Mining, water and human rights: making the connection

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ABSTRACT

The minerals industry interacts with water in many different ways that can affect the environment and communities. In the context of emerging debates about the status of access to water as a distinct human right and the mining industry's engagement with human rights discourses, this article highlights points of disconnection between technical, scientific and engineering-based approaches to water management on the one hand and human rights perspectives on the other. We argue that greater understanding and emphasis on the intersecting nature of water and human rights is important from a sustainable development perspective. Better connections will increase the likelihood that mining companies will respect human rights, avoid or mitigate adverse social and environmental risks that occur through their interaction with water and collaboratively identify water-related development opportunities. Discursive, organisational, political and conceptual barriers of these various disconnects are considered and strategies for strengthening points of connection provided.

1. Introduction

Access to water is recognized as a precondition of the fulfilment of universal human rights and indispensable for leading a life with dignity (de Albuquerque, 2009a,b; WEF, 2009; CESCR, 2002a). At the same time, water security is essential to the business of mining. Consequently, the operational needs of mining and the human rights of local people intersect in complex and sometimes conflicting ways (Bebbington et al., 2008; Bebbington and Williams, 2008; Bridge 2004). Despite increased commitment to sustainable development (SD) by parts of the mining industry, which includes responsible water management and respect for human rights, these themes are being addressed along parallel but largely disconnected tracks. We argue that failing to adequately understand this intersection not only flies in the face of corporate commitments to SD, but may also increase the social and human rights risks that mining poses to local communities. In turn, this can expose the industry to reputational, production and/or financial risks as a result of company-community conflict that delays or halts operations, or when litigation ensues based on community claims of corporate human rights abuses. Globally, water is one of the most critical sustainability issues facing the mining industry (Moran, 2006; Moran et al., 2008; Bridge, 2004), therefore, bridging work that genuinely connects technical, scientific and engineering-based approaches to water management with human rights perspectives is needed.

To underscore the disconnects and highlight the potential for the industry to make stronger connections between mining, water and human rights, we address the following six questions: What are the mining industry's main interactions with water? What are human rights and how do they relate to water interactions in mining? Where is there evidence of disconnects? Why do disconnects exist? How can emerging technical frameworks strengthen connections between water management and human rights in mining? What more can be done to advance further points of connection? In answering these questions, we suggest some pathways forward as a response to some of the ingrained structural, political and professional challenges involved.

We ask these questions within a broader framework of mining and SD, within which water management and human rights have become conceptually embedded (ICMM, 2003). There has been lengthy debate on SD and mining in scholarly literature. Hilson and Murck (2000) note the proliferation of SD guidelines on various aspects of SD, including: environmental and socioeconomic impacts, waste management, cleaner technology and community partnerships. Their larger concern, however, is that many SD frameworks lack clear pathways towards implementation at the

mine site level. Alongside industry engagement with SD as a frame of reference, powerful public sector actors, such as The World Bank Group, also exercise influence in how minerals operations develop their assets (Cooney, 2004). The contest over who is the proper arbiter for regulating and determining SD practices in the minerals industry continues today (Gifford et al., 2010; Whitmore, 2006). In this paper we do not seek to explore or resolve the complex of questions related to mining and SD, but we do recognize the significant and ongoing contestations in this area of scholarship.

2. What are the mining industry's main interactions with water?

The minerals industry uses water for processing and transport of ore and waste, minerals separation, dust suppression, washing of equipment and human consumption (DRET, 2008; Mudd, 2008; van Berkel, 2007; Bridge, 2004). Extraction from surface and groundwater can directly impact ecosystems, and result in competition for access with other water users, particularly in the presence of alternate industries. Even in cases where an operation benefits from high average rainfall, there can be instances of local and punctual water scarcity. To ensure a secure water supply (input) most mining operations must store water in dams or mining voids. In wet climates, or situations of water abundance, extreme rainfall events can cause these storage facilities to discharge surplus water, often contaminated, into local waterways, which can have severe social and environmental consequences.

Mining also disposes of waste and wastewater (output) once valuable commodities have been extracted. Waste rock dumps and conventional tailings facilities are the most common methods of managing mine waste. Failure of these facilities can devastate local water endowments upon which local communities rely, such as the tailings dam disaster of Marcopper at Marinduque in the Philippines (Coumans, 2002; Plumlee et al., 2000). While atypical, examples exist of mining waste that has been directly disposed into rivers, oceans and lakes, particularly in circumstances where rugged topography, high rainfall, seismic activity, high groundwater levels, the lack of 'cross-valley' locations, or the absence of suitable embankment material preclude the impoundment of tailings (Franks et al., 2009a).[1] Direct disposal has the potential to result in widespread water contamination, as at the El Salvador Mine, Chile (UNEP, 1997).

Waterways and groundwater can be affected by the various landscape transformations that result from mining (Franks, 2007; Loeb, 2007; Bridge, 2004). One example is mining voids; both open and underground pits that commonly extend below the water table and require dewatering. Mine dewatering can cause draw-down of the water table in instances where naturally occurring recharge is not sufficient to replenish water used by mining. Younger et al. (2002) points to the documented consequences of decreases in natural storage of groundwater decrease in natural recharge of aquifers (drying-up of springs) and decrease in rate of natural groundwater discharge to streams.

Water endowments can also be affected by acid and metalliferous drainage (AMD), which can occur when minerals associated with ore bodies decompose in the surficial environment. Mining

activities trigger this phenomenon by exposing walls of open pits, underground structures, and crushed waste rock and tailings to water and oxygen, which can generate AMD containing a number of potentially harmful constituents. AMD is among the most serious and potentially enduring legacies of the mining industry throughout the world (DRET, 2007; Akcil and Koldas, 2006). There are also numerous examples where use of chemicals and reagents in mineral processing, such as the use of cyanide in gold extraction, have had negative effects on waterways and groundwater.

Landscape management issues are also implicated in relation to mining's interaction with water, including sensitivity to the role of water within ecosystems. When mining operations interrupt natural water cycles, biodiversity and organism lifecycles can be profoundly affected. Responsible mining companies must recognize that it is not enough to simply manage the consequences of these interruptions during active operations. They must also attend to cumulative impacts (Franks et al., 2009b; Franks et al., in press), the broader implications of river and runoff diversions, as well as closure and rehabilitation when careful stewardship of the legacy of mines must be managed over the long-term (Heikkinen et al., 2008). We support the idea that corporate responsibility must extend beyond ecological considerations to also include social aspects (Bridge, 2004), including human rights.

From the above, it is clear that mining's interaction with water involves a complex of activities as part of the core business of mining. These activities also exist within diverse social and ecological contexts and as such, have the potential to lead to multi-dimensional conflicts with community stakeholders. In addition to core activities, mining companies can either provide water, or enable local community access to water, through infrastructure and services as part of social or community investment strategies. Water provision and access can be for potable or drinking water in the domestic sphere, such as at the Tolukuma mine in Papua New Guinea when riverine water became compromized due to mining activities (Miles and Trip, 2007); or it may be for agricultural or industrial purposes, as at the Yanacocha site in Peru (Newmont Corporation, 2008). Water supply can also be part of local-level agreements, for example, dewatering associated with the El Dorado mine in El Salvador (PacRim Mining, 2010). In the following section we explore the relationship between the mining industry's interaction with water and human rights discourses.

3. What are human rights and how do they relate to water interactions in mining?

International human rights law covers a wide range of considerations. In broad terms, civil and political rights are associated with physical security, such as freedom from torture or arbitrary detention, the right to a fair trial, freedom of religion and free speech. Economic, social and cultural rights include considerations such as the right to a livelihood, to participate in the cultural life of a community, the right to a fair wage, the right to health care and other social services, the right to family life and freedom from gender and other types of discrimination. There are a number of human rights which are not explicitly enshrined in international law as distinct rights, but are expressed in internationally agreed frameworks. The right of 'access to water' is one such right. Although the right to access water is not itself recognized in international law as a distinct right, it is a component part of the right to health and the right to life. The status of this right is debated internationally and it has the potential to become an explicit right in the future. Recognition of access to water as a distinct human right in international law would have significant implications for the mining industry, beyond their existing policy commitments, which typically relate to a fuller suite of human

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[1] Submarine tailings disposal (STD) refers to the direct discharge of mine process tailings into the ocean. There are two distinct types of STD. The first is the disposal of wastes at the ocean surface. The second type of STD is the disposal of wastes at depth, below the maximum depth of the surface mixing layer the euphotic zone and the upwelling zone. This type of tailings disposal is known as deep sea tailings placement (DSTP). Riverine tailings disposal (RTD) is the direct discharge of mine process tailings into rivers. In addition to marine disposal, mining wastes have also been disposed into lakes (LTD) (Franks et al., 2009a: pp. 8–9).

rights. To help focus the discussion that follows, we identify four types of water rights as they relate to mining: legal, cultural, universal and distinct human rights.[2]

In some jurisdictions *legal* rights to water, either littoral or riparian, are defined through instruments such as legislation or regulatory permits, leases and contracts. Through such instruments mining companies can secure a legal right to use and/or discharge water. Narrowly defined legal rights that fall under State jurisdiction are not the focus of this article, although we acknowledge that legal rights in national jurisdictions do not always reflect international human rights law. Some communities claim traditional, native, indigenous or sovereign rights to access and use water; rights that are not always formally recognized by State law. These *cultural* rights have often been negotiated over generations and are usually context specific. In some situations, disruption of access to traditional ways of interacting with water may infringe on internationally recognized human rights, but not always.

The third category of rights is *universal* human rights. Leading mining companies and industry organisations have endorsed the UDHR, and International Covenants on Civil and Political Rights and Economic, Social and Cultural Rights (Potter and Sine, 2009). The International Council on Mining and Metals Sustainable Development Framework (ICMM, 2003) requires member companies to uphold human rights and respect cultures, customs and values in dealings with employees and others who are affected by their activities. Many universal human rights can in one way or another be affected by mining's interactions with water. For example, if a mining company pollutes water, this can have implications for the right to health, or the ability to secure a livelihood if this water can no longer be used for agricultural purposes, or for fishing, such as at the Tolukuma mine in Papua New Guinea when riverine water became compromised due to mining activities (Miles and Trip, 2007).

Additionally, if a mining company negatively affects a body of water that is central to cultural practices of a particular group of peoples, this may have implications on the right to participate in cultural life, or religion. Or, company activities might compromise access to a particular body of water that is necessary for cultural survival. In certain contexts, these types of water impacts may represent a corporate abuse of human rights. Alternatively, if a company provides a local community with access to water through water infrastructure provision, this may have positive implications for the realization of a range of universal human rights. But, if access to water is provided in a way that discriminates against women (Singh, 2008), or other marginalized groups, then once again, companies may be accused of human rights abuse.[3]

Access to water is also emerging as a *distinct* human right, the fourth category in this typology. Under international human rights law, its precise status and scope remain unclear. The right to water access − which relates specifically to potable or clean drinking water − was explicitly recognized as a human right by the Committee on Economic, Social and Cultural Rights (CESCR, 2002b) in November 2002 with General Comment 15. Previously, the right to water was understood implicitly as integral to the realization of other rights, including: the right to life; the right to an adequate standard of living; and the enjoyment of the highest attainable standard of physical and mental health (Filmer-

Wilson, 2005). The founding international human rights instrument − the United Nations (UN) Universal Declaration on Human Rights (United Nations, 1948) − does not expound upon the right to water, but observers have argued that the right to air and water is so obvious that the original drafters of the UDHR did not see a need to list it (Glieck, 1999). Otherwise, the right to water is mentioned in two other international human rights instruments: the UN Convention on the Rights of the Child (United Nations, 1989) and the UN Convention on the Elimination of all Forms of Discrimination Against Women (United Nations, 1979).

The question of whether access to water should be designated a *distinct* human right, or remain embedded in the full suite of *universal* human rights remains open. The international campaign for the right to access water essentially grew out of the anti-water-privatization campaign and is based on arguments that recognition of water access as a distinct right would: increase the political priority placed on water; compel States to supply basic water needs; and reflect what is already implicit under international human rights law (Bakker, 2007). However, questions exist about how a human right to access water would be applied in practice and result in meaningful change on the ground. There is also the long-standing critique of the anthropocentric nature of human rights. Bakker (2007: p. 438) highlights that a human right to water access may "…ironically, imply the further degradation of hydrological systems on which we depend." As the mining industry considers the interrelationships between water and human rights, the debate about access to water as a distinct human right cannot be overlooked.[4]

Despite the various policy-level contestations, the past few years have seen significant developments on the issue of access to water as a distinct right specifically as it relates to business. For example, in 2008, the UN Human Rights Council appointed an Independent Expert on the issue of human rights obligations related to access to safe drinking water and sanitation, Catarina de Albuquerque, whose mandate includes promoting dialogue with industry on these issues.[5] Then, in 2009, the Institute on Human Rights and Business (IHRB, 2009) released a draft paper, *Business, Human Rights and the Right to Water* (2009) to advance the discussion about the responsibilities that national and trans-national corporations have in regard to water and human rights. The IHRB canvasses three responsibilities that relate to business as: a user or consumer of water; an enabler of access to water; and/or a provider (source) or distributor of water. The framework outlines requirements for each of these three areas of responsibility. To date, there has been no formal response to the IHRB's framework from the mining industry.

A fair degree of circumspection continues to exist on the part of mining companies about how human rights apply in practice, across the full spectrum of their activities. Conceptually, it is possible to see how human rights must be 'in frame' for any responsible mining company. This perspective has been strengthened by the United Nations (UN) Secretary-General's Special Representative on Business and Human Rights, John Ruggie's

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[2] Like any typology, the categories have been separated here for the purpose of explanation only.

[3] Some mining companies are becoming increasingly aware of gender roles, since women and girls are often more severely impacted than men through changed water use/transformation and access arrangements that may come about through mining (Rio Tinto, 2010a,b).

[4] For a detailed explanation of the genesis of international debates surrounding the right to water and the flaws of pursuing the human right to water as an anti-privatization campaign see Bakker (2007: pp. 436–440). While related, the broader debate surrounding the privatization of water is not the central focus of this article.

[5] This paper primarily pays attention to water and human rights. However, the UN Independent Expert on Water and Sanitation's position paper on Climate Change and the Human Right to Water and Sanitation (2009) also prioritizes the human right to sanitation, by arguing that although sanitation is inextricably linked to the right to water, it has not been given adequate attention by the international community, due to a host of factors including its status as a taboo subject in many cultures.

(2008) *Protect, Respect, Remedy* (PRR) framework, which was unanimously accepted by the UN Human Rights Council. The framework recognizes the corporate responsibility to respect human rights and describes how it may be discharged through human rights due diligence. However, clear methodologies for mining and other industries to integrate and operationalize human rights on the ground are still not entirely clear, and continue to evolve.[6]

4. Where is the evidence of a disconnect between technical water management and human rights in mining?

In this section, evidence of the disconnect between technical water management and human rights in mining is drawn from analysis of corporate policy, sustainability reporting, as well as industry guidance and regulation, suggesting that the disconnect is more systemic, rather than simply an industry oversight. There are, however, a few isolated points of connection, which are highlighted below.

Our analysis reflects an examination of 19 ICMM member companies and their reports from 2008 to 2009. All members had established company-level human rights commitments or policies in one form or another. Only two members were found to have examples of corporate-level water management strategies (*cf.* Rio Tinto, 2010a,b; Xstrata, 2010). While both companies had water management strategies, social dimensions were canvassed in a general sense, with neither mentioning water-related human rights. This lack of policy plays out in practice, for example, when localized competition between communities and mining operations over water can potentially cause or exacerbate conflict within the community, between existing users, or with the company (Bebbington et al., 2008; Bebbington and Williams, 2008). Water conflicts such as these have, too often, been a hallmark of a number of minerals operations around the world. When they emerge, the existing policy gap is revealed as companies are forced to engage with the human rights dimensions of their water interactions by non-government organizations (NGOs), local communities and other civil society advocacy groups (Bridge, 2004) at points of crisis around water. However, this represents a reactive corporate response, rather than a strategic approach to water management and human rights within a sustainability framework.

Companies may not explicitly integrate human rights into their technical water management strategies that are focused on use, but neither do they seem to integrate human rights into water-related community contributions or investments strategies that relate to provision of water (including services and/or infrastructure). These findings do not mean that mining companies take no action on the issue of facilitating water access for communities. However, when water contributions are mentioned in sustainability reports, for example, they are framed by either a philanthropic or a needs-based framework (*cf.* Freeport McMoRan, 2008). Only a few companies actively report their contributions towards the achievement of the Millennium Development Goals (MDGs), which include goals for water and sanitation (*cf.* Rio Tinto, 2009; BHP Billiton, 2007), but even then, discussion is not framed from a human rights perspective. This represents an industry tendency to overlook integration of human rights in the context of social and community development and a lost opportunity for companies to highlight how they may be working to uphold the human rights of locally affected people.

In our analysis of 19 ICMM member company sustainability reports, we looked for reporting patterns on water management

and human rights. Studies of sustainability reporting on these two topics have been undertaken on water issues management in mining (Mudd, 2008; Cote et al., 2007) and corporate human rights reporting more broadly. Umlas' (2009a,b) multi-sector study on human rights reporting found that most companies do not report at all on human rights, and many that do report do so very selectively. Our analysis of mining industry reports found that neither the 'environment' nor 'social/community' sections of sustainability reports, which typically canvass water management and water development issues respectively, integrates the other aspect.

Industry bodies such as the ICMM encourage a formal approach to water stewardship alongside commitments to human rights. However, links between the two categories of 'best practice' are not explicit. The ICMM has formally endorsed the *Protect, Respect, Remedy* framework (Ruggie, 2008) and in response produced an industry guidance document titled, *Human Rights in the Mining and Metals Industry: Overview, Management Approach and Issues* (ICMM, 2009), but again, explicit links between human rights and mining's various interactions with water are not explored. Only one ICMM member explicitly recognizes water as a human right that needs to be honored as such (Teck, 2008).

Some companies have individually signed up to a range of voluntary international policy frameworks, such as the United Nations Global Compact (2000), which commits businesses to align their operations and strategies with ten universally accepted principles in the areas of human rights, labour, environment and anti-corruption. Under the environment category, water is not a specific point of focus. Another example is the CEO Water Mandate (UNGC, 2010). Implicitly positioned within a human rights framework through its connection to the UN Global Compact, the CEO Water mandate is a public–private partnership which brings attention to the development, implementation and disclosure of water sustainability policies and practices of the business sector. At the time of writing, from the minerals industry, only Anglo American had recently joined the mandate and had not yet implemented its principles across operations. Other voluntary human rights frameworks to which the industry has committed, such as the Voluntary Principles on Security and Human Rights, are more focused on civil and political rights, and do not explicitly deal with water in relation to human rights either. A number of sites have voluntarily implemented participatory water monitoring as an attempt to prevent and manage community conflict and address issues of trust and divergent perspectives on impacts (scientific and values-based), though again without explicit reference to human rights (CAO, 2008; Bebbington et al., 2008).

In recent years there have been moves within the industry towards independent third-party certification, such as the ISO 14001:2004 (ISO, 2004) and the Cyanide Code (2009), both of which relate to water management. ISO 14001:2004 provides all minerals companies a standard by which to manage their environmental management systems effectively. The Cyanide Code requires gold mining operations to implement measures to protect waterways, groundwater and aquatic organisms from intentional and unintentional cyanide exposure. However, in neither certification system is there a reference to human rights, giving the misguided impression that human rights are not affected by those particular activities. In addition to these international standards, some operations are subject to national or local regulatory standards that require environmental monitoring and reporting and disclosure of water management to various levels. However, there are no known regulatory frameworks that explicitly require monitoring and reporting of water in relation to human rights.

Leading practice for sustainable access, use and stewardship of water resources for the minerals industry are sometimes captured in country-level industry guidance publications. The Australian

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[6] The SRSG's final report to the UNHRC in 2011 will focus on the issue of 'operationalization'.

Federal Government, for example, released a strategic water management framework (MCMPR, 2006) and a leading practice guide to water management (DRET, 2008), both of which outline the strategic and operational risks associated with water management, including corporate, regional (catchment) and local (site and surrounding environment) perspectives. Notably, the DRET leading practice handbook recognizes "access to water as a fundamental human right" (2008: 36), even though access to water is not yet explicitly recognized as a distinct human right within international frameworks (cf. Section 3). Similar publications by the South African Government (2008) and an earlier guide by the Minerals Council of Australia (1997) make no such suggestion that water is a human right.

The DRET handbook's statement about access to water stresses the importance of community participation in decision-making about water, reflecting a core human rights principle: participation (Filmer-Wilson, 2005). However, reference is only made to community involvement in decisions about water efficiency and quality, not other human rights considerations, such as the larger suite of concerns relating to universal human rights, such as livelihoods, health, culture or spirituality. Therefore, the DRET statement appears, on the surface, to extend recognition of human rights well beyond international debates, but in fact does not provide practical guidance on universal human rights in relation to water in the mining context. So, while connections are evident, further work is necessary to broaden the focus to include the full suite of human rights.

5. Why do disconnects between water management and human rights in mining exist?

Several explanations are possible as to why the current division between technical water management and human rights perspectives in the minerals industry exists. One explanation is that the current situation reflects disciplinary barriers between the dominant engineering and natural science professions and the minority, social science, professions (Kemp, 2009). Lack of team integration — both intra (i.e. within environment departments) and inter (i.e. between environment and other departments) — can thwart progress towards sustainable water management (Cote et al., 2010).

Beyond disciplinary barriers, there are organizational factors to consider. A human rights perspective and associated policies are usually driven by corporate offices, whose representatives have engaged at the global level, with international NGOs and multilateral organizations, whereas operational-level personnel, the people who are required to implement corporately-endorsed water policies, have not typically been closely involved in the larger debates. Consequently, they are often professionally disconnected from the drivers and pressures that have advanced the global agenda around water and human rights. Unless operational-level personnel are specifically trained or have experienced local-level conflict over water and human rights issues, they may not have either the necessary information or the will to take meaningful action at the mine site-level. Equally, corporate representatives can be quite removed both physically and pragmatically from 'on-the-ground' realities.

Another cause of the divide is that despite the intense, high-level engagement regarding human rights and business, useful assessment frameworks are somewhat immature. Human rights impacts assessments (HRIA) are recommended by the SRSG on Business and Human Rights and by other leading organisations (IBLF and IFC, 2007; International Alert, 2005) as a means for companies to understand the human rights implications of their actions and meet their obligations and commitments. This includes concerns about water. However, HRIA is a new and developing methodology that has not yet been widely applied or tested. There are indications that HRIA can be problematic in practice (Boege and Franks, in press), but this may relate to methodological issues rather than the concept of HRIA itself. Exacerbating the challenge of improving HRIA methodology is that the vast majority of assessments are not publicly available, largely it seems, due to corporate concerns around legal liability. So it is virtually impossible to determine exactly whether and/or how companies are rigorously assessing the human rights impacts of their interactions with water based on information available in the public domain.

On the issue of impact assessment, it is possible that an exclusive focus on stand-alone HRIA may result in a separation from, rather than integration with, existing and more well-established assessment and management frameworks, such as social impact assessment (SIA) and environmental impact assessment (EIA). In the mining industry, these processes have by and large failed to prioritize human rights. The International Principles for SIA endorsed by the International Association for Impact Assessment recognize human rights as a fundamental principle of development (Vanclay 2003). Clearly, scope exists to incorporate human rights as a frame of reference within SIA. Whether stand-alone HRIA is undertaken, or human rights are integrated into SIA, EIA or other processes, current practice suggests that assessment of human rights in relation to water has not yet occurred in any significant or systematic way within the minerals industry, in part reflecting that human rights is a relatively new corporate frame of reference (c.f. Section 3).

Successful application of a human rights perspective also relates to the inherent circumstances in particular country contexts at the State and community levels. For example, it is challenging to apply a rights-oriented approach to water management in highly centralized single-party political systems or where governance frameworks are weak, corruption is high, human rights awareness is low, or where there is an absence of independent NGOs. The reason is that mining companies often rely on a State to grant mineral rights, so situations where companies might choose to seriously question or challenge human rights performance of the State granting their license is, frankly, uncommon. At the community level, a human rights perspective can disrupt or challenge existing power dynamics within and between social groups, for example, if companies seek to give voice to women (Singh, 2008) or other groups who have previously been excluded from impact assessment and other decision-making processes, but who may have a special relationship, or rights, to water. Therefore, as companies strive to achieve and maintain a 'social license to operate', a human rights perspective could arguably jeopardize approval from dominant local and national groups, particularly if a company attempts to change the status quo according to exogenous conceptions of responsibility regarding human rights (Mgbeoji, 2006).

6. How can emerging technical frameworks help to strengthen the connection between water management and human rights in mining?

The mining industry is starting to adopt an agreed and consistent model for describing mine water systems (Cote et al., 2009; Cote and Moran, 2009; DRET, 2008) and we build on this progress. It is founded on a conceptual model that represents a mining or mineral processing operation (an operational facility) as delimited by its site boundary and embedded within a surrounding environment, in turn framed by broader governance considerations (Fig. 1).

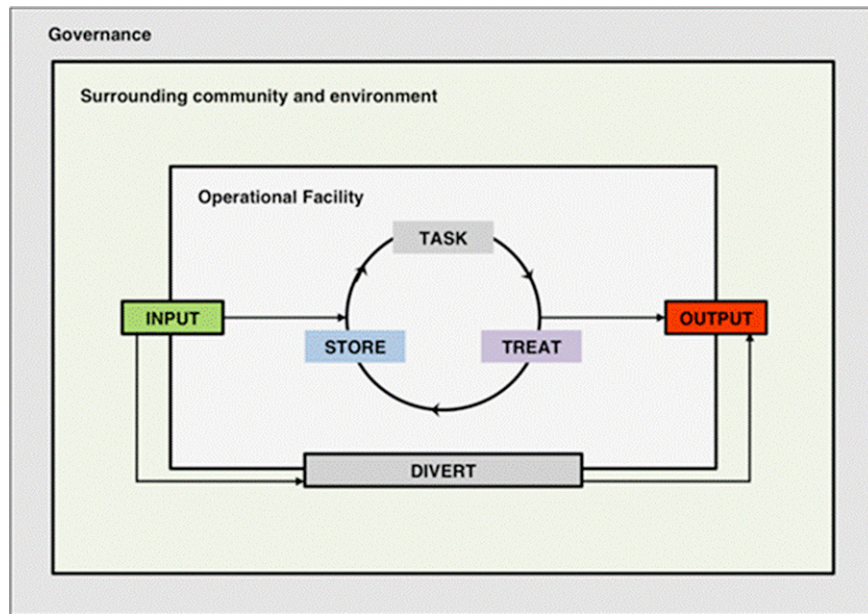The conceptual model comprises four functional elements: inputs, outputs, diversion and the "task-treat-store cycle"

Fig. 1. A mining operation water system map (adapted from DRET, 2008).

(Cote et al., 2009; Cote and Moran, 2009). In this model, inputs represent the receipt of water to the operational facility and are characterized by their source and quality. The Global Reporting Initiative (GRI, 2006) requires that the sources from which water is withdrawn are reported.[7] Four sources are defined: surface water, groundwater, sea water and third-party water. The quality of water can vary according to chemistry (salts, minor and trace elements), biological make-up, radioactivity, dissolved gases, redox state (oxidation/reduction), pH, temperature, pressure, turbidity, and total suspended solids. Discriminating between various categories of water quality can be based on the extent of treatment that is required to produce potable water (WHO, 2008). In this paper, we propose here a three-tiered approach to categorising water quality (See Table 1).

Outputs represent the removal of water from an operational facility. They are categorized by quality (as above) and characterized by destination, which qualifies the point of water receipt, or its fate, outside the operational facility. The seven destinations are: surface water, groundwater, sea water, supply to a third-party, evaporation, entrainment and other (used when a clear destination pathway cannot be identified). Outputs to surface water include discharge to rivers and creeks as well as environmental flows. Outputs to groundwater include aquifer reinjection and seepage. Diversions describe the flows of water that are moved around or away from an operational facility, but not used for any other operational purpose. It is water that is actively managed by an operation, but is not used in a traditional, consumptive sense. Diversions are common within the minerals industry and can take the form of river diversions, runoff diversions and aquifer dewatering (cf. Section 2).

The "task-treat-store" cycle includes the majority of operational tasks (such as processing plant, dust suppression, tailings), water storages, technologies and processes that are implemented to

minimize water losses and promote water use efficiency. It enables the adoption of a consistent format to communicate water use efficiency (as required by the GRI), through the description of whether or not water has gone through a task and/or was treated. In this sense, water can be described as follows: raw water has not been previously handled for any purpose; worked water has been tasked and is returned to storage; and treated water has been processed to provide water of a suitable quality for a particular purpose. With these definitions, water reuse can be calculated consistently by compiling worked water flows to the tasks.

A complete description of a facility's inputs and outputs — its 'water account' — describes an operation as a consumer of water. The analysis of inputs and outputs identifies the primary water interactions an operation has with its surrounding environment and community. It also enables the consistent and transparent communication and reporting of these interactions from a water use perspective. Key to the analysis of this accounting model is the understanding that when water moves through an operation, it does not disappear (Moran, 2006). It continues to exist in one form or another. Thus, in the context of water scarcity, the magnitude of inputs can be compared to the local availability of water resources. In the context of water abundance, the model maps the increased opportunities for water to interact with mining wastes including the potential of increased risk of spills from water storage and tailings facilities. In both contexts, the reporting of outputs communicates both planned and unplanned discharge of water.

An analysis of worked water flows assesses how efficiently an operation transforms water. A description using the 'quality' categories contributes to the assessment of transformation activities, at least from an operational perspective. It can, for instance, show an operation importing large volumes of Category 1 water and transforming it into Categories 2 or 3 water. The technical frame identifies the means through which an operation provides water back to the hydrosphere by accounting of outputs to surface water, groundwater and third-party destinations, from where it can be extracted again by other users.

A consistent technical frame to describe mine water systems is one way to start to address the current disconnects between water management and human rights. A complete description of a mine

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[7] The Global Reporting Initiative is a voluntary reporting protocol whereby minerals companies rate themselves on various points of compliance to industrial best-practice, including human rights and water as discrete — not linked — categories.

Table 1
A three-tiered approach to categorising water quality in mining.

Water category	Summary description	Characterisation
Category 1	Close to the standards of drinking water, as it only requires minimum treatment (disinfection) to be safe for human consumption. It can be used for all purposes.	Characterized by a total dissolved solids (TDS) concentration less than 1000 mg/L and concentrations in other physical and chemical constituents below agreed thresholds (WHO, 2008)
Category 2	Water that requires treatment to remove total dissolved solids and other constituents to be safe for human consumption. It can be used, without treatment, for many agricultural and recreational purposes.	Characterized by a TDS concentration ranging between 1000 and 5000 mg/L and concentrations in some of the other constituents not meeting the criteria listed above
Category 3	Hyper saline water that cannot be used for any agricultural purposes without removal of total dissolved solids	Characterized by a TDS concentration above 5000 mg/L. Sea water inputs are Category 3 water but all other inputs can be of any category

water system assists in communicating mine and water interactions within the boundaries of the operational facility, and provides the foundation for a more specific conversation about a facility's water interaction with the surrounding community and environment, and as part of this, specific human rights impacts. When combined with external engagement and reporting (represented by the outer two frames of Fig. 1) this foundation provides a potential model for improved understanding and shared decision-making about the full range of mining's interaction with water, not only as a consumer of water, but also as a provider, enabler of access and transformer of water.

By using the model described above, it is possible to start to make specific connections between technical and human rights understandings of mining's interactions with water. For example, Category 1 water represents the quality of water that would need to be provided as an output by an operation to contribute to the fulfilment of the distinct human right of access to water, recalling that this debate is about access to potable water. If the right to water is eventually enshrined in international law, as a distinct human right, this will have significant implications for the minerals industry in relation to water management and community contributions. Formalizing access to water as a distinct human right would strengthen the position of communities in relation to demanding that their rights be fulfilled by the State as well as by non-State actors (Filmer-Wilson, 2005), such as mining operations. Furthermore, significant negative effects on Category 1 water through inputs, outputs or diversion, may be more clearly considered a corporate abuse of human rights, rather than merely a technical issue or a social impact or risk to be mitigated or managed.

Categories 2 and 3 water (i.e. non-potable water fit for agricultural and other productive purposes) would typically relate to universal rights, to which many major mining companies have already committed as reflected in many of their sustainability reports. Irresponsible use of Category 2 water inputs might potentially infringe on the right to a livelihood, for example. From another perspective, provision of Category 2 water by an operational facility to a local community might contribute to the fulfilment of rights if this water was put to productive use by the local community. And, while Category 3 water inputs may be of lower quality, these sources of water may hold great cultural significance to local communities and therefore represent a concern relevant to universal human rights.

Key to incorporating a human rights perspective into this model is that operating facilities must consider the extent to which overarching governance frameworks recognize the four different types of water rights outlined in Section 3. This will have implications for the degree to which legal compliance, for example, aligns with corporate commitments to human rights. Any pre-emptive industry recognition of water as a distinct human right poses an interesting situation if a company recognizes a distinct right to access water before it is enshrined in international law. Whatever the context, companies should be aware of the various governance arrangements under which they are operating across the full range of intersecting water and rights categories.

While the international human rights framework establishes a broad suite of universal human rights, to which everyone is entitled, how they are protected, respected and experienced remains context specific (Kirkemann and Martin, 2007). As such, we argue here that mining operations should also aim to open up dialogue and discussion with local communities around how a facility's predicted or actual water interactions, captured in the water account, 'maps' against community understandings of water and human rights. This paper contends that such dialogue has the potential to generate shared understanding between the operating facility and local populations, thus providing a basis for informed decisions over planned use of shared water resources, not just site-specific water efficiency considerations. Dialogue and discussion may also facilitate greater levels of shared understanding between professionals working at the nexus of these issues. A water accounting framework provides a useful place to start taking a broader perspective in order that operations better understand how they are currently impacting human rights (either positively or adversely) through their current approach to water management, and where human rights impacts may go unrecognized or overlooked.

7. What more can be done to advance points of connection between mining, water and human rights

The articulation of types of water rights, the use of a consistent technical frame, and the development and reporting of water accounts, provide solid foundations for improved understandings. However, they are insufficient on their own to bridge the various points of disconnection that exist between technical and human rights perspectives. Further multi-disciplinary research is required in order to extend the points of connection more comprehensively.

This paper has advanced the idea that water transformation is a meaningful consideration when establishing a greater connection between water management and human rights considerations in mining. Towards that end, we suggest that the emerging IHRB framework for business, water and human rights explicitly incorporate aspects of water transformation as an area of business responsibility for the mining industry, in addition to the existing three responsibilities that relate to business; that is, as a user or consumer of water; an enabler of access to water; and/or a provider (source) or distributor of water. We suggest that nuances to these three categories can be made by considering the water transformations that occur through mining. This paper has explained how water transformation may result from 'use', such as when companies utilize Categories 2 or 3 water and transform them to Category 1 (potable) water, or 'provision' if this transformed water is distributed to the local community. Water transformations can also be passive or unintentional, such as through the generation of AMD. Issues of water transformation as they relate to human rights warrant further detailed exploration.

Analysis elsewhere in this paper (*cf.* Section 3) highlighted that other global guidance tools such as ICMM's publications, the GRI, the Cyanide Code and the UN Global Compact could provide greater connection between water and human rights. None of the existing schemes or frameworks that dominate minerals industry approaches to water management require consideration of human rights together with water, or provide a sense of the issues that might arise in this nexus. We suggest that this situation must change and that such global frameworks should be more holistic in orientation. This paper has also drawn attention to important debates occurring around the responsibilities of business in relation to water as a distinct human right. We suggest that the mining industry should be more actively attuned to this debate, while at the same time take a more comprehensive approach to commitments already made to universal human rights as they relate to water.

There are several organizational aspects that may also offer potential for establishing greater connection between technical water considerations and human rights in mining. For example, more should be known about whether and how core business processes, such as project approvals, capital investments, planning decisions, acquisitions and risk assessment processes can connect these agendas. However, little is known about the extent to which cross-cutting topics are covered within core processes listed above and the capacities of those involved in such processes to incorporate human rights considerations. Of course, the situation is not helped by the fact that human rights due diligence and assessment methodologies for business are still in their infancy and shrouded in a veil of confidentiality.

Finally, it is important to strive to overcome longstanding and ingrained professional divisions, such as between hard and soft sciences. Overcoming professional divides will take time; however, industry should encourage engagement of social science professionals on technical issues and at the same time engage technical professionals in social and human rights perspectives. Ideally, professionals undertaking human rights due diligence should reflect a multi-disciplinary, cross-departmental internal approach and facilitate the participation of local people. The use of the water accounting model holds promise towards accomplishing a more holistic dialogue and has the capacity to maximize levels of integration and 'buy in' across the project proponent organization, which would enhance points of connection related to water management and human rights in mining. Cross-disciplinary capacity building such that social scientists and human rights experts understand the fundamental principles of technical water management and technical scientists have a greater appreciation of social and rights dimensions will be important. If companies are serious about SD, then ongoing training and professional development towards this end is essential.

8. Conclusion

This paper sought to make connections between mining, water and human rights. With its intimate association with water use, provision, access and transformation, the mining industry has a unique role to play as the international community grapples with its impacts on the broader suite of universal human rights alongside the growing trend towards recognition of water as a distinct human right. However, the dominant approach taken by the industry to water appears overly utilitarian in the sense that water is regarded a key business asset, for use in mining and production processes that poses various risks to be managed. The human rights implications of water are rarely ever explained, profiled or examined in industry policy or documentation, despite strong industry commitment to human rights as part of their sustainability frameworks. Without those connections in place, the industry potentially exposes local people to adverse social and human rights impacts, which in turn

heightens the industry's own reputational, financial and production risks. Lack of connection also represents a lost opportunity for companies to highlight how they may be working to uphold the human rights of locally affected people. Greater clarity and understanding in this area may: increase the likelihood that companies will respect the human rights of project-affected peoples; more effectively avoid or mitigate adverse human rights impacts that stem from mining's interaction with water; and be in a stronger position to collaboratively identify water development opportunities so that local people derive some benefit from mining.

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