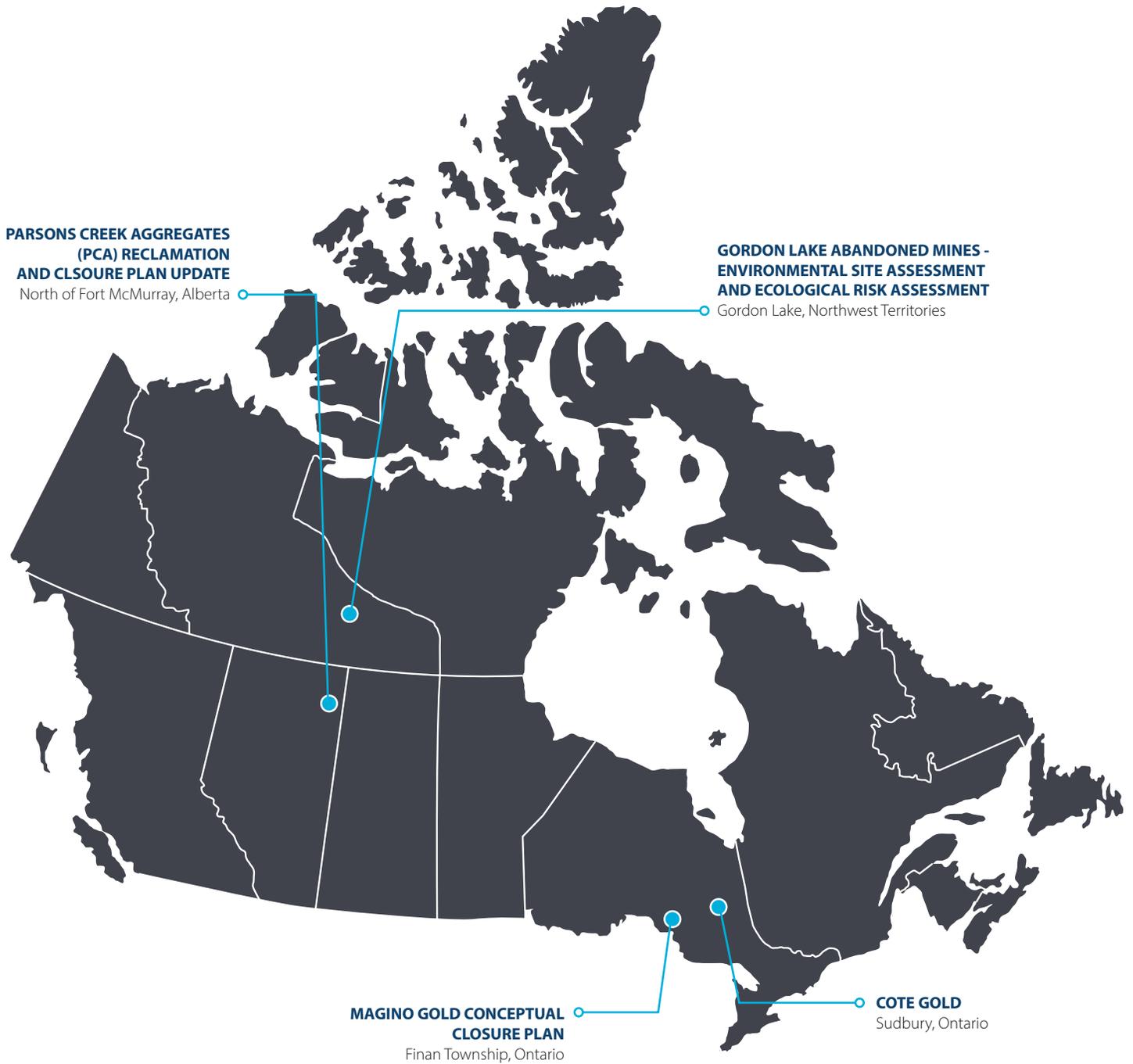
Northern Territory, Australia

Lead engineering team delivering the rehabilitation strategy and design for the remediation of a legacy mine site. This included waste rock dump design, capping and landform evolution modelling, water treatment plant, water-filled pit backfill strategy, civil infrastructure design and river realignment. Bill of Quantities, technical specifications and construction quality control documentation suitable for tender were produced, and a P80 construction cost and schedule developed. The design developed took into account both environmental requirements and the interests of the Traditional Owners of the site.

APPROVALS AND DETAILED DESIGN FOR PORTAL, DRIFT AND SHAFT CLOSURE

New South Wales, Australia

Multidisciplinary team delivering the approvals framework and detailed engineering design for the sealing and closure of underground mine infrastructure, including 3 mine portals, 2km drift and ventilation shafts. Study included detailed geotechnical, geomechanical, hydrogeological, engineering and environmental investigations. Early contractor engagement to develop bespoke backfill methodologies (utilising mine waste), offering significant cost savings and safety improvements. Deliverables included certified seal design, design drawings and technical specifications, bill of quantities and construction quality control documentation.



CANADA PROJECTS

CÔTÉ GOLD

Ontario, Canada

IAMGOLD is a leading mid-tier gold producer with operating gold mines in Canada and abroad and plans to construct, operate and eventually rehabilitate a new open pit gold mine in Ontario. In 2016, Federal and Provincial Environmental Assessment approval was received for the Côté Gold Project. In 2017 the project was optimized, which required assessing the changes to the identified potential environmental effects to ensure they were documented and properly managed. A Closure Plan for the Project was required to be developed and approved before construction could commence. Various permits for the Project also required the development and coordination of a permitting schedule.

GORDON LAKE ABANDONED MINE SITES - ENVIRONMENT SITE ASSESSMENT AND - ENVIRONMENTAL SITE ASSESSMENT AND HUMAN HEALTH ASSESSMENT

Northwest Territories, Canada

PSPC required an assessment of contamination on the site, non-hazardous waste assessment, physical hazard assessment, remedial options assessment, liability estimates, and a human health and ecological risk assessment of

site contaminants to aid in long term management. The work included assessing the presence, extent and volume of contaminated media on the sites; conducting a geotechnical investigation; completing a remedial options assessment; defining the preferred remedial option; completing liability estimates; assess physical hazards and acid mine drainage; using risk assessment and site specific risk based targets to design a remedial plan.

MAGINO GOLD CONCEPTUAL CLOSURE PLAN

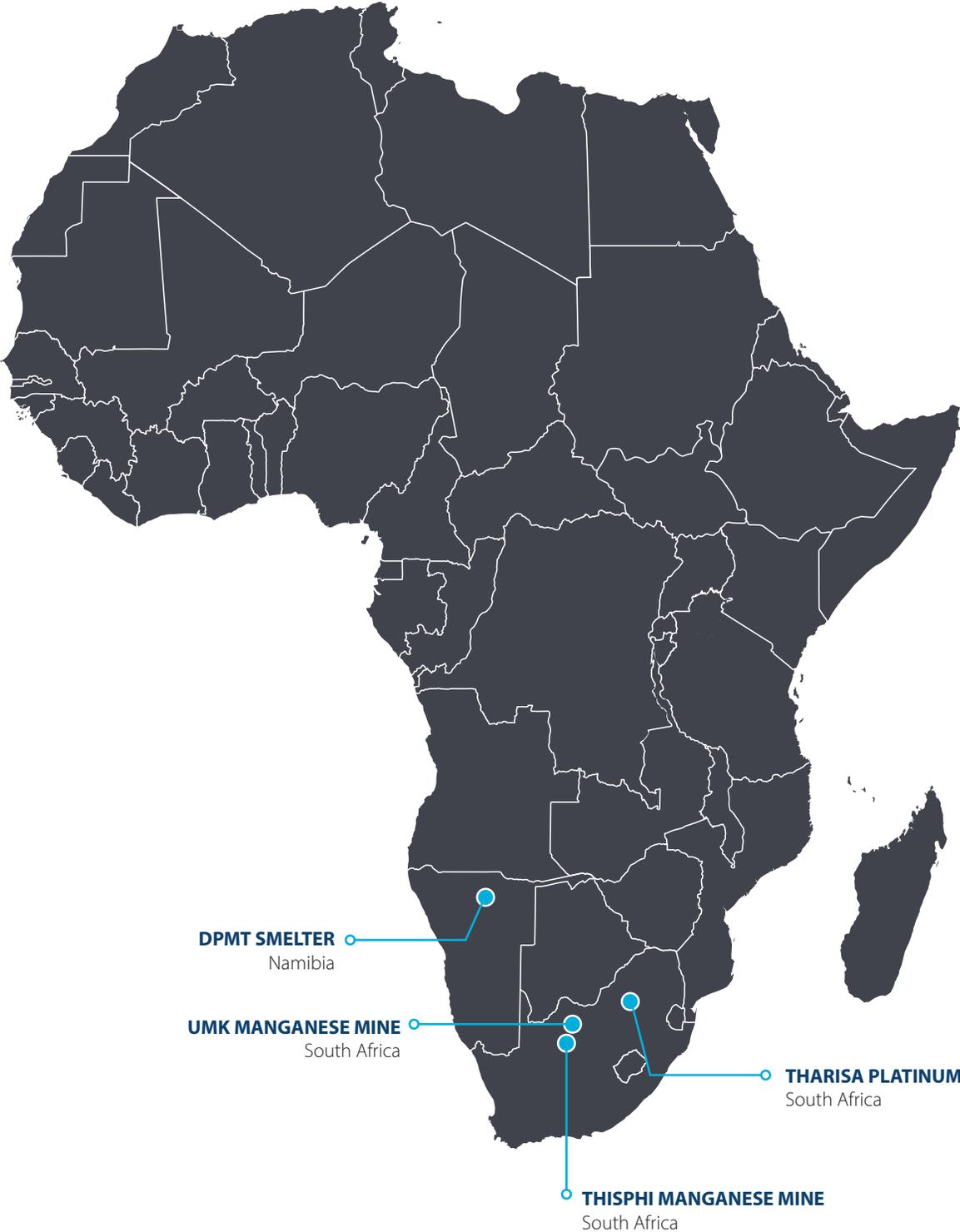
Ontario, Canada

The Magino Gold Project is located on a brownfield site. As part of the environmental assessment for the project, SLR developed a conceptual closure plan to meet the requirements of both the Canadian Environmental Assessment Act and conceptually address closure planning requirements under O. Reg. 304/07 Mine Development and Closure, under Ontario's Mining Act. SLR developed a conceptual closure plan that involved the decommissioning of the site, as well as the closing of waste management areas in an environmentally acceptable manner once the mine ceases operation, as well as for temporary suspension and state of inactivity scenarios. Alternative methods for the decommissioning and closure phase were evaluated and preferred concepts were selected to ensure that the Projects site is closed in a manner that reduced potential impacts on the social and natural environment.

PARSONS CREEK AGGREGATES (PCA) RECLAMATION AND CLOSURE PLAN UPDATE

Wood Buffalo, Canada

Parsons Creek Aggregates (PCA), a joint venture between Graymont Western Canada Inc. and Lehigh Hanson Materials Limited, operates a limestone quarry under provincial EPEA (Environmental Protection and Enhancement Act) Approval. The quarry is located on 290-hectare of provincial Crown land between the Athabasca River and Highway 63, north of Fort McMurray. It provides quality aggregates for oil sands, municipal infrastructure and construction projects in Fort McMurray and the Regional Municipality of Wood Buffalo. PCA must update the original conceptual R+C plan by September 2020. SLR is preparing the R+C update to meet Approval requirements while better matching clients desired outcomes and realistic end use goals for the project.



AFRICA PROJECTS

THARISA PLATINUM (AND CHROME) MINE

South Africa

SLR have been reviewing and updating the mine closure liability for Tharisa platinum mine (Tharisa) on an annual and/or bi-annual basis since compiling the original 2008 EIA for the mine. Tharisa currently has a commitment to completely backfill both of their opencast pit voids to original ground level at closure. A recent conceptual study has proven the techno-viability of an underground mine that is too deep for economic opencast mining, and SLR are now busy re-evaluating Tharisa's mine closure solution and closure objectives in the context of evolving technical, commercial, environmental, socio-economic and legal considerations.

TSHIPI MANGANESE MINE

South Africa

SLR have been reviewing and updating the mine closure liability for Tshipi manganese mine (Tshipi) on an annual basis since compiling the original 2009 EIA for the mine. Tshipi currently has a commitment to completely backfill their opencast pit void to original ground level at closure. SLR has previously undertaken a pit backfill study using conveyors at the mine, as well as, obtaining authorisations for additional waste rock dumps and for combining its pit and waste rock dump with the adjacent South32 Mamatwan pit and waste rock dump. SLR has recently submitted an alternative closure and rehabilitation solution for authority approval that will result in a partially backfilled pit and pit lake following mine closure. This project involved a number of specialist studies assessing the long-term viability of a pit lake and remaining waste rock dumps (including biodiversity, land capability, water quality, socio-economic, technical and commercial aspects).

UMK MANGANESE MINE

South Africa

SLR have been reviewing and updating the mine closure liability for UMK manganese mine (UMK) on an annual, bi-annual and/or quarterly basis since compiling the original 2007 EIA for the mine. UMK currently has a commitment to completely backfill their numerous opencast pit voids to original ground level at closure. SLR previously undertook a pit closure options analysis for UMK considering various pit backfill scenarios (complete backfill, partial backfill and in-pit dumping only). SLR are now busy with a number of specialist studies (including biodiversity, land capability, water quality, socio-economic, technical and commercial aspects) in order to confirm and/or re-evaluate UMK's mine closure solution including the long-term viability of pit lake(s) and remaining waste rock dump(s) for each of the opencast pit voids.

DPMT SMELTER

Namibia

SLR have been assisting Dundee Precious Metals Tsumeb since 2011 with numerous EIA's, water and waste specialist studies. SLR are currently busy updating the closure plan, environmental risk assessment and closure liability for the DPMT smelter (and historic mining) site. The smelter is one of only a few in the world that can treat complex copper concentrates. There is significant soil contamination at the smelter site due to historic mining and smelter operations and legacy waste stockpiles (prior to Dundee Precious Metals Tsumeb acquiring the site). The closure plan update incorporates previous SLR studies for the smelter site, such as: the 2019 ESIA for the proposed smelter expansion project (and associated specialist studies), the 2018 3-D groundwater flow and contaminant transport model, the 2018 water management framework and the 2017 waste management review.



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