Water management in mining

Catherine Hercus and Tamer Elbokl, PhD| October 13, 2025 | 5:50 pm

Q&A with Andrea Bowie

Surface water sampling at Lobo Marte in Laguna Satna Rosa, Chile. Credit: SRK Consulting.

Andrea Bowie, a principal consultant at SRK Consulting with a B.Sc. in engineering chemistry from Queen's University, has over fifteen years of experience in mine water treatment and management, water and load balances, permitting support, and remote northern operations. In this interview, she discusses challenges and opportunities in water treatment, permitting and closure, emphasizing First Nations consultation, realistic planning, best available technology (BAT), recycling and hybrid systems, cost variations, proactive modelling, clean energy, continuous community engagement, and the broader complexities of project development and water management in mining.

Andrea Bowie. Credit: Stephanie Lamy

Q: What do you think are the main reasons some projects are not successful?

A: There are several. Two of the biggest are team experience and how consultation is handled. Engaging meaningfully with First Nations and local communities is critical. If people feel shut out of the process, opposition can delay or stop a project altogether. Too many companies underestimate the importance of relationship building.

Another challenge is being realistic about the technical and logistical difficulties of working in remote locations. Mines in Canada often deal with long distances, limited access, harsh weather, and supply chain bottlenecks.

Ignoring those realities leads to budget overruns and schedule slippage. Then, there are market conditions. In 2008, I worked on a zinc project that was well-advanced, but when zinc prices collapsed overnight, the economics no longer worked.

No matter how capable your team is, external conditions matter. Success requires strong planning, stakeholder trust, and resilience. Bringing a project through the permitting process to the construction stage is as much about credibility and persistence as technical design.

Q: Does the technology readiness level (TRL) framework in B.C. make permitting more difficult?

A: Permitting in B.C. is demanding, and not only because of technology readiness levels. A key improvement is the Ministry of Environment's best available technology handout, which compares treatment and management options by performance, cost and reliability. Step four favours proven technologies, giving regulators and the public confidence but creating bias against unproven ideas. Clients can move new technologies from bench tests to pilots and full-scale plants, but scaling is slow. The framework highlights what is achievable and promotes transparency.

Technology readiness levels (TRLs), created by NASA, measure maturity from research (1-2) through development (3-5), demonstration (6-8), to adoption (9).

Q: How long does it take to plan a water treatment system?

A: Timelines vary. Mines in Canada are rarely near established infrastructure, and design is iterative and requires contributions from engineers, regulators, and local communities.

Smaller, straightforward systems can be designed, permitted, and built in a matter of months, particularly if they fit into existing infrastructure. Adjustments to current plants are often quicker.

Entirely new, complex systems — especially treatment plants built from the ground up — can take five years or more to plan and deliver.

Q: Is water recycling common in new underground mines?

A: Extremely common. The industry average is that about 80% of process water is recycled. In regions with a positive water balance, operators face the challenge of discharging excess water without harming receiving streams.

In arid climates, scarcity makes recycling essential. At the process level, some solutions include coarse particle flotation, tailings dewatering, and evaporation control. The goal is to close the loop as much as possible to reduce withdrawals and limit environmental impact.

Q: How is water recycled, and how do you filter out any contaminants?

A: The answer depends on the commodity and processing methods. In most operations, water travels as slurry to the tailings facility, where some dilution occurs. In drier climates, evaporation concentrates metals and salts in the water column.

That reclaimed water may require treatment before reuse. Mill processes also contribute; for example, the thickening stage often operates at a high pH, which allows metals to precipitate out of solution. This acts as a polishing step that can make recycling more feasible.

In other cases, additional treatment is needed before water can be fed back into the mill. Each site has its own water chemistry fingerprint, which dictates treatment steps.

Q: When you are planning a system, are hybrid systems more common now?

A: They are becoming more common, but applications are very site-specific. In northern Canada, passive systems are rarely suitable because of climate, except as polishing steps where flows are small and water quality is already good.

We are increasingly developing in situ options, where pits or underground workings are used as reactors for treatment. This approach is particularly useful in closure or post-closure phases, when sites are not staffed year-round.

Water can be left to accumulate over winter. Then, in summer, when logistics are easier, personnel arrive to treat and discharge it at times when receiving waters can handle the load. Once treatment is done, the site can be left until the next cycle.

This seasonal strategy reduces costs, minimizes risks associated with winter access, and still meets environmental obligations.

Q: What challenges arise in closure and transition?

A: Cost and logistics dominate. Operating water treatment systems post-closure is expensive. Winters bring storms, travel delays, and higher safety risks. Staffing is reduced, so efficiency is critical. Reagent delivery can be difficult. At closure, companies must maintain monitoring, treatment, and environmental sampling, often with fewer people and limited infrastructure. Optimizing the footprint and designing systems that can run seasonally or with minimal intervention is vital.

The challenge is finding approaches that are technically sound, environmentally protective, and financially sustainable for decades after mining stops.

Q: What is the average cost of a water treatment system?

A: There is no set cost. Flow rates, layout, and chemistry matter. Reservoirs or pits cut pond expenses. Chemistry often drives cost: lime treats acidic water with metals, while selenium requires complex biological methods. Reagents increase logistical and transport burdens. Each site demands early, detailed cost assessment.

Q: How important is flexibility in planning?

A: It is essential. We use operational water and load balance models to simulate mine sites. These models are constantly updated as conditions change.

For example, the chemical signature of waste rock is defined from exploration samples, but once you are deeper into mining, you may discover differences that require treatment adjustments.

Our models allow us to test scenarios: different climates, different waste rock profiles, or different mine schedules. Based on the outcomes, we can recommend upgrades, new systems, or different management approaches.

Flexibility prevents surprises. Most adjustments are small course corrections, but they keep the site compliant and reduce long-term costs.

Q: Does SRK rely on proprietary technology?

A: No. We are consultants, not vendors. We do not sell equipment. That independence is important because it allows us to evaluate all options fairly and recommend the best fit for each site. Our only goal is to help the client find the right solution.

Q: How much monitoring can be remote?

A: Remote technologies have improved, but people are still needed on site. Equipment can fail — sensors get stuck, floats jam — and only physical presence can resolve those issues.

Compliance monitoring also requires samples to be collected and analyzed on a schedule, often weekly or monthly. Downstream monitoring is also essential.

Most operating mines already have staff on site, so water treatment monitoring fits into existing responsibilities. Remote systems are helpful, but they cannot fully replace people.

Q: Is clean technology a bigger factor now than a decade ago?

A: Yes, awareness of sustainability has grown significantly. Ten years ago, clean power was often considered optional. Now, it is an expectation to be considered during project design.

We are seeing more projects integrate renewables, though feasibility depends on geography and cost. Remote sites still need fuel backups, and even renewable projects rely on mined materials. But public and investor expectations are clear: companies must show they are minimizing emissions and environmental impacts. Clean technology is no longer a side consideration — it is central to project design and community acceptance.

Q: Does SRK promote consultation with local communities?

A: Consultation is central to project development. At SRK, Canadian teams act as technical experts, explaining risks and uncertainties, attending meetings, responding to requests, and providing transparent analysis of environmental outcomes. This builds trust, especially with First Nations, who have experienced mining's impacts — from gold rushes to abandoned sites. Skepticism is understandable. Today, emphasis is on sustainable projects and reclamation, with First Nations directly involved. Without consultation, projects rarely succeed socially or environmentally.

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