

SPECIAL COMMENT

Global Mining Industry

Water Scarcity to Raise Capex and Operating Costs, Heighten Operational Risks

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Summary

- » **We think water scarcity and broader environmental risks will continue to push up development and operating costs in the global mining industry as these trends become more pronounced.** As the consequences of poor environmental risk management are likely to increasingly lead to production stoppages, protests, fines and license withdrawals, we expect to place greater analytical emphasis on rated mining companies' environmental policies and risk management practices in our credit assessments.
- » **Water scarcity is already changing the mining landscape.** Mining projects are increasingly competing for limited water resources with local communities and municipalities, while compliance with more stringent environmental rules is adding to the capital expenditure (capex) budgets for new mines. As ore reserves dwindle, mining companies are expanding their operations into increasingly remote and arid regions, necessitating them to find new, innovative ways of managing and procuring water.
- » **Projects will take longer to complete, be costlier and riskier, with credit-negative implications for the entire industry.** Meeting tighter environmental permitting requirements will add to project timelines. Capex will also increase as new projects require more complex water procurement systems, which in turn will push up operating costs because of the higher associated maintenance and energy costs. Furthermore, political and operational risk will increase as competition for water resources between mining companies and local populations intensifies.
- » **In general, smaller, less-diversified mining companies – particularly those with single-mine operations – in water-scarce regions, such as South America, are the most vulnerable.** This is because they are likely to have the greatest exposure to event-risks, but have more limited financial and technical resources at their disposal to handle them.
- » **The large, globally diversified mining companies, such as [Rio Tinto plc](#) (A3 stable), [Anglo American plc](#) (Baa1 stable) and [BHP Billiton Limited](#) (A1 stable), will continue to be adversely affected given their global footprints and willingness to operate in the most remote and arid regions.** While these companies have the expertise and financial strength necessary to build complex water procurement systems for large-scale projects – and are likely to emerge as the 'partners of choice' in water-scarce countries seeking to exploit their natural resources as a result – evidence suggests that they have to date needed to absorb increasingly significant costs related to environmental risks.

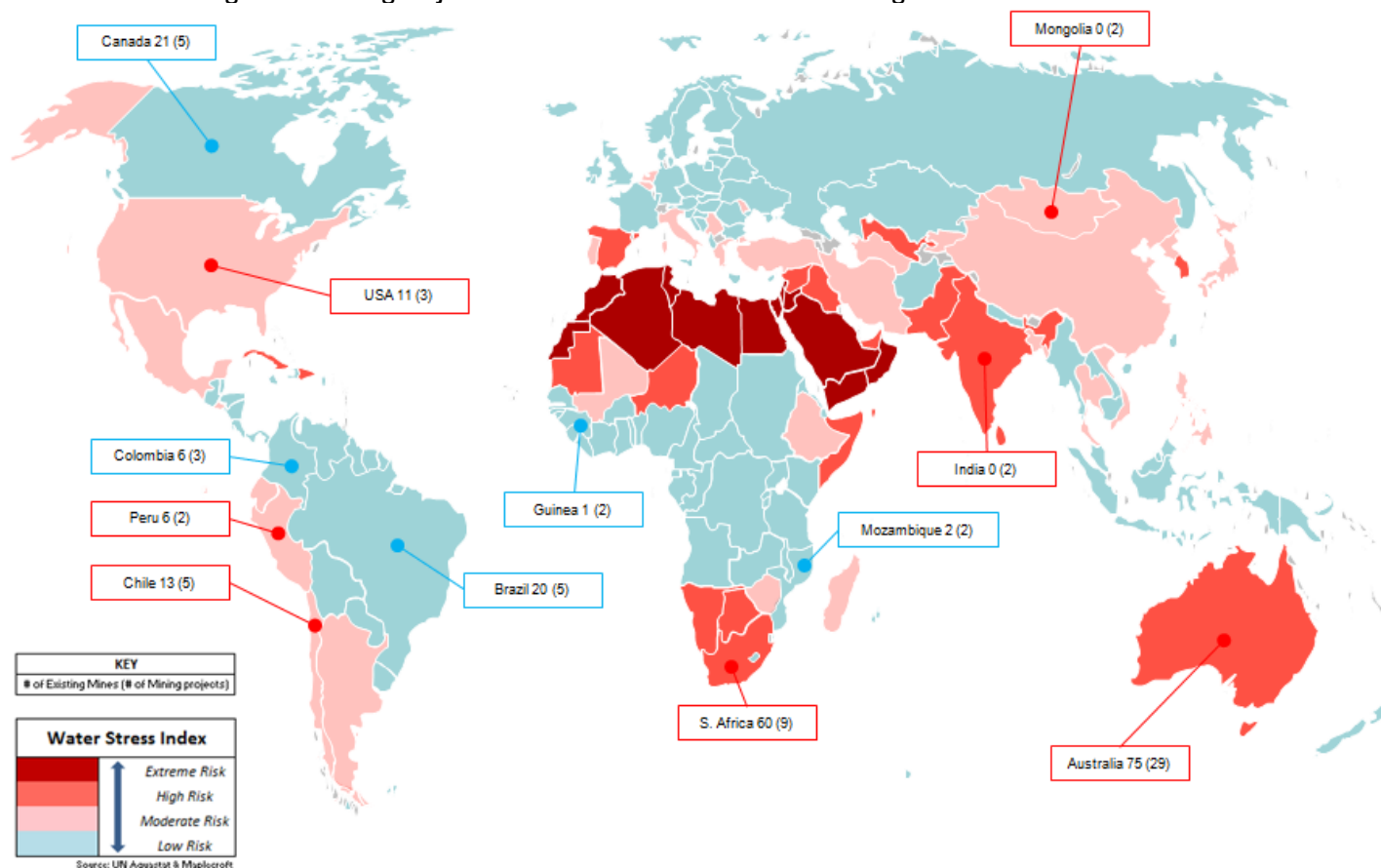
Water scarcity is emerging as a key risk for the industry

We believe water scarcity is likely to emerge as a key risk for mining companies over the coming years, and that if rated companies do not proactively manage these risks their ratings could be adversely affected as a result. As global ore reserves dwindle, securing and managing an adequate water supply has become a major challenge for mining companies as they continue to expand operations into remote locations with limited freshwater resources. Population growth, urbanisation and rising incomes are driving greater water usage across emerging markets, with the effect that mining companies are increasingly competing with local communities and the agricultural industry for water supplies. As shown in Exhibit 1, many of the world's largest mining projects are located in countries, such as Peru and Chile, where water scarcity is an issue.

The financial implications for mining companies are already being felt: project development costs are rising as companies need to invest in alternative water sources, such as desalination facilities, and pipelines to transport water over long distances. Mining companies' operating costs are also going up as securing, treating and managing water from alternative sources is often energy-intensive and requires significant ongoing maintenance expenditures.

EXHIBIT 1

Two-Thirds of the "Big Six's*" Mining Projects Are in Countries with Moderate or High Water Risk



* BHP Billiton Limited, Rio Tinto plc, Anglo American plc, Vale S.A, Xstrata plc and Glencore International AG

Water scarcity poses a number of additional risks for mining companies that could potentially hurt their ratings:

- 1) As environmental legislation and water usage regulations become more stringent, the costs associated with compliance – such as carefully managing discharge levels – will continue to rise. At the same time, a growing regulatory framework increases the potential for non-compliance, which exposes mining companies to production stoppages, fines and reputational damage which could affect their chances of obtaining licenses and permits in the future;
- 2) Operating in water-scarce environments increases political risk as mining companies' water supplies can be 'turned off' if the needs of local communities increase, or if they are disrupted by mining activities;
- 3) As environmental risks, such as water scarcity, are better understood, we believe that the capital markets will increasingly factor such risks into their lending and investment decisions. While many of the major banks already stipulate minimum environmental, social and governance (ESG) criteria before lending to a potential client, asset managers are responding directly to investor demands by devoting a greater proportion of assets directly to "ESG-friendly" companies and indices, as well as increasingly using ESG risk tools to 'pre-screen' potential investments in companies.

Water: an essential part of the mining process

Mining projects frequently require significant amounts of water in order to maintain basic operations. The vast majority of water is used in the processing of ore, but water consumption can increase dramatically when used as part of the extraction or transportation process.

Mining projects have traditionally secured their water supply by capturing surface water and groundwater, or by entering into long-term contracts with local municipalities. However, these options are becoming increasingly unavailable to mining companies as governments are reluctant to grant surface and groundwater access rights to mining companies due to greater demand from agricultural and municipal users. This trend is exacerbated in arid regions where water scarcity is already an issue.

As traditional water sources have dried up, engineers have responded by designing projects which require less water, and mining companies recycle water wherever possible. While such improvements generate incremental benefits, they are usually insufficient to meet a project's total water requirements. As such, mining companies are increasingly being forced to source, transport, desalinate and finally 'make safe' raw seawater – an expensive process that can make or break the economic viability of a mine.

Water scarcity is already having an adverse effect on mining companies...

In Peru, which has become one of the world's largest producers of copper and gold as a result of the past decade's mining boom, water scarcity has emerged as a major risk affecting both existing mining operations and new projects. In April 2012, following months of violent protests, the Peruvian government halted the development of [Southern Copper Corporation's](#) (Baa2 stable) \$1-billion Tia Maria project on the grounds that the new mining project could harm local water supplies. The decision led Southern Copper to delay the project significantly, conduct a new environmental impact assessment, which will take over a year to complete, and consider piping raw seawater to the mine for desalination in order to avoid using local water in the mining process. Meanwhile, progress at Anglo

American's \$3-billion Quellaveco copper project was delayed throughout 2012, owing to difficulties in obtaining the necessary water permits. Another example is [Newmont Mining Corporation's](#) (Baa1 stable) roughly \$5-billion Minas Conga project. In June 2012, the company said that it would spend around \$200 million building several reservoirs to supply water to the local population, who currently only have water flowing during the rainy season. The announcement followed months of protests and road blockades by local protesters concerned about the effect the mine would have on local water resources.

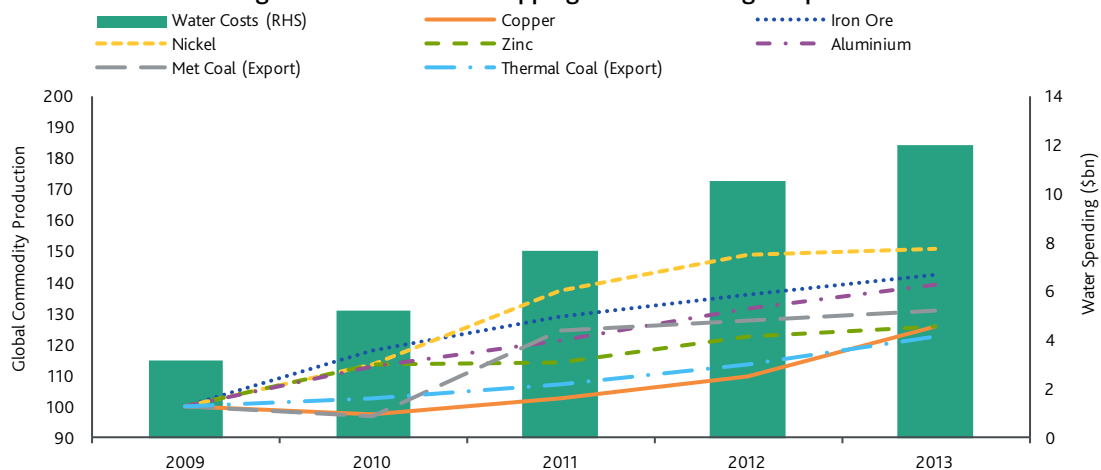
However, such events, which invariably lead to delays, lost production, additional capital expenditure and damage to corporate reputations, are not limited to new development projects. For example according to media reports, in September 2012, [Barrick Gold Corporation](#) (Baa1 stable) temporarily suspended production at its Peruvian Pierina mine following a deadly clash between the police and protestors, who claimed the mine was exacerbating local water shortages. In addition, earlier that year, [HudBay Minerals, Inc.](#) (B2 stable) and Hochschild Mining plc (unrated) received requests to suspend their operations while the Peruvian government conducted a 30-day environmental review in the Southern Andes, following allegations from local residents that the mining operations had contaminated local water supplies. And in September 2011, Rio Tinto responded to governmental concerns over local water shortages in the Pilbara district of Australia by announcing that it would surrender its priority entitlements to the local water supply and also invest \$310 million developing a new borefield and pipeline system to procure coastal waters for the group's expanding operations.

....And will only get worse in the future

As the quality of exploitable ore grades is getting lower, mining companies need to process a greater amount of ore in order to achieve one tonne of refined product, increasing the water requirements of the mine at a time when global water scarcity is worsening. According to Global Water Intelligence (GWI), a UK-based specialist water consultant, mining companies will spend around \$12 billion globally on water infrastructure in 2013. This is a 56% increase on the \$7.7 billion the industry spent in 2011, and a 275% increase on the \$3.2 billion spent in 2009. This compares to a net increase in global mining output for the major commodities of between 20% and 52% during the same period, as illustrated in Exhibit 2.

EXHIBIT 2

Increase in Water Management Costs is Outstripping Gains in Mining Output



Source: Moody's estimates, company reports, GWI

One of the main reasons why water management costs are rising is because the majority of new mining development projects are based in water scarce regions, such as Australia, South Africa, Chile and Peru. Indeed, the mining and project development footprints of the “Big Six” global diversified mining companies – BHP Billiton, Rio Tinto, Anglo American, [Vale S.A.](#) (Baa2 Stable), [Xstrata plc](#) (Baa2 stable) and [Glencore International AG](#) (Baa2 stable) – which produce over 50% of the world’s total output across the major metals, typify the ongoing water-scarcity challenges facing the wider industry. Using a measurement system developed by UN Aquastat and Maplecroft¹, 70% of the “Big Six’s” existing mines are located in countries where water stress is considered a high risk (56%) or moderate risk (14%). And despite the growing risks associated with operating in a water-scarce environment, around 66% of the “Big Six’s” development projects are located in countries where water stress is considered a high risk (53%) or moderate risk (13%). Against this backdrop, we believe that water management costs are set to continue rising.

Such costs can frequently be predicted, quantified and at least partially mitigated in highly developed countries like Australia given the well-established regulatory frameworks for mining companies and the state-sanctioned requirements for greater levels of advanced infrastructure planning. However, mining projects located in countries where local water shortages are already a problem for many communities and have led to social unrest, such as in Peru, are exposed to greater risks because of continued public pressure on mining companies to use less water. Despite these challenges, the pace of project development in water-scarce countries shows no sign of abating. For example, although issues relating to water scarcity have severely hampered several mining operations across Peru over the past two years, Peru’s Minister for Energy and Mines Jorge Merino recently told reporters that he expects the country to attract \$10 billion of mining investment in 2013, and for investment projects worth \$53 billion to be carried out over the next 10 years.

Large, global miners are finding new, but costly, ways to secure their water supplies

While mining companies are finding innovative ways to manage and recycle water, such as at the Collahuasi project in Chile, a development jointly owned by Anglo American, Xstrata and a Japanese consortium led by [Mitsui & Co Ltd](#) (A2 stable) that aims to recycle around 76% of total water used at the mine site, companies developing new projects are increasingly opting to build large-scale desalination plants in order to secure water. For example, in Chile, [Corporacion Nacional del Cobre de Chile](#) (CODELCO, A1 stable) and [Freeport-McMoRan Copper & Gold Inc.](#) (Baa3 stable), joint owners of the El Abra copper mine, have launched pre-feasibility studies for a desalination plant and pipeline to support a potential expansion of the mine. Meanwhile, [Freeport-McMoRan Corporation](#) (Baa2 stable) is building a \$300 million desalination plant for its Minera Candelaria mine, while Anglo American has said it will spend \$96 million on a desalination plant at its Mantoverde copper mine. Furthermore, [CITIC Pacific Limited](#) (Ba1 negative) is building a high-capacity desalination plant (51 gegalitres a year) and a 30-kilometre pipeline at its Sino iron ore mine in Australia to ensure that it does not have to rely on the local municipal water supply.

While desalination plant technology can provide a secure and stable water supply for mining operations, building and operating a desalination plant can fundamentally change the economic viability of a mine. Not only is the desalination process itself highly energy-intensive, often requiring a dedicated, purpose-built power source, but treated water also has to be transported to the mining site often over significant distances. As a result, desalinated water can cost up to 10 times more than using

¹ Maplecroft is a UK- based, independent research organisation. Aquastat is the United Nations’ global water information system

locally sourced freshwater – especially when water has to be pumped into the mountains, as in the Atacama mining region in Chile.² At the same time, mining companies will incur further costs disposing of environmentally hazardous salt generated by the desalination process.

Costs to rise across the board, but smaller, less-diversified mining players face the biggest credit risks

With a significant proportion of new mining projects are based in countries where water stress is already a moderate or high risk, we expect water scarcity and broader environmental risks to increase mining development and operating costs over the coming years. In our opinion, the consequences of poor environmental risk management will increasingly lead to production stoppages, protests, fines, and license withdrawals – all factors which may directly impact mining companies' profitability and credit risk profiles, and in turn their ratings. Furthermore, higher levels of investment in water management infrastructure will increase operating costs across the board, leaving all mining companies more susceptible to volatility in commodity prices.

Moody's Global Mining methodology³ already captures some aspects of environmental risks and liabilities through a range of earnings and cash flow-based quantitative factors. However, we expect to place greater analytical emphasis on rated mining companies' environmental policies, risk-management practices and exposure to environmental event-risks in the future. While the sustainability reports produced by the "Big Six" and other large rated mining companies, such as Freeport-McMoRan and CODELCO, indicate a growing appreciation of water usage and scarcity, we would expect our water management analysis to remain largely qualitative and complement our existing methodological assessment of environmental risks.

Risks arising from water scarcity will not affect all mining companies equally. In general, smaller, less-diversified (and especially single-mine) high-yield mining companies that operate in higher-risk regions, such as South America, are likely to become increasingly exposed to event-risk challenges. Indeed, stoppages, suspensions and permitting delays could severely harm their credit metrics and weaken often already fragile liquidity positions. We would expect large, diversified, investment-grade mining companies to manage environmental risks more proactively, however, and so better preserve their ratings profiles.

In our opinion, large, investment-grade mining companies have significant advantages over smaller, high-yield mining companies because: (1) they have larger financial resources at their disposal to invest in water management technology and infrastructure, as evidenced by the \$10billion of water-related spending in 2012; (2) possess the project management expertise to design and build large-scale water procurement and treatment systems, as well as navigate complex and lengthy permitting and licensing paths; (3) generally maintain strong liquidity positions, which would enable them to continue servicing debt commitments during production stoppages and suspensions; and (4) are likely to emerge as the 'preferred partners' for local governments in water-scarce regions given their scale and experience in managing environmental risks in challenging locations.

That said, the potential credit impact of water scarcity on an individual mining company will need to be assessed on a case-by-case basis to take into account the dynamics of specific projects. This is because while water stress within a country is certainly a useful indicator of potential future problems,

² According to the Mining Council of Chile.

³ For more information, see Moody's [Global Mining Industry Rating Methodology](#), published in May 2009.

some mines in water-scarce countries happen to be located close to a unique water source (such as a deep aquifer⁴), whereas some mines in water-rich countries can still struggle with water management issues because of the configuration of the landscape or distance from the nearest water source.

⁴ An aquifer is an underground layer of water-bearing permeable rock from which groundwater can be extracted using a water well.

Moody's Related Research

Industry Outlooks:

- » [Global Base Metals Industry Outlook, December 2012 \(148186\)](#)
- » [European Steel Industry Outlook, December 2012 \(147877\)](#)

Sector Comments:

- » [Weak Aluminium Prices, Slowing Demand Will Continue to Dull Producers' Prospects, October 2012 \(146776\)](#)
- » [Weak Iron Ore Demand Is Credit Negative For Global Producers, August 2012 \(145131\)](#)

To access any of these reports, click on the entry above. Note that these references are current as of the date of publication of this report and that more recent reports may be available. All research may not be available to all clients.

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