

# Surrounded by Change – Collective Strategies for Managing the Cumulative Impacts of Multiple Mines

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## ABSTRACT

Intensive resource extraction, in the form of multiple mining operations, presents significant assessment and management challenges for resource developers, governments, community and the environment. Cumulative impacts, ie the successive, incremental and combined impacts (both positive and negative) of an activity on society, the economy and the environment, can place significant pressure on social, economic and environmental capital and render conventional mine-by-mine approaches to management ineffective. Cumulative impacts can be what are most important to environments, communities and economies surrounded by multiple mining operations because cumulative impacts are what they experience.

There is much to gain from increased consideration of cumulative impacts. Unmitigated impacts have the potential to delay or even prevent expansion of mining in existing and prospective areas. On the other hand proactive management of cumulative impacts can benefit regional environments and communities and contribute to the industry's social license to operate. Resources are often not the limiting factor to better cumulative impact management. More effective coordination of existing resources may go a long way toward mitigation and enhancement, and better planning and assessment may help avoid impacts and exploit opportunities for efficiency gains through reduced duplication.

In this paper we draw from working examples to present five practical assessment and management strategies applicable to resource companies to enhance positive, and avoid and mitigate negative, cumulative impacts. The strategies are presented based on their capacity for achieving outcomes, ease of implementation and cost effectiveness and are drawn from a multi-year study on the assessment and management of cumulative impacts in the Hunter Valley, New South Wales and a follow-up study to improve cumulative impact assessment and management practice in the Australian coal mining industry, both reported elsewhere.

## MINING AND CUMULATIVE IMPACTS

Cumulative environmental, community and economic impacts (both positive and negative) are assuming growing importance in the resource industries. The overwhelming number of components and complexity of interactions of cumulative impacts challenges our institutions and methodologies and the effectiveness of conventional mine-by-mine approaches. Cumulative impacts are the successive, incremental and combined impacts of an activity on society, the economy and the environment (Brereton *et al*, 2008; Damman, Cressman and Sadar, 1995). Impacts can be both positive and negative and can vary in both intensity as well as spatial and temporal extent. Cumulative impacts tend to persist over time and may interact such that they trigger or become associated with other impacts. They may accumulate linearly, exponentially or reach 'tipping points' after which a major changes in system state may follow.

In the mining context cumulative impacts can arise from compounding activities of a single operation or multiple mining and processing operations, as well as the interaction of mining

impacts with other past, current and future activities that may not be related to mining. The nature and scale of cumulative impacts can vary considerably depending on such factors as the type of mining activity, the proximity of the mines to each other, the extent of other contributing activities and the characteristic of the surrounding natural, social and economic environments. The compounding effects of multiple mine closures (a kind of 'reverse' cumulative impact where impacts are generated by the absence of activities) can be as challenging for regional communities and economies.

The central idea behind the assessment of cumulative impacts is that it is insufficient to only study the impacts of a single project or action. The sustainability of environmental and social systems requires that we understand the full range of human generated stresses. The role of cumulative impact assessment is to examine the interactions of projects in the context of the interactions between the environment and society and all of the human-generated stresses. The role of cumulative impact management is to keep the total effects of all stresses at acceptable, or desired, levels (Duinker and Greig, 2006).

In this paper we provide advice on how to assess and manage such aggregate stresses. We present five practical assessment and management strategies to enhance positive, and avoid and mitigate negative, cumulative impacts. The strategies are drawn from working examples and are presented based on their capacity for achieving outcomes, ease of implementation and cost effectiveness. The strategies are drawn from two studies undertaken by the authors into cumulative impact assessment and management in the coal industry in Australia. Brereton *et al* (2008) reported on a three year study of cumulative impacts of five mining operations that surround the town of Muswellbrook, Hunter Valley, New South Wales. Franks, Brereton and Moran (2008) traversed current assessment and management practice in the Australian coal mining industry as part of a follow-up study to improve industry practice in the management and assessment of cumulative impacts. We begin by considering the business case for greater attention to cumulative impacts before suggesting five priority strategies for assessment and management: understanding and assessing the accumulation and interaction of impacts; collective community reporting; cross-company networking, forums and working groups; cross-company community engagement; and coordination of community and environmental investments.

## THE BUSINESS CASE FOR ADDRESSING CUMULATIVE IMPACTS

The value of a social license to operate is increasingly recognised within the extractive resource industries (Kurlander, 2001). Resource developers are more aware that unmitigated impacts have the potential to delay or even prevent expansion of mining in existing and prospective areas as a result of community opposition. Consultations with industry and government representatives, by one of the authors, have revealed that in the past industry has been reluctant to assume the burden of remedying the cumulative impacts of actions for which it may not be individually responsible and governments have been reluctant to make investments due to uncertainty about the scale of resource development, particularly given the tendency for

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boom and bust cycles. Communities and local governments are increasingly demanding greater attention to the assessment and management of cumulative impacts, particularly in the presence of multiple mining operations (URS, 2000; Freeleagus, 2006; Brereton *et al.*, 2008, QLD DIP, 2008; CCAG, 2008) and a collaborative space is emerging to address these issues (Brereton *et al.*, 2008).

Cross-industry coordination and partnerships are increasing. Precompetitive research and development has long been a part of industry practice, but now a post-competitive space is emerging where synergies and coordinated monitoring, mitigation and enhancement programs are embarked on in the stages after mines have established. Difficulties remain because of differences in the timing and phases of development, the attribution of responsibility, the attraction of exclusively branded spending and the differences in corporate culture. Cumulative impact management can also level the playing field in which companies operate. When environmental and social systems reach their capacity to absorb impacts, effective allocation can share the burden of staying within limits or thresholds across all who are contributing to a problem, rather than leaving the last development in line to suffer the consequences of stricter standards or the prospect of the activity not proceeding.

With regard to environmental and social impact assessments most jurisdictions now require cumulative impacts to be comprehensively addressed. When development proposals attract public controversy the lack of attention to analysis of cumulative impacts can be an area where further assessment is requested, which can lead to delays in approval or even rejection of the proposal. The quality of cumulative impact analysis is commonly raised as an area of concern in community consultation and impact statement public submissions. Approvals can be challenged in the courts and the insufficient treatment of cumulative impacts can be an easy target for litigation (Kennett, 1999). For example, at Newmont's Carlin Trend gold deposits in Nevada a court ruled that the environmental impact statements (submitted in 1997) did not adequately consider the potential for cumulative impacts arising from the proposal to expand the mines, thus sparking an 11 year delay (Pettit and Grotbo, 2008). Even in cases where legislation does not explicitly mention cumulative impacts courts may rule to mandate their inclusion. For example, the Australian Commonwealth *Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act)* provides for an impact assessment function that is triggered in cases where the Minister believes there to be likely impacts on matters of national environmental significance from a proposal. While the act does not mention cumulative impacts a series of Federal Court rulings have interpreted the act in such a way that the Minister must consider cumulative impacts when considering the significance of an action<sup>4</sup>.

At a national and international level the International Council on Metals and Mining (ICMM) and the Minerals Council of Australia (MCA) have both specified standards and principles that require the consideration of cumulative impacts when proposing developments (see ICMM Principal 6; ICMM, 2008; MCA, 2005).

The quality of life of employees is a priority for companies competing to attract skilled workers. Pressure on social infrastructure, such as schools, childcare, health services from the demands of mining operations and deterioration of environmental conditions such as air quality and water quality can reduce the amenity of resource communities and the attraction and retention of staff. Proactive planning has the potential to avoid impacts and result in significant cost savings

when compared to unplanned solutions. There are many areas where resources are not the limiting factor to better cumulative impact assessment and management, including better information on future activities and data sharing and opportunities exist for efficiency gains through reduced duplication. More effective coordination of existing resources devoted to mitigation and management may go a long way toward mitigation.

## FIVE STRATEGIES FOR BETTER CUMULATIVE IMPACT ASSESSMENT AND MANAGEMENT

There are a large number of approaches that may assist in cumulative impact assessment and management. These include methods to improve project level and strategic impact assessments, coordination and planning, research, information and data sharing, mitigation and enhancement programs, collective monitoring, advocacy, networks and forums (Franks, Brereton and Moran, 2008).

When deciding where to prioritise cumulative impact assessment and management efforts an obvious start is to coordinate between the multiple operations of a single company. Cross-industry and multi-stakeholder partnerships can simultaneously offer greater outcomes and challenges. Likewise early consideration and planning may identify areas where processes may be modified to eliminate or generate impacts before it becomes necessary to reduce, mitigate or enhance them. Beyond these rules of thumb strategies should demonstrate the capacity for outcomes, be relatively easy to implement and cost effective. In the following section we present five collective strategies that we believe meet these criteria.

### Strategy 1 – understanding and assessing the accumulation and interaction of impacts

Understanding the ways by which impacts accumulate and interact is crucial for informing more practical strategies to avoid, mitigate, or enhance impacts. Such information is necessary across the life-cycle of mining projects, but is usually collected during impact assessments and ongoing monitoring. Impacts may accumulate in a number of ways and a differentiated approach is needed for measurement and management. Brereton *et al.* (2008) distinguish between three categories of impacts, namely, spatial, temporal and linked impacts:

*Spatial impacts* are those which occur over an area. Spatial impacts may vary in both extent and intensity. A *spatial extent impact* may consist of the area over which vegetation has been cleared for mining, while *spatial intensity impacts* may occur in areas where there is overlap between spatial extent impacts from more than one source, such as an area of dust deposition where the source of the dust is several upwind mine sites.

*Temporal impacts* are those that vary over time. *Simple temporal impacts* have a specific time of commencement and a measured form over time, for example the economic activity in a nearby town tracing a similar time series to the production of a group of mines. *Offset temporal impacts* occur when multiple simple temporal impacts are superimposed upon one another over time. The simplest types are where the same simple temporal impact comes from one mine at time  $t$  and from a second mine at time  $t + i$ . Materials moving through rivers are a good example. When one mine opens offset in time from another it may become very difficult to separate contributions from each given that they are in different phases of their likely maximum outputs to the rivers.

*Linked impacts* involve more complex interactions such as where one impact triggers another or where a single activity has multiple effects. *Linked triggered impacts* are those that occur when one impact either by its occurrence or by reaching a threshold level, triggers another impact that would not otherwise

4. See for example: Brown versus Forestry Tasmania, Wielangta Forest decision, 2006, FCA F1729; and Queensland Conservation Council Inc versus Minister for the Environment and Heritage, Nathan Dam case, 2003, FCA 1463.

have occurred. The second impact is the triggered impact. An example of a triggered impact would be when the economic activity in a town, associated with multiple mines operating, becomes sufficiently large for a new amenity to be financially viable, eg a new shopping outlet. Similarly, as the population of a community grows it is able to support activity networks such as sporting teams. *Linked associative impacts* occur where multiple impacts occur as a result of a single event or change as a result of opening a new mine, expanding a mine or changing operations. An example of this type of impact may be where financial support or the population maintenance in a town allows a school to remain open or some other form of educational facility to open. A wide range of potential benefits can flow to the community as a result of the availability of local education facilities.

An additional cleavage that is evident in cumulative as well as direct and indirect social and environmental impacts is whether the impact is a source or sink. A sink impact results from the addition of material to a receiving environment (eg coal dust, greenhouse gas or social spend). A source impact results from changes to existing natural, social, human or economic capital (eg the water draw from a river or pressures on health services). For both source and sink impacts it is important to have a good understanding of the nature of the impact and the responsiveness of the environment receiving the impact. Arguably the interaction between sink impacts and their environment are better understood in the mining context than source impacts. This is probably because the attention paid to impacts, such as air and water quality, has led to research to define thresholds above which impacts are considered significant. With the exception of air quality (most notably greenhouse gases) the spatial extent of most sink impacts arising from mining are local (vibration, noise, dust and amenity) and more clearly bounded (eg watersheds, airsheds and bioregions). Source impacts, such as changes to surface and groundwater, biodiversity, social services, human resources (skills and employment), social infrastructure (housing, health services) and community cohesion (volunteering) can be difficult to understand in both baseline and impacted states and may extend across ill-defined spatial extents.

The type and characteristics of cumulative impacts and the relationship between impacts is important when considering which management strategies may be most effective. Management of sink impacts may consist of the selection of a particular technology or emission standard, while for source impacts usually management involves the determination and enforcement of thresholds and limits, and methods of allocation of the resource being utilised. Market based instruments, particularly trading schemes and offsets, have become a popular method to manage source and sink impacts as they can be an efficient way of allocating entitlements or offsetting consumed natural capital. As most sink impacts act over a local domain, the contribution of the industry to the impact can be more easily ascertained and mitigated. By contrast, the impact of one of a number of mines to the demand on regional health services, for example, is quite difficult to ascertain.

The interaction of impacts can be modelled by understanding the pathways by which activities lead to effects (Brismar, 2004). Cause-effect relationships are often difficult to establish, particularly for linked impacts. An activity may contribute toward existing stresses within social and environmental systems generated from other (non-mining) activities or may generate multiple stresses and effects. Research helps to understand the processes of impact generation, accumulation and interaction. Research can develop and test technically-rigorous methods that can be applied to identify system thresholds, social limits, triggers to changes in system state, non-linear functional relationships, temporal and spatial extents of impacts, synergism between impacts and the pathways of effects. Through understanding the cause and effect relationships of impacts, management can be tailored to achieve specific outcomes.

Thresholds and limits are difficult to determine and can be poorly understood, particularly in regions of transition or where little baseline information exists. Sometimes assessments proceed in the absence of information on thresholds or limits or under the assumption of a linear system. In such cases it is important to be conservative when estimating the capacities of social and ecological systems. Thresholds refer to scientifically defined points where undesirable changes result if they are exceeded. Limits consider what may be acceptable to the community as determined through consultation. Threshold analysis should be undertaken over meaningful time scales and are best determined collaboratively (Duinker and Greig, 2006). Not all impacts can be separated and analysed independently because they do not exist in isolation of the ecosystem and social context. A project may exhibit undetectable effects that are thus declared insignificant but when in concert with other activities amount to a significant consequence.

## Strategy 2 – collective community reporting

In circumstances where multiple mining operations are located in close proximity to a single town or community there is often an absence of information that provides comprehensive overview of industry investments, activities, aggregate impacts and the state of environment. While impacts are experienced by communities, economies and environments cumulatively, reporting and communication almost exclusively presents information only on individual companies or operations. Such information can be incomplete, repetitive and overwhelming for community to digest and read. Collective reporting to the community on the economic, social and environmental performance of the industry may be more effective at communicating the overall contribution of the industry and the totality of activities and impacts.

Reporting may consist of information on direct and indirect employment, the provision of training opportunities, local business spend, contribution toward government and financial and in-kind support for community programs. Complaints patterns and trends may be presented alongside the responses of individual mines and collective efforts to mitigate activities (Moran *et al*, 2007). More broadly, efforts to avoid, mitigate, or enhance impacts can be presented, including details such as management of visual impacts (Moran *et al*, 2007), land disturbance, water usage and water quality, and dust and air quality. Research commissioned on the measurement and management of impacts may also be presented.

Some areas are best addressed on an operation specific level and the consistency of data and methodologies may need to be addressed to present aggregate information. Regional organisations and industry bodies are best placed to coordinate such efforts, however, the absence of a representative organisation is not necessarily prohibitive.

The Regional Aquatics Monitoring Program and the Wood Buffalo Environmental Association in Alberta, Canada, are examples of collective approaches to monitoring and reporting. Both of these organisations monitor the impacts of the oil sands industry on water and air sheds in the region of Wood Buffalo. These multi-stakeholder organisations have a membership that includes resource companies, environmental, indigenous and community organisations and government agencies. The data generated from the regional monitoring programs is shared with stakeholders and the public. Both organisations periodically present aggregated data as community updates (RAMP, Wood Buffalo Environmental Association and the Cumulative Environmental Management Association, 2008).

The Hunter River Salinity Trading Scheme (HRSTS) is another excellent example of how partnerships can be developed between key stakeholder groups to monitor, mitigate and report cumulative impacts. Due to the pressures on the Hunter catchment from mining, agriculture and electricity generation, a

comprehensive monitoring and regulation framework, the Salinity Trading Scheme was trialled in 1994, and implemented in 2003. Under the trading scheme, salty water can only be discharged when the salt concentration in the river is low. Under low river flow conditions no discharges are permitted, under high flow conditions limited discharges are allowed, as determined by a system of tradable salt credits, and under flood conditions unlimited discharge is permitted (up to a threshold salt level; NSW EPA, 2003)<sup>5</sup>.

The ownership of credits, their price and the volume and concentration of discharges are publicly reported to the community.

### **Strategy 3 – cross-company networking, forums and working groups**

Informal and formal networks can provide important opportunities to exchange experiences at the operational and strategic level to better manage the impacts of multiple activities. Informal networks are relatively common within the industry both within and between companies. Such professional networking is an opportunity to exchange ideas and advice and communicate approaches (both successes and failures). More formal networking arrangements such as forums of mine managers and professional staff provide an ongoing opportunity to discuss common issues and coordinate activities.

Multi-stakeholder working groups are an opportunity to facilitate partnerships around a particular goal. At a broader level, working groups can share strategic information, develop and coordinate solutions, undertake research into best practice and assessment methodologies and facilitate cross-sector communication. At a resource province level, local working groups can provide ongoing engagement and feedback to resource companies, identify and deliver preferred strategies, programs and projects that are consistent with regional planning. For example, the Pilbara Industry's Community Council (PICC), is an industry led multi-stakeholder body in Western Australia that currently has an indigenous employment program and a stream on improving towns (CME, 2008). PICC consists of representatives from the iron ore, and petroleum industries, the Commonwealth, Western Australian and local Governments, Pilbara communities and the Chamber of Minerals and Energy Western Australia (CME, 2008).

### **Strategy 4 – cross-company community engagement**

The mining industry has developed well established community consultation arrangements, including formal committees. Community engagement is currently conducted mainly at the individual mine level (in some cases as a legislative requirement) leading to multiple community consultative committees in regions of intense resource development. Anecdotal evidence suggests that this can have the effect of becoming repetitive and demanding on community representatives and can lead to 'consultation fatigue'.

Joint multi-mine engagement mechanisms may be better able to address the issues at a broader level and facilitate a more collaborative approach to managing issues associated with community impacts. The tasks of such a consultative committee would be to inform stakeholders of actions taken by the industry

to manage multi-mine impacts; provide a forum for feedback and discussion of issues and solutions; and identify and plan collaborative initiatives to contribute to the development of the region. Representation from groups such as youth and aged organisations, local business, tourism, health, welfare, policing and education in addition to environment, government and community groups would help to ensure a broad range of issues are covered. A collaborative approach may also result in efficiency gains, reducing the time and resources spent on multiple consultative committees. Joint committees would still need to address operation specific issues and account for the overlapping phases of mining development. In the absence of a collective approach informal coordination across mining operations on the timing of community consultation initiatives can better facilitate community input and help reduce any consultation burden.

### **Strategy 5 – coordination of community and environmental investments**

Most mining operations have sponsorship and donations programs to financially support community activities such as schools, clubs, societies, community events and natural resource management. In the presence of multiple mining operations an opportunity exists to focus and coordinate these investments to target community and environment needs and generate the best value for each spend through pooling resources.

Individual mining companies are already coordinating community development with community priorities and identified needs at a site and regional level. For example in the town of Clermont, in the Bowen Basin of Queensland, Australia, Rio Tinto has responded to local government requests for infrastructure development by facilitating a community strategic planning initiative called the Clermont Preferred Futures. Sponsored by Rio Tinto, yet led by the Belyando Shire Council and facilitated by the Institute for Sustainable Regional Development at Central Queensland University, the community plan is a strategic framework to guide development in the community over the coming two decades and ensure investments meet community goals (ISR, 2008). The planning exercise is an example of a single company initiative to manage the impacts of multiple operations within its portfolio.

Initiatives that involve multiple mining companies can present greater challenges because the reputational benefits of branding investments may limit the enthusiasm to pursue joint programs with competitors. However, the benefits of coordination are most obvious at the stage of selecting which projects to pursue, so that priority areas are targeted and synergies maximised. Collaboration to determine community and environment needs and priorities could occur independently of the delivery phases where organisations may choose to exclusively brand activities. For larger investments cobranding can have the effect of demonstrating a cohesive industry.

At the broader level there are three types of investment to manage cumulative impacts. These are: mitigate/enhance the impacts of past and existing development; mitigate/enhance the impacts of the project under development or consideration; or mitigate/enhance the impacts of potential future projects (or, in the case of regulators, consider whether and how these projects should proceed; Duinker and Greig, 2006). Sometimes the most effective approach may not be to target impacts generated from mining but to invest 'off-site' to ameliorate or enhance impacts generated by other activities. Partnerships with organisations, service providers, governments, other mining companies and peak industry bodies can be effective in mobilising greater resources, leveraging investment and coordinating activities to respond to complex issues.

5. Stakeholders hold a licence for a certain number of credits which permits them to discharge salt into a river block in proportion to the number of credits they hold (one credit allows the holder to contribute 0.1 per cent of the total allowable discharge). There are a total of 1000 credits in the trading scheme; these may be traded among stakeholders in the marketplace (NSW EPA, 2003).

## CONCLUSION

Issues that have manifest in an aggregate sense as a result of multiple activities, policies and behaviours are best approached collectively. In this paper we have presented five priority collective strategies for resource companies to assess and manage cumulative impacts. These approaches are drawn from a multi-year study on the assessment and management of cumulative impacts in the Hunter Valley, New South Wales and a follow-up study to improve cumulative impact assessment and management practice in the Australian coal mining industry. More advanced approaches, such as the facilitation of 'industrial' synergies, the collective management of data, proactive management on the timing and location of developments, the coordination of information on planned developments, and multi-stakeholder regional monitoring and threshold definition, could build on the strategies outlined here. There is much to gain from increased consideration of cumulative impacts. Proactive management of cumulative impacts can help avoid or enhance impacts, make better use of existing resources, benefit regional environments and communities, and contribute to the industry's social license to operate.

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