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COUNTRY CASE STUDIES

These country case studies go deeper into the challenges that extractive industries face in South Africa, Australia, Canada, Brazil, and China, and what this means for the financial sector. Given that water is often a local or regional issue, it is important to realize that water risks are influenced by both the hydrology of the country or region in question, and the institutional capacity to cope with these challenges:

(1) **Hydrology.** The countries selected have distinctive hydrological regimes. South Africa and Australia are generally water scarce, while Brazil and Canada have an abundance of fresh water resources at national scale. In China and Canada, the hydrological regimes vary quite dramatically by region. This distinction is critical as water risks change depending on their inter-seasonal and intra-seasonal regimes. Furthermore these countries and regions have variable climate features, which impact water risks.

(2) **Institutional capacity.** Countries also have varying levels of institutional capacity. South Africa, Brazil, and China have moderate institutional capacity to address environmental risks, while Canada and Australia have a higher capacity to cope with water risks.

The differences in hydrology and institutional capacity significantly impact the degree to which water risks occur and are addressed in these countries. It is important to note that it is more likely that the larger financial risks for regulation will arise from those less regulated markets. The reason is that governments in these countries where there is weak or little regulation will take more retrospective action when serious problems occur, which tends to involve heavy costs. As countries experience greater water risks and their institutional capacity increases, there is a greater likelihood of significant regulatory change. In the OECD countries, the risk of greater change is less likely although regulatory compliance may be more costly at present. This distinction presents different risk profiles for equity related investments which have a shorter term view and for debt related investments which are more concerned with longer time horizons. These nuances are explored in the following country sections.

The 3rd issue of the Chief Liquidity Series (CLS 3) portrays water risk in terms of "blue water scarcity" (see below for a description of key terms). These are portrayed for each of the five focus countries in terms of:

1) *Average annual* blue water scarcity
2) *Maximum monthly* blue water scarcity

Furthermore, case studies are used to explain how water is material to mining companies.

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SOUTH AFRICA

Sub-sector focus: coal and precious metals

5.1 Overview

South Africa has a long history with the extractive sector in coal, precious metals, and base metals. Mining has played a central role in the development and growth of the South African economy in particular the areas around Johannesburg. The mining industry impacts water resources in different ways in different locations throughout the country.

South Africa is a relatively water scarce country. The areas where current mining operations exist and future ones are planned are situated in the most water arid regions of the country such as the northeast and in the relatively high water yield areas of the grasslands. The arid areas are forecasted to receive less precipitation in general climate models. Therefore in these areas mining faces water scarcity but also social challenges from communities that are historically disadvantaged (including disadvantages in their access to water). To compound these problems, South African mines often experience inadequate service provision and compliance regulation from institutionally weak local authorities. Therefore, both current and future planned mining operations must aggressively plan water strategies to maintain their operations.[61]

South African mining operations are impacted by water and use water in a number of ways. These impacts and uses can broadly be structured into four categories:

- **De-watering.** Inflows of ground water have to be pumped out (de-watering) in order to maintain safety in the workings. In South Africa, some gold mines are situated in an area where the ore body is overlain by water bearing dolomitic strata. Mines can be required to pump some 70 Ml of groundwater per day to surface. This water is generally collected, treated, re-used or disposed. De-watering operations can have water pollution impacts and severe pollution has occurred where water has not been dewatered effectively before it comes into contact with sulfide-bearing host rocks.
- **Abandoned mines.** Mine companies rarely make adequate financial provision to continue dewatering after mining has ceased. South Africa has nearly 6000 abandoned mines, many of which result in uncontrolled Acid Mine Drainage (AMD). Currently the government (the South African tax payer) is footing the bill for treating AMD in the Witwatersrand basin where gold mines have closed down and have not made provision to treat groundwater flowing into old mine shafts. The water level is rising and in some areas of the Eastern Basin, is discharging into springs and rivers.[62]
- **Water for processing.** Most mines undertake extensive treatment and recycling of water in order to use it for dust allaying, cooling and metallurgical processes. De-watering provides some water for these activities and mines purchase any surplus they require from local water service providers.
- **Water for domestic needs.** Mines often require potable water in order to supply employee settlements situated near the mine for drinking, cooking, ablution and sanitation. It is estimated that 30% of the water purchased from Rand Water by mines in South Africa is distributed for such domestic applications. In some remote areas where the mine forms the apex of the settlement, the mine operations include water services provision.

South Africa has decreasing water resources and some areas are fully allocated and already experience water stress. This situation places pressure on water users and the challenge is further compounded by a need to redistribute or reallocate water resources toward those who were previously disadvantaged. Although South Africa has recently undertaken reforms in water administration, there are often bureaucratic and regulatory inefficiencies, which can impact upon mining operations. South Africa therefore presents an interesting cross-section of water risk profiles for extractive industries.[63] This briefing focuses on two important sub-sectors in South Africa:

(1) **Coal.** South Africa has the fifth largest coal deposits in the world. In 2006 coal accounted for 93% of the electricity generated in South Africa, followed by nuclear (4.6%) and hydropower (2.2%). By 2030, the Revised Balanced Scenario proposes that South Africa's generation mix should be as follows: 48 % coal, 14 % nuclear, 16 % renewable energy and 9 % peaking open cycle gas turbine.[64] This is less of a reallocation as it is a scale up of energy requirements to meet the needs of industrial expansion. This reflects that coal will continue to play a leading role in South African power generation and its economic development.

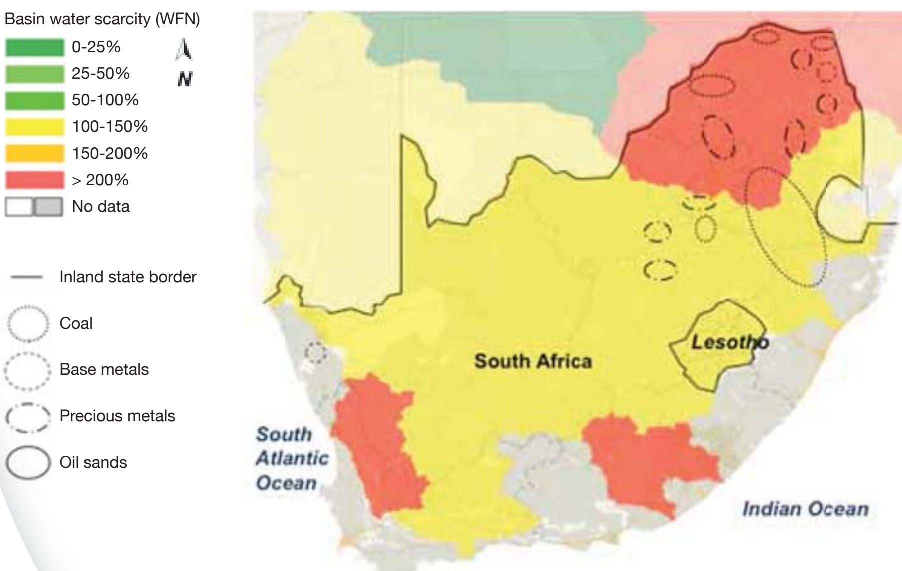
South Africa also exports a large volume of coal to other countries. Coal rents, the difference between the value of both hard and soft coal production at world prices and their total costs of production,[65] as a percentage of GDP were 5.07(%) in 2010. Its highest value over the past 40 years was 9.10% in 2008. The coal industry is located primarily in the Mpumalanga and Limpopo provinces in the north of the country.

(2) **Precious Metals.** The precious metals industries in South Africa consist mainly of platinum and gold. South Africa is the number one supplier of platinum and one of the top five producers of gold globally. In 2009, according to the Chamber of Mines of South Africa, the mining industry as a whole contributed 8.8% directly, and another 10% indirectly to the country's GDP.[66] These industries therefore are of great economic and geo-political importance to the country. Like coal, the precious metals deposits are located in semi-arid regions primarily in the Northwest and Limpopo provinces.

Geographical distribution of coal and precious metals mining in South Africa in the context of water scarcity.

Figure 3:

Average annual blue water scarcity for South Africa

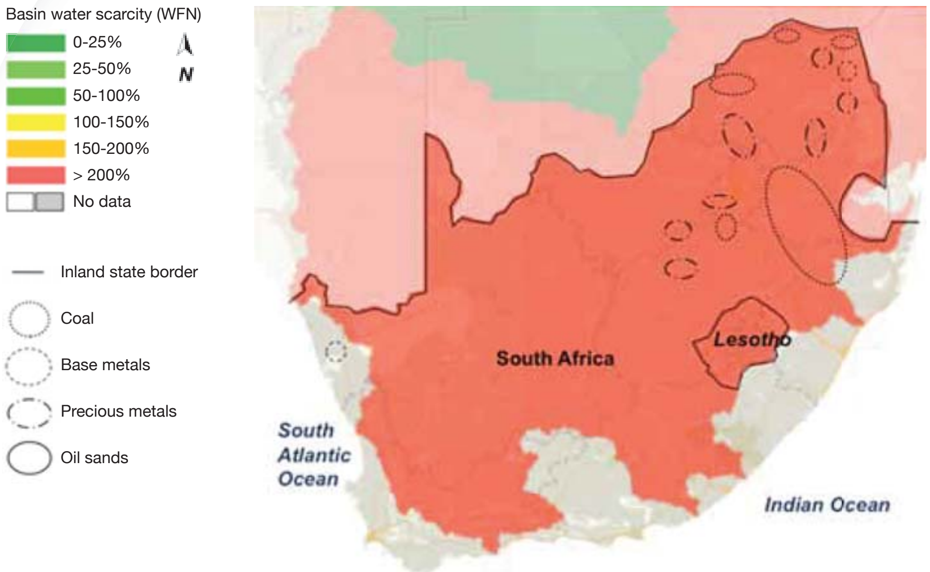


Description: Annual average of the twelve monthly blue water scarcity values per basin, equally weighted. Blue water scarcity is defined as the ratio of blue water footprint "how much water is consumed" (rather than withdrawal) to blue water availability, where the latter is taken as natural runoff minus environmental flow. Blue water resources are surface water and ground water. 1996-2005.

Source: Hoekstra, A.Y., Mekonnen, M.M., Chapagain, A.K., Mathews, R.E. and Richter, B.D. (2012) Global monthly water scarcity: Blue water footprints versus blue water availability, PLoS ONE 7(2)

Figure 4:

Maximum monthly blue water scarcity for South Africa



Description: Blue water scarcity in the month with the highest scarcity level - defined as the ratio of blue water footprint to blue water availability – where the latter is taken as natural runoff minus environmental flow. >100% means that consumption is higher than availability in that particular month. Blue water resources are surface water and ground water and are based on data from 1996-2005.

Source: Hoekstra, A.Y., Mekonnen, M.M., Chapagain, A.K., Mathews, R.E. and Richter, B.D. (2012) Global monthly water scarcity: Blue water footprints versus blue water availability, PLoS ONE 7(2)

5.2 Case Study 1: Increased water charges due to water scarcity

South African platinum mines in the Olifants face long term risks associated with escalations in water charges. Charges for additional water supply in the Olifants River system will be ten times their current value by 2020, due to water scarcity in the region. This is a significant cost factor for new mining operations. Furthermore, due to negative stakeholder perceptions about mining impacts on water, there have been instances where water supplies were allocated to agriculture rather than mining despite economic benefits associated with the reverse.

The Olifants River System in South Africa supplies both mining operations and agriculture. The Eastern limb of the system is platinum rich and a number of new platinum mines have recently been established, or are currently under construction, in the area. These developments will further burden the existing water resources in the area and, as such, water users in this region are facing short term water supply shortages and longer term risks of high water costs. At present, water demand exceeds the 98% level of assurance for supply (which is what indicates a higher risk of short term shortages.) In the long term, the Department of Water Affairs reconciliation scenario indicates that long term supply augmentation options are extremely expensive and the costs of new sources of water will be R19/m^3 by 2020 (USD2.50/m^3) which is almost ten times more than the cost of current sources.

The need for significant long term water supply augmentation is in large part due to the phasing in of ecological water requirements, which will assist in supplying the Kruger National Park, but the ecological water requirements have put additional strain on an already challenging situation. Opportunities exist to manage demand through industrial and agricultural efficiency measures. Nationally the Department of Water Affairs has launched a campaign called *War on Leaks* (WAR) to strengthen water demand management and reduce losses due to leaks from aging infrastructure in urban supply systems. In some areas, miners are collaborating with this process to ensure water availability for their operations.

Water scarcity in the Olifants can lead to two types of risks for miners that banks, investors and other financial institutions should pay attention to:

- **Financial risk:** New operations will face water charges that are ten times higher than what is currently paid. This represents a significant cost for new investments in the Olifants.
- **Reputation risk:** Water scarcity and competing water usage in the Olifants have led to negative stakeholder perceptions around water for mining. It has impacted decisions around water allocation in the region.

5.3 Case Study 2: Acid Mine Drainage

Acid mine drainage (AMD) poses a severe risk to communities as well as ecological systems and the magnitude of the task to overcome AMD increases exponentially as the implementation of intervention measures are delayed. The South African Government is responding by formulating a strategy for pollution charges. They are also considering an environmental levy on operating mines to cover the costs of treating AMD of mines that have been closed.

The gold mining sector and the growing platinum and coal mining sectors in South Africa pose a severe strain on the environment in the form of AMD.[67] When mining activities cease and there is no longer de-watering, a hydrological recovery process begins where water in the underground mine rises to its previous levels and comes into contact with sulfide minerals, making the water highly acidic. This water then reacts with other minerals, which in turn produce other pollutants in the water such as aluminum, lead, zinc, uranium and radium. AMD refers to the phenomenon whereby this underground, highly polluted, acidic water flows outwards onto the surface from abandoned mines. AMD is responsible for costly environmental and socio-economic impacts. For example, as the underground polluted water rises to the surface, it decants into springs and rivers and becomes a part of the drinking water that is utilized by both the urban as well as agrarian population. The intake of this water is highly hazardous to human health as a result of the presence of a mix of toxic metals including aluminum and uranium in the water and neutralisation and sometimes reverse osmosis of the water is necessary to make it potable or suitable for other economic uses (AMD cannot, for example, even be used to grow food crops).[68] AMD not only poses a hazard to South Africa's water supplies, but also to its major industrial centers. As water levels recover in previously dewatered areas there is an increased risk of sink-hole formation.

Despite significant progress being made in South Africa in shifting policy frameworks to address mine closure and mine water management, implementation of the current legislative framework does not adequately address the risks posed by AMD. However, the issue is gaining media attention and the social impacts, especially those on urban populations, are becoming too great to ignore. Government can therefore be expected to take retrospective action. The entire mining sector and its position in the public and private sectors is under review by the ANC (in particular the SIMS report - State Intervention in the Mining Sector) and new policies are expected to emerge at the end of 2012 from the ANCs policy conference at Mangaung.

The magnitude of the task to overcome the threat of AMD is a costly exercise and the costs associated increase exponentially as the implementation of intervention measures is delayed. The Department of Water Affairs is currently formulating a pollution charges strategy aimed at more fully recovering the cost of water treatment to miners and other polluters. However, since AMD is largely the result of water rising in abandoned mines where de-watering has ceased, the Department has also tabled an environmental levy which will be placed on operating mines and is designed to partly cover the costs of dealing with AMD and the legacies of past mining.

AMD poses four types of risks to South African mining operations and should therefore be noticed by banks and investors that finance operations where AMD can become a liability:

- **Physical risk:** AMD impacts on water scarcity in a region as it reduces the availability of usable water.
- **Regulatory risk:** Compliance is made more difficult by the current time lags in various environmental, water and prospecting and mining license processes which are not harmonized. Lack of enforcement and monitoring encourages miners to take regulatory risks and proceed with insufficient legal compliance.
- **Reputation risk:** AMD is associated with mining operations and these impacts on stakeholder perceptions. As water scarcity increases the need for reallocation of water between water users (which is carried out with stakeholder engagement), miners will face greater uncertainty over their water supply allocation unless they engage with this risk.
- **Financial risk:** The long term costs of treating AMD, particularly post-closure, are not adequately accounted for on miners' balance sheets at present. Pump-and-treat management of mines post-production may be necessary for several decades as water levels and flow regimes re-establish a new equilibrium. If these costs are fully internalized, mine production costs would be significantly higher.[69]

5.4 Case Study 3: Regulatory risks related to water permits

South African mining faces regulatory risk where there is a disconnect in the timing of granting of mineral licenses and water licenses. It is not uncommon for mining operations to be halted by long lead times in water permit applications. There are also instances where operations have begun without a permit and where government has forcefully suspended illegal operations until the requisite approvals are gained.

In 2009, a parliamentary question highlighted an estimated 104 mines in South Africa were operating illegally because they did not have a required water license.[70] This situation occurs because there is a lack of coordination between the two government departments which issue mining and water rights. This environment of uncertainty and regulatory inefficiency has an element of risk for mining operations in South Africa.

Although the Department of Water and Environment officials are engaging with the Department of Mines to rectify the situation, the official position of the Department is that in cases where a mine needs a water license for its activities and it has not applied for one or the information submitted in the application is incomplete, mining should be suspended.

In 2011 a state-owned coal mine in Mpumalanga and two other mining companies in the province were issued with a pre-directive to shut down operations until they were issued with their water licenses. The pre-directives were in line with the National Water Act.[71]

The mine chief executive admitted the company was operating without a water license but also added the application for an integrated water-use license was submitted to the department of water affairs in 2008. As a result of the shutdown, the majority of mine employees were retrenched and it is anticipated the mine will not reopen for six months.[72]

It is also notable that a mining license will often be revoked when mining companies fail to submit an Environmental Management Plan to the Department or do not implement the Plan as submitted. In 2011, the Department of Mineral Resources sent a Section 47 notice to Central Rand Gold, informing it of the intention of the Minister to suspend or cancel the mining operation in question''. This is because neither the social and labor plan nor the environmental management programme was fully implemented.[73] The company was ordered to cease mining operations until approval was obtained from Water Affairs and environmental authorization is issued by the Department for EIA (Environmental Impact Assessment) listed activities.

Bureaucratic inefficiency and regulatory uncertainty can lead to mining operations being undertaken by some actors without the requisite authorizations in place. This can have costly repercussions when plant shut-down is enforced by regulators.

Based on the case studies, some key considerations emerge for water risk in South Africa.

	Asset management	Corporate finance	Project finance
Water Scarcity	Loss of dividends and dip in share price where water scarcity impacts on production levels, increases the costs of water or there is reputational risk associated with AMD.	Change in risk profile as a result of delay of future investments or temporary closure of mine.	Delay or cancellation of project or premature closure.
Regulatory Risk	Failure to meet regulations as a result of permitting delay which leads to operational suspension. Profitability structure of investments change as additional regulatory costs emerge.	Change in corporate profitability profile as a result of project delay, suspension or termination.	Permitting delay, failed acquisition or additional regulatory charges lead to project cancellation or costs associated with significant rehabilitation.
Water quality risk	Lower dividends or dip in share price as a result of increased costs from AMD impacting on water quality.	Inability to have projects approved as a result of past corporate performance.	Permitting delay or failed acquisition because of poor behavior from other mines or significant clean up costs.