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Coal Miningⁿ

Managing the cumulative impacts of multiple mines on regional communities and environments in Australia

Daniel Franks, David Brereton and Chris Moran

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Dr Daniel Franks is a Research Fellow in, and Professor David Brereton is the Director of, the Centre For Social Responsibility in Mining, Sustainable Minerals Institute, The University of Queensland, Brisbane Queensland 4072, Australia; Emails: D.Franks@smi.uq.edu.au and D.Brereton@smi.uq.edu.au; Tel: +61 7 3346 3164; Fax: +61 7 33464045. Professor Chris Moran is the Director of the Sustainable Minerals Institute, The University of Queensland; Email: C.Moran@smi.uq.edu.au. The research was supported financially by The University of Queensland and the Australian Coal Association Research Program. This paper was originally presented as 'Developing Good Practice for Managing the Cumulative Impacts of Coal Mining on Regional Communities in Australia'.

Coal Miningⁿ : Managing the cumulative impacts of multiple mines on regional communities and environments in Australia

Regional communities and environments in Australia have experienced the rapid transitions associated with expansion of the coal mining industry and now face the prospects of industry contraction as a result of declining global resource demand. While communities have benefited from the expansion of the coal industry through the creation of jobs and the investment in economies the compounding impacts of multiple mining operations have stretched environmental, social, human and economic capital. Such change has multiplied the extent, magnitude and profile of cumulative (or multi-mine) community, economic and environmental impacts and rendered conventional mine-by-mine approaches to management and mitigation ineffective. In this paper we draw from examples in the Bowen Basin, Hunter Valley and Gunnedah Basin to traverse the range of impacts resulting from mining activities and detail management and assessment practices drawn from working examples that have aimed to enhance positive, and avoid and mitigate negative, cumulative impacts.

Keywords: cumulative effects, impact assessment, coal mining, sustainability, social license, regional development, landscape level planning, strategic assessment, community development.

Effective management and assessment of cumulative impacts requires holistic understandings, co-ordination, integration and co-operation. However, the overwhelming number of components and complexity of interactions that contribute to cumulative impacts challenges our institutions and methodologies. Institutional, discursive, information and communication barriers must be overcome and approaches must be adopted that are flexible enough to cope with the varied interests and constraints of diverse stakeholders. In short, cumulative impact management and assessment demands a multitude of tailored approaches to reflect the multitude of situations in which cumulative impacts manifest.

Cumulative impacts can be what is most important to communities and environments because cumulative impacts are what they experience (Kennett, 1999). Multiple mining operations may demonstrate additive effects (e.g. mine impact + mine impact), compounding effects (e.g. mine impact x mine impact or mine impactⁿ), or may breach triggers or thresholds that when surpassed result in changes to the state of systems. Mine impacts may also interact with the impacts of other past and current activities. The proactive management and assessment of cumulative impacts by industry and government has the potential to benefit regional environments and communities and contribute to the industry's social license to operate. Resource provinces in Australia have experienced major transitions associated with an extended period of growth and are coming to terms with the compounding effects of multiple operations in a landscape already under environmental, economic and social strain. These same regions now face the prospect of declining demand and the associated economic and social impacts that may accompany industry contraction. Resource development continues to bring economic and employment benefits to towns and regions, however the distribution of positive and negative impacts is uneven in scale and dimension as well as in space and time.



Figure 1. Bulk carriers queuing to load coal from the Hunter Valley off Newcastle, New South Wales, Australia. Rapid resource expansion since 2003 has stretched economic, social infrastructure and environmental systems. In mid 2007 the coal loading bottleneck was between 70 and 80. In July 2008 the cue was reduced to 40 (source: James Croucher, The Australian Newspaper, 2007).

Effective assessment and management of cumulative impacts is not easy but successful examples do exist that can be drawn from to guide future approaches. In this paper we detail management and assessment practices from working examples. First we discuss cumulative impacts in a mining context and describe the characteristics that may be important for tailoring assessment and management. Second we introduce three major Australian coal resource provinces and the challenges confronting each region: the Hunter valley in New South Wales, a mature high density mining region with 19 mines and 7 developments under consideration and construction; the Bowen Basin in Queensland, a relatively dispersed mining region with 34 active mines and 30 mine developments and expansions underway; and the Gunnedah Basin in New South Wales, a prospective region with 4 mines and 3 planned developments. Third we outline management and assessment practices adopted to respond to the diversity of cumulative impacts in these regions and provide recommendations for how the Australian coal mining industry can improve current practice. We traverse approaches such as project based cumulative assessment, strategic assessment, coordination and planning, research, information and data sharing, mitigation and enhancement programs, collective monitoring, advocacy, networks and forums. We provide examples of collaborative arrangements including, multi-stakeholder, government, single company, multiple company and cross-industry approaches.

Cumulative Impacts in the Mining Context

In the broadest sense, cumulative impacts are the successive, incremental and combined impacts of an activity on society, the economy and the environment (Brereton et al., 2008; Damman et al., 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 (homotypic impacts), as well as the interaction of mining impacts with other past, current and future activities that may not be related to mining (heterotypic impacts; Canter and Kamath, 1995). 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. Rapid resource development in several Australian mining provinces has led to increased attention on 'cumulative impacts', however the

compounding effects of multiple mine closures (a kind of 'reverse' cumulative impact) can be as challenging for regional communities and economies.

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 pollution to a receiving environment (e.g. coal dust or greenhouse gas). A source impact results from the draw down, or growth of, environmental, social, human or economic capital (e.g. the water draw from a river or the growth of skills from training programs). For both source and sink impacts it is important to have a good understanding of either the capital being drawn on or the environment receiving the impact, and importantly the responsiveness of both to 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 of the attention paid to impacts such as air and water quality has led to research to define thresholds after which impacts are considered significant. With the exception of air quality (most notably greenhouse gases) the spatial extent of most sink impacts arising from coal mining are local (vibration, noise, dust, and amenity) and more clearly bounded (e.g. watersheds and bioregions). Source impacts, such as the drawdown of 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 different impacts can be important when considering which management strategies may be most effective. Management of sink impacts may consist of requiring 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 impacts as they can be an efficient way of allocating entitlements or offsetting consumed environmental capital. As most sink impacts are point source the contribution of the industry to the impact can be more easily ascertained and mitigated. The impact of one of a number of mines to the demand on regional health services, for example, is quite difficult to ascertain. Point source impacts may also be more unique to the coal mining industry and thus may not exhibit the complexities of contributions from other activities and industries.

The Australian Coal Industry

Australia is the world largest exporter of black coal and the fourth largest producer. The industry generates \$AUS 24.3 billion in exports and directly employs 28,000 people (ABARE, 2008; MCA, 2008). Black coal production in Australia has increased from 345 Mt (raw) and 273 Mt (saleable) in 2001-02 to 417 Mt (raw) and 325 Mt (saleable) in 2007-08 (ABARE, 2008). Queensland is the largest producer of black coal in Australia. In 2007-08 Queensland produced 229 Mt (raw) up from 135 Mt a decade earlier (1997-98; ABARE, 2008). The large majority of operations are in the Bowen Basin followed by the Surat, Galilee, Clarence-Moreton and Tarong Basins. New South Wales is the second largest producer of black coal in Australia. In 2007-08 the state produced 177 Mt up from 134 Mt a decade earlier (1997-98; figures are for raw coal; ABARE, 2008). The Sydney Basin (that includes the Hunter coalfields) hosts the large majority of mines, with Gunnedah emerging as a prospective region.

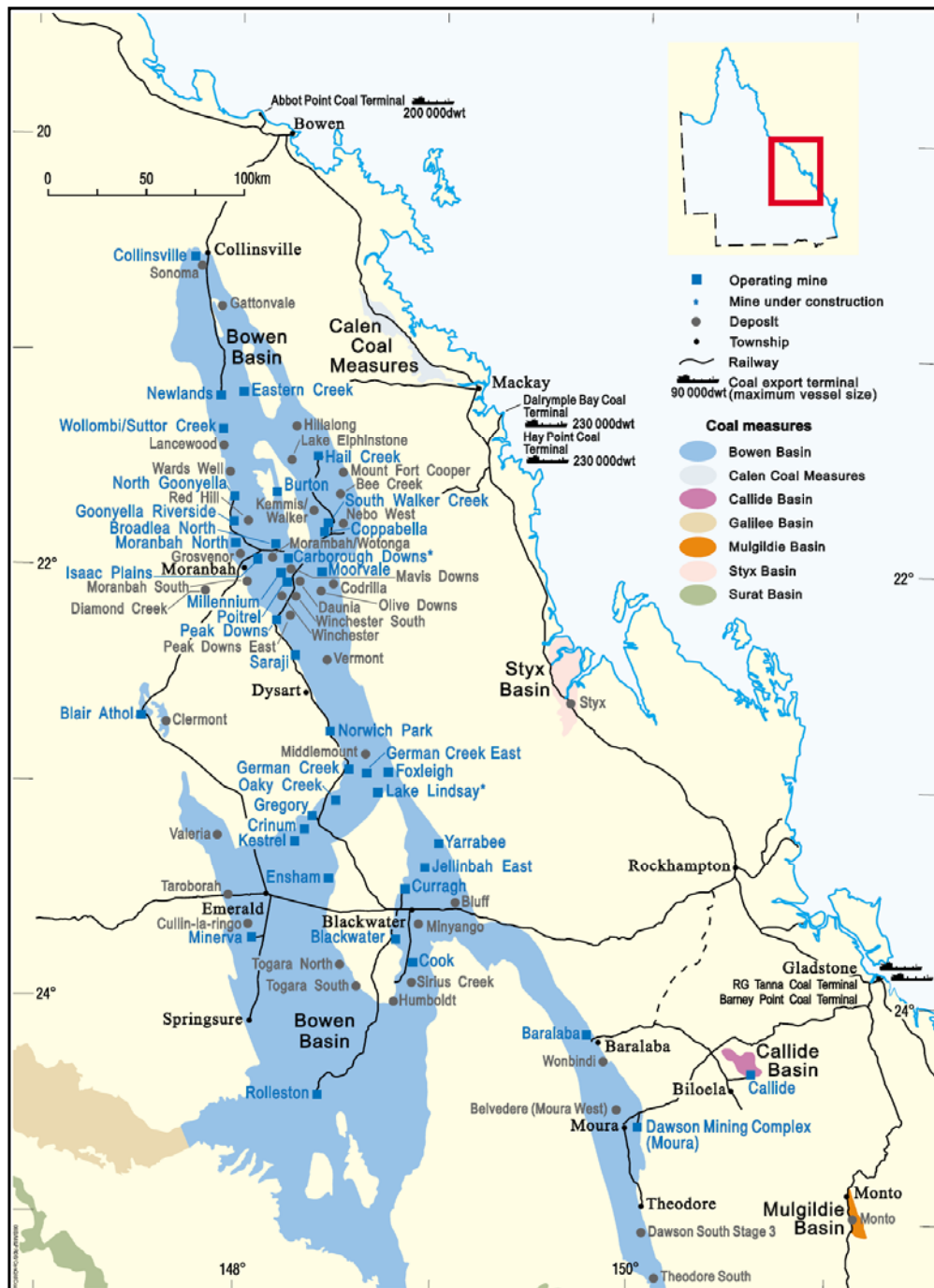


Figure 2. Coal mines and deposits of the Bowen Basin, Queensland (source: Queensland Department of Mines and Energy, 2007b).

Bowen Basin³⁴

The Bowen Basin covers an area of approximately 60,000 km² in Central Queensland stretching from Collinsville in the north to Theodore in the south (Figure 2). The Basin hosts 34 operational mines and produces over 100 million tonnes of black coal annually (Qld DIP, 2008b). A further 22 mines and 8 expansions are under development (ISRD, 2008). The Bowen Basin is a relatively dispersed mining region due to the size of the Basin and the relatively even distribution of the mining operations, though there are a number of locations where operations are closely spaced (e.g. Moranbah). The

Bowen Basin is serviced by communities including Collinsville, Nebo, Glendon, Moranbah, Clermont, Dysart, Middlesbrough, Tieri, Emerald, Blackwater and Moura (see Figure 2). The Basin has a total population of around 70,000, with an additional 10,000 non-resident workers in company accommodation (e.g. single persons quarters) while on roster that fly-in fly-out (FIFO) and drive-in drive-out (DIDO) to the coastal centres of Mackay, Rockhampton, Gladstone and Bowen (Qld DLGPR, 2006). Coal from the Basin is mostly exported through ports at Mackay, Gladstone and Bowen. Glendon, Dysart, Tieri, Middlesbrough, Blackwater and Moranbah are purpose built mining communities, while other communities co-exist with rural industries, particularly grazing.

Reference to cumulative impacts in the Bowen Basin is usually in the context of social and human capital and economic infrastructure. The region is experiencing shortages in affordable accommodation and housing (e.g. rents in Emerald and Moranbah are up to 95% more expensive than the state capital city of Brisbane; Rolfe et al. 2007), skills shortages in trades, difficulties in retaining staff in the non-mining sectors, and pressure on community services such as child care, employment and skills training, health and education. The transformation to a camp based workforce and FIFO and DIDO work and travel arrangements in Queensland whereby workers reside in coastal towns and commute to mining regions for extended shifts has been a notable feature of the industry over the past decade. At some operations a shortage of single person accommodation has led companies to adopt hot-bedding practices whereby night shift and day shift workers alternately occupy the same room. In addition to the issues identified above participants of a Resource Community Summit in the Bowen Basin town of Dysart in November 2008 identified the following issues: community preference for mine workers to reside in towns rather than mine site camps, maintenance and funding for roads, disruption to agricultural enterprises from exploration activities, water quality issues, the impact of mining on flood plains, the impact of 12 hour shifts such as driver fatigue, and pressure on local medical and dental services (Qld DIP, 2008b). Where mining operations are located close to towns, such as around Moranbah, the impacts of dust, noise, visual amenity and vibration are also evident.

*Hunter Valley*¹⁹

Located in New South Wales to the North West of Sydney, the Hunter Valley is a mature high density mining region. The Hunter Valley coalfield hosts 19 mines with 7 developments underway and produced 110.8 Mt of raw coal in 2006-07. The Hunter Valley is one of a number of coal fields within the Sydney Basin (Figure 3). Coalfields in the vicinity of the Hunter Valley include the Western coalfield (10 mines, 7 developments, 21.7 Mt), the Newcastle and Gloucester coalfields (14 mines, 2 developments, 13.4 Mt), the Central coalfield (no active mines), and the Southern coalfields (8 mines, 2 developments, 13.4 Mt; NSW DPI, 2008).

The Hunter Valley is approximately 50km in width and 100km in length, and has a population of around 50,000 people. The region is located in the headwaters and upper reaches of the Hunter River and the main towns of the region are Singleton, Muswellbrook, Denman, Aberdeen and Scone. Traditionally a rural-based economy the Hunter is now known for equine and wine industries, coal mining and energy production. Reference to cumulative impacts in the Hunter Valley is usually in the context of environmental and amenity impacts (dust, water quality, noise, vibration, greenhouse gases, biodiversity, health, and scenic amenity) though social impacts are also important. In towns like Muswellbrook there was a distinct shift in focus during the early 1990s from a community focus on direct impacts to one of cumulative impacts of multiple mining operations (URS, 2000, 199). Muswellbrook formerly a rural town in a dairy and farming district is now surrounded by 5 mining operations (Figure 4). The main cumulative issues of concern to the community in Muswellbrook are feelings of 'social dislocation' and changing sense of place, biodiversity, dust, noise, vibration, visual amenity, water quality and community infrastructure (Brereton et al., 2008; URS, 2000, 192, 219).

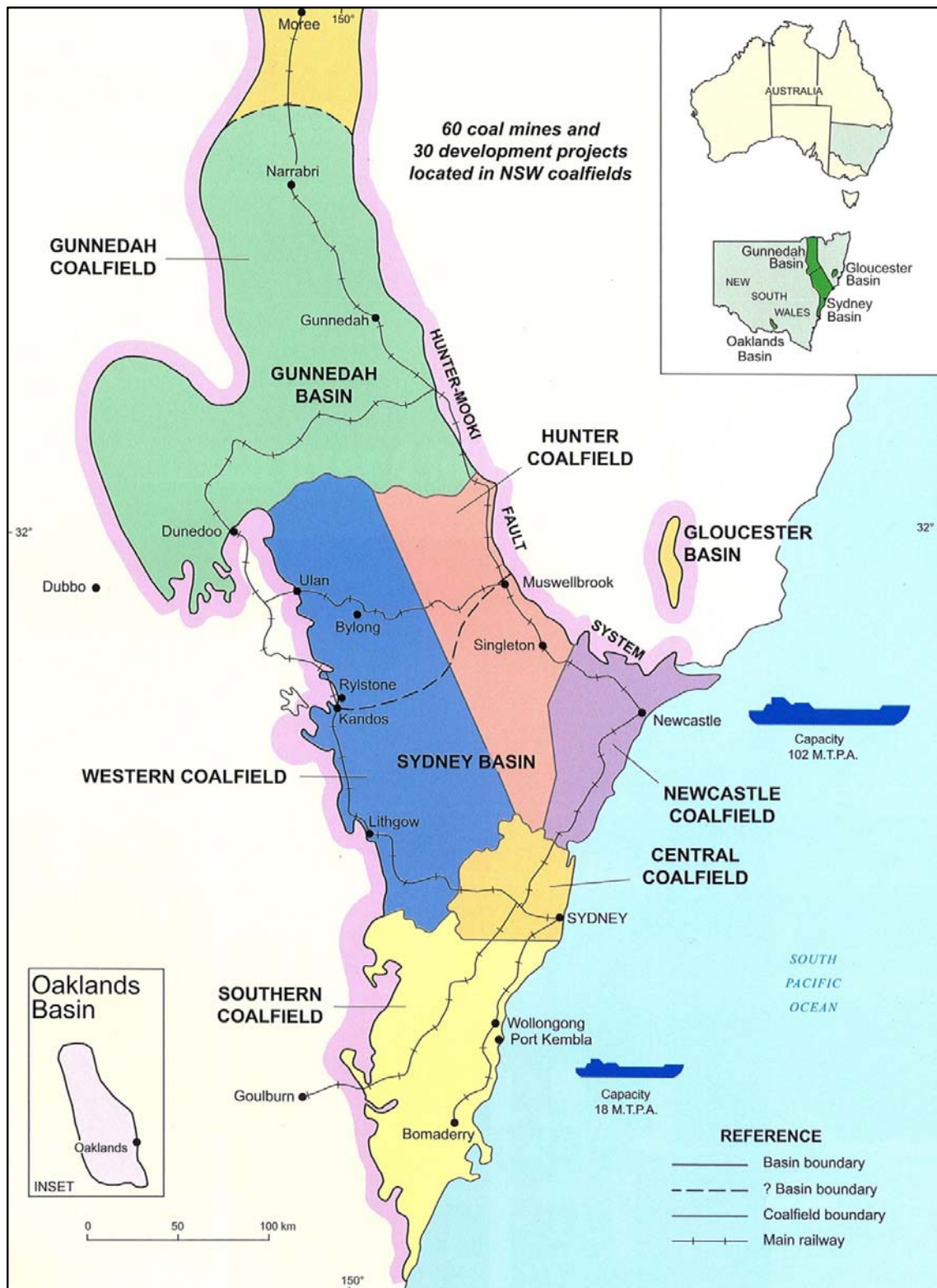


Figure 3. Coal mining regions of New South Wales (source: NSW DPI, 2008).

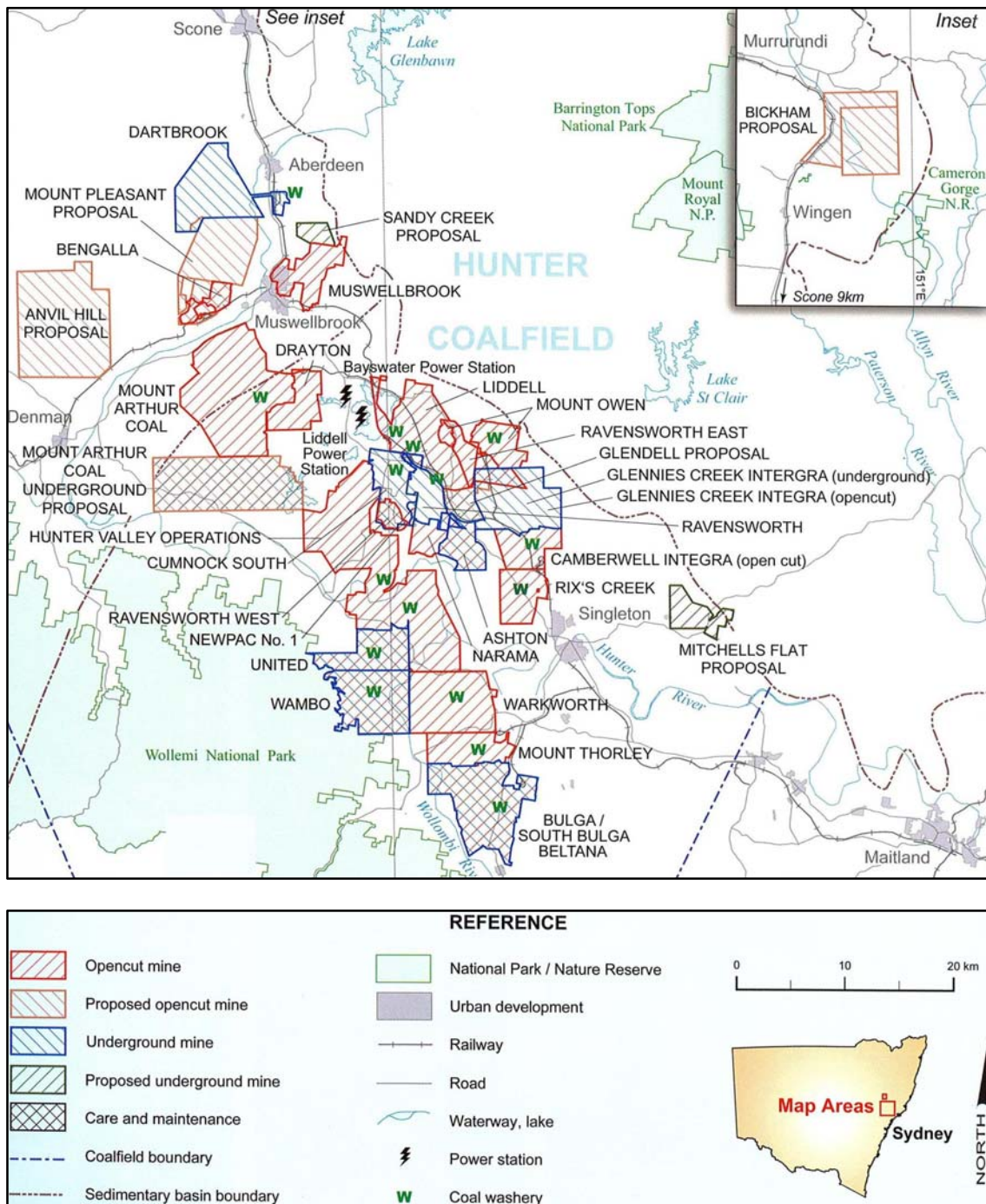


Figure 4. Coal mining operations of the Hunter Coalfield (source: NSW DPI, 2008)

Gunnedah⁴

The Gunnedah Basin is often touted as the next major coal province in New South Wales (Freed, 2006). There are 4 current and 3 proposed coal mining projects in the Basin. In 2006-07 the Basin produced just 3.7 Mt of coal, however, the New South Wales government projects the development of a number of small to medium sized mines with prospects for larger operations in the coming decade (NSW DPI, 2008). The Basin is approximately 150km wide and 200km in length, stretching

from Dunedoo in the south to Narrabri in the north (Figure 3). Towns in the Basin include Gunnedah, Tamworth, Quirindi, Narrabri, Caroon, Curlewis and Coonabarabran.

The Liverpool plains, one of Australia's most productive farming regions is also located in the Basin. These black soil alluvial plains are located between Gunnedah in the north and Murrumbidgee in the south and produce around one third of the country's durum wheat and one fifth of its sorghum. BHP Billiton began exploration in the area in 2006 with the view to establish an underground longwall mine (the Caroon Coal Project). The exploration lease was awarded by the New South Wales Government through a competitive tender. The farming community is concerned that ground and surface waters may deteriorate or become cross-contaminated as a result of mining; that the region lacks detailed hydrological mapping and knowledge; that subsidence from longwall mining will alter the features of the flood plain that make it attractive to farming; and that pollution may reduce air, land and water quality. In 2006 landowners formed the Caroon Coal Action Group (CCAG). The group believes that the New South Wales *Mining Act* 1992 and the *Environmental Planning Act* 1979 do not provide adequate regulatory protection to ensure that "the cumulative offsite impacts of mine developments" are assessed and managed effectively (CCAG, 2008). In July 2008 the group blockaded BHP Billiton from accessing land for exploration drilling after the New South Wales Mining Warden had issued an injunction to force a landowner to provide site access. The CCAG has vowed to continue the blockade until an independent study of ground and surface water is agreed to for the region. BHP Billiton has made a public commitment to maintain the groundwater values of the region and in an attempt to ease community and landowner concerns announced in August 2008 that any future mines would not be located on the flood plain. Instead mining would be confined to the ridge country. The company modified its exploration activities to reflect this commitment, however, CCAG remain concerned about the links between the groundwater systems of the ridge country and the flood plain.

Assessing Cumulative Impacts

Cumulative impact assessments in New South Wales and Queensland are most commonly undertaken by proponents as part of mandated project level assessment and by governments as part of strategic assessments. Project level assessments in both Queensland and New South Wales consist of the same basic process:

- 1) the production of an initial advice statement (Queensland) or application for approval (New South Wales) by the proponent that broadly outlines the scope of the proposal;
- 2) the development by the relevant agency of a Terms of Reference (Queensland) or report detailing the environmental assessment requirements (New South Wales) to be covered in the assessment (in Queensland the ToR includes provision for public comment, while in NSW the requirements must take into account the views of other government agencies);
- 3) the production of the Environmental Impact Statement (EIS) by the proponent;
- 4) a period of public review and comment, and if required by the relevant authority, a supplementary report to address issues raised by public submissions; and
- 5) an agency/Ministerial decision whether to approve the proposal and an environmental assessment report that provides an overview of the process and indicates whether the EIS has complied with the act.

Table One lists the requirements to address cumulative impacts in relevant Australian, Queensland and New South Wales legislation and EIS terms of reference. In Queensland mining projects are commonly assessed under the *Environmental Protection Act* 1994. In such cases the process is managed by the Queensland Environmental Protection Agency (EPA). Impact statements are accompanied by Environmental Management Plans, which outline ongoing monitoring and treatment of impacts and establish the conditions for an Environmental Authority (permit). Projects considered 'significant' by the Queensland Government are required to be assessed under the *State*

Development and Public Works Organisation Act 1971. In these cases the assessment process is managed by the Coordinator General, a division of the Department of Infrastructure and Planning. In practice there is significant overlap between what is required under both systems, with the Coordinator General often basing the Terms of Reference (ToR) on the generic ToR developed by the EPA. The impact statements of 'significant projects' are required to be more detailed.

Cumulative impacts are not specifically mentioned in either the *Environmental Protection Act 1994* or the *State Development and Public Works Organisation Act 1971*. These acts both specify that an EIS must be written in the form requested by the agency and as such guidance on the type of impacts that need to be assessed are given in the ToR developed by the agencies (Table 1). While no definition of cumulative impacts is provided by the Queensland Government the EPA's generic ToR does provide some guidance by stating that cumulative impacts "must be considered over time or in combination with other (all) impacts in the dimensions of scale, intensity, duration or frequency of the impacts" (EPA, 2008). Evidence of collaborative management is also required.

Under the Queensland *Environmental Protection Act 1994* the development of Draft ToR is the responsibility of the proponent, with a period of public comment and then finalisation by the EPA. This procedure is designed to tailor ToRs to the specific features of each proposal (i.e. what is assessed). In practice this has led to the removal of references to the assessment of cumulative impacts in the ToR, when compared to the generic ToR provided by the agency (i.e. how it is assessed). This is most likely due to the perception by proponents that cumulative impacts are only relevant in areas of high mining density and the difficulty of cumulative impact assessment. More recently the EPA has demanded closer alignment to the generic ToR, arguing that the generic ToR represents the 'approved form' as required under the act and this change has led to a more comprehensive treatment of cumulative impacts within final ToRs.

Cumulative impacts also play a role in the consideration of the level of impact assessment required. The Queensland EPA (2000) considers the potential influence cumulative impacts may have on the overall impacts of a proposal when deciding whether the proposal is a standard (does not require an EIS), non-standard (without the requirement of an EIS) or non-standard application (with the requirement of an EIS) under the *Environmental Protection Act 1994*.

In New South Wales impact assessment is regulated under the *Environmental Planning and Assessment Act 1979*. The act is supported by the *State Environmental Policy (Major Projects)* that was introduced in 2005 and defines the classification criteria for different levels of assessment. Mining projects generally fall into the 'Designated' and 'State Significant Development' categories (for more information see NSW DUAP, 2000, 2). The New South Wales Department of Urban Affairs and Planning has published a guideline for the preparation of EIS for coal mines and associated infrastructure (2000). The guidelines describe cumulative impacts as the result of "a number of activities with similar impacts interacting with the environment in a region...they may also be caused by the synergistic and antagonistic effects of different individual impacts ...[and] due to the temporal or spatial characteristics of the activities and impacts" (NSW DUAP, 2000, 37). Cumulative impacts are required to be considered when prioritising issues, in site selection, the assessment of potential impacts, and management (2000, 13, 15, 23). Proponents must consider the resilience and capacity of the receiving environment to cope with impacts, the relationship to other mines and infrastructure, and must refer to existing regional, cumulative and strategic studies (such as the Upper Hunter Valley Cumulative Impacts Study), catchment or cumulative water quality management strategies and compliance arrangements (2000, 3, 17, 23, 26, 37). For analysis of air quality the guidelines describe a suggested methodology of cumulative assessment (2000, 28) and compel the proponent to take into account the cumulative effects of other developments that have been approved but are yet to commence (2000, 29). Measures to avoid and mitigate river impacts through discharge schemes, trading or supply to and from adjacent mines and industries, and reuse opportunities are also to be considered (2000, 27).

At a federal level the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) also includes 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. Both Queensland and New South Wales have bilateral agreements with the Commonwealth to manage the assessments as a part of the State assessment process. While the EPBC Act does not specifically mention cumulative impacts a number 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 (see for e.g. *Brown v Forestry Tasmania*, Wielangta Forest decision [2006] FCA F1729; and *Queensland Conservation Council Inc v Minister for the Environment and Heritage*, Nathan Dam case, [2003] FCA 1463). 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, 10; MCA, 2005, 17, 23). The major coal producing companies are members of both ICMM and MCA.

Current Cumulative Impact Assessment Practice

Cumulative impact assessment in coal mining impact statements in New South Wales and Queensland is generally brief although the standard does appear to be higher in New South Wales, perhaps a function of the higher density of mines and the longer period of time in which cumulative impacts have been an issue of public concern. Recent Queensland examples exist where the only mention of cumulative impacts in the EIS is in the ToR attached as an appendix (in one such case the mine was situated close to several other coal mines). Impact assessments often claim an inability to consider cumulative impacts due to factors beyond the control of the proponent and commonly assert that capacity exists within a system to absorb pollution or demand on environmental, social, human and economic capital. Where analysis is attempted it typically consists of an aggregation of the contribution of the project to the impacts of existing activities and whether the increased impacts meet regulatory standards. Such analysis is almost exclusively conducted on sink impacts such as noise, air quality and traffic. Assessments rarely assess the effect of planned and foreseeable future projects and do not employ explicit methodologies to model plausible future scenarios, understand the pathways of interaction of cumulative effects, or determine or describe thresholds and limits.

Of course there are legitimate difficulties that proponents face when undertaking cumulative impact analysis. Information on the plans and activities of other current and future operations can be difficult to ascertain, impacts may have temporal and spatial extents beyond those which can be studied in a project level assessment, limits and thresholds may be poorly understood, particularly in regions of transition or where little research exists, and when information is available there are often issues with the compatibility of methodologies and data sets. A simple improvement that would assist the availability of data would be to create a repository of past impact statements (perhaps using existing infrastructure as a part of the refurbished Australian Agriculture and Natural Resources Online). The repository would also have the effect of promoting consistency in practice and methodologies. More comprehensive improvements may involve investment in regional datasets, scientific modelling, scenarios and preferred futures, research into impact interactions, trends, effects pathways and areas of maximum mitigation impact, better regional planning, the establishment of thresholds and limits, joint monitoring, the collection of information on planned developments and more consistent data standards and methodologies.

Table 1. Requirements to address cumulative impacts in relevant Australian, Queensland and New South Wales legislation and EIS terms of reference.

Legislation or Terms of Reference	Indicative Extract
Commonwealth <i>Environment Protection and Biodiversity Conservation Act 1999</i> (2007, 450).	<ul style="list-style-type: none"> No specific mention of cumulative impacts. Impact is defined to include direct, indirect and reasonably foreseeable consequences of actions. Federal court rulings have interpreted the act to include cumulative impacts.
Queensland <i>Environmental Protection Act 1994</i> (Section 40 a; State of Queensland, 2008).	<ul style="list-style-type: none"> No specific mention of cumulative impacts. The draft ToR must be 'in the approved form.' In practice this means that it must cover what is defined in the generic ToR developed by the Environmental Protection Agency. The purpose of an EIA is to assess: 'the potential adverse and beneficial environmental, economic and social impacts of the project; and management, monitoring, planning and other measures proposed to minimise any adverse environmental impacts of the project.'
Queensland Environmental Protection Agency Generic ToR (2008, 15, 16) – <i>Environmental Protection Act 1994</i> .	<ul style="list-style-type: none"> 'Describe any cumulative impacts on environmental values caused by the proposal, either in isolation or by combination with other known existing or planned sources of contamination.' 'The cumulative impacts of the proposal must be considered over time or in combination with other (all) impacts in the dimensions of scale, intensity, duration or frequency of the impacts'. 'Where impacts from the proposal will not be felt in isolation to other sources of impact, it is recommended that the proponent develop consultative arrangements with other industries in the proposal's area to undertake cooperative monitoring and/or management of environmental parameters. Such arrangements should be described in the EIS.'
Queensland <i>State Development and Public Works Organisation Act 1971</i> (State of Queensland, 2007).	<ul style="list-style-type: none"> No specific mention of cumulative impacts. Act requires compliance to the ToR finalised by the Coordinator General.
Queensland Coordinator General. Terms of Reference for the New Acland Coal Mine Stage 3 Expansion EIS (2007, 7) – <i>Queensland State Development and Public Works Organisation Act 1971</i> .	<ul style="list-style-type: none"> 'Direct, indirect and cumulative impacts should be identified and assessed with respect to the environmental values of the Project area and its potential area of impact. Cumulative impacts include impacts accumulating over time and impacts exacerbated by intensity or scale or frequency or duration of impacts both at the site and remote to the site.'
New South Wales <i>Environmental Planning and Assessment Act 1979</i> (State of New South Wales, 2008).	<ul style="list-style-type: none"> No specific mention of cumulative impacts (except in environmental assessment of fishing activities).
New South Wales Department of Urban Affairs and Planning. Coal Mines and Associated Infrastructure. EIS Guideline (2000, 37).	<ul style="list-style-type: none"> '(a) identify other existing or proposed activities in the area with similar environmental impacts or which are likely to impact on the same elements of the environment (e.g. clearance of the same type of habitat)' '(b) assess the extent to which the environment affected by the proposal is already stressed' '(c) identify any likely long-term and short-term cumulative impacts, such as air quality, noise or traffic disturbance, visual impacts, surface water and groundwater issues, public health; or loss of heritage items, vegetation or fauna habitat' '(d) consider the receiving environment's ability to achieve and maintain environmental objectives', and '(e) consider options for integrating operations with adjoining mines to obtain operational synergies, reduce costs, prevent environmental impacts or lessen land degradation (e.g. spoil transfer, wastewater exchange for reuse, integrated rehabilitated landforms, joint rail or road haulage works, joint coal handling or treatment facilities, integrated and shared monitoring networks and programs).'

In most cases where cumulative impact analysis is missing or brief regulatory agencies deem such assessments to have adequately met the requirements of the terms of reference (enforcement of the ToR is a function of the responses received during the submission process). This situation provides little incentive for proponents to consider more comprehensive assessment. In some cases agencies acknowledge deficiencies in the environmental assessment reports and suggest follow up after approval and depending on the issue, and the spatial extent where it occurs, agencies may or may not have regulatory powers to impose management conditions.

There are risks, however, to superficial treatment of cumulative impacts within project level EIS. The quality of cumulative impact analysis is commonly raised as an area of concern in community consultation and EIS public submissions in Australia. Regulatory agencies do have the ability to request additional information to be provided by a proponent to satisfy issues raised during the submission process. When development proposals attract public controversy the lack of attention to analysis of cumulative impacts can become an area where further assessment is requested by regulatory agencies, which can lead to delays in approval. Approvals can also be challenged in the courts and the insufficient treatment of cumulative impacts can be an easy target for litigation (Kennett, 1999).

Lockie et al. (2008, 182) has also identified limitations in the analysis of cumulative assessment in project level EIS in Australia. They reviewed a case study sample of 16 coal mining EIS produced in Australia between 1996 and 2006. In their assessment of the social and economic aspects of the reports they found that a number of EIAs acknowledged the potential for cumulative impacts on communities situated near multiple mines, but not a single case proposed management or mitigation activities to address the identified issues. A subsequent government review of EIA processes in Queensland has led to a number of changes that will strengthen the assessment process. A social impact function has been established within the Department of Infrastructure and Planning and Social Impact Plans will also now be negotiated and detail management strategies for impacts identified during the assessment. The EIS process is currently under review in New South Wales.

Strategic Assessments

Strategic assessments are often promoted as a method to more effectively account for cumulative impacts as they are broader in spatial and sometimes temporal extent; they may make explicit regional standards, thresholds, and links to land use planning; and they often establish regional databases, protocols, management systems and tools for implementation (e.g. methods for threshold allocation). Strategic assessments may also offer advantages for business by avoiding the duplication of project level assessments, informing developers about the environmental context in which they operate, and the potential for more certainty in the approvals process¹. Strategic assessments may sometimes also remove the requirement for project level assessments if the proposal is consistent with the scope of the strategic assessment. Such an approach has obvious benefits for business as it can provide certainty for development proposals, reduce the potential for consultation fatigue, reduce the regulatory burden, and shorten the approvals process.

The New South Wales Government in particular has utilised strategic assessments to specifically assess the cumulative impacts of coal mining in the Hunter Valley. In the mid 1990s the New South Wales Commission of Inquiry for the Bayswater No. 3 and Bengalla coal mines recommended that the Department of Urban Affairs and Planning undertake a study of the cumulative impacts of coal mining on the Upper Hunter Valley Region. This recommendation was prompted by pressure from community and local government. The study, the 'Upper Hunter Cumulative Impact Study and Action Strategy' developed triggers, indicators and an action strategy. The study provided guidance

¹ Regional Forestry Agreements are examples of strategic assessments that guide potential resource development in Australia.

for project level assessment and called for more focussed examination of cumulative impacts in assessments, improved regional and sub-regional planning and strengthened monitoring and datasets (NSW DUAP, 1997).

A strategic assessment has also been developed to analyse the coal mining potential of the Upper Hunter Valley (NSW Department of Planning, 2005). The assessment takes into consideration coal resources, mine development potential, surface and groundwater, social and amenity issues, natural and cultural heritage, land and agriculture. In late 2006 the New South Wales Government initiated a strategic review of the impacts of underground mining in the Southern Coalfield, specifically subsidence. The findings of the independent review stress the need for better assessment of cumulative and regional impacts and improved attention to cumulative impacts within project level EIAs. Furthermore the study recommended that regulatory agencies and industry consider collaborative efforts with other 'knowledge holders' to develop improved regional and cumulative environmental data sets for the Southern Coalfield (NSW DIP, 2008).

Managing Cumulative Impacts

Well rehearsed debates about the responsibility for cumulative impact management are beginning to be replaced by partnerships and coordinated investments. Industry has been reluctant to assume the burden of remedying the cumulative impacts of past actions for which it may not be individually responsible. As long as industry is paying royalties for resource extraction they will continue to look to government to fund the physical and social infrastructure of towns and regions². Government on the other hand has argued that the industry has benefited from the accumulation of past positive impacts (e.g. infrastructure and skills) and should contribute along with government to ameliorate the effects of proposed activities, including those in the social and economic domains. Governments have been reluctant to make upfront investments prior to the income generated from development because they lack future certainty about the scale of resource development, particularly given the tendency for boom and bust cycles.

Industry is, however, coming to recognise the value of a social license to operate and the business case for cumulative impact management has become easier to articulate. Unmitigated impacts have the potential to delay or even prevent expansion of mining in existing and prospective areas. The quality of life of employees is also a priority for companies competing to attract skilled workers and the reputational benefits of environmental and social management are better understood. 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.

Perhaps the most compelling argument for collaborative cumulative impact management is that more effective coordination of existing resources devoted to mitigation and management (e.g. company social spend) may go a long way toward mitigation, and better planning and assessment may help avoid impacts. There are many areas where resources are not the limiting factor to better cumulative impact management, including better information on future activities and data sharing, and opportunities exist for efficiency gains through reduced duplication.

Cross-industry coordination and partnerships are also increasing. Pre-competitive 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

² In Queensland long term trends away from the establishment of company towns, and the popularity of FIFO and DIDO work arrangements, have transformed the role industry plays within resource communities but pragmatic considerations still compel industry to underwrite towns dependant on mining development.

the timing and phases of development, the attribution of responsibility, the attraction of exclusively branding spending, and the differences in corporate culture.

In the following section we traverse a range of cumulative management approaches (coordination and planning, information and data sharing, mitigation and enhancement programs, advocacy, monitoring and networks and forums). We detail current practice and emphasise working examples of collaborative arrangements including, multi-stakeholder, government, single company, multiple company and cross-industry approaches.

Coordination and Planning

Effective coordination and planning are the foundations of successful management of cumulative impacts. Issues that have manifest as a result of multiple behaviours are best approached collectively. While environmental management in Australia has long been approached from this perspective (e.g. management of diffuse water pollution of the Great Barrier Reef as a result of farming practices or the incremental extraction of water from the Murray-Darling Basin) mining has historically been managed by individual stakeholders. A flurry of recent initiatives, however, is changing this situation.

Prompted by local governments and communities and the experience of the constraints that ineffective planning has placed on resource expansion, the Queensland and New South Wales State Governments have led a series of coordination and planning initiatives to better manage cumulative impacts. In October 2004 the Coal Infrastructure Coordination Group was formed by the Queensland Government, later changing its name to the Queensland Government Coal Infrastructure Taskforce. The mandate of the Coal Infrastructure Taskforce is to lead whole-of government planning for the provision of coal infrastructure (transport, water, energy, housing and social infrastructure) in Queensland. The body, which is part of the Queensland Department of Infrastructure and Planning, reports to the Cabinet Budget Review Committee thus providing the Taskforce with a direct line to state government funding. The Taskforce is an attempt to expedite the infrastructure investments to cope with the sharp expansion of the coal industry since 2003 and to proactively address the cumulative impacts on physical and social infrastructure, especially in Bowen Basin mining communities.

In 2005 the Queensland Government, with the support of the Queensland Resources Council (QRC; the peak Queensland mining industry body), prepared the Coal Infrastructure Program of Actions to coordinate development to meet Queensland's current and future coal infrastructure needs. The program of actions is heavily focussed on transport infrastructure but areas such as water and power supply, workforce skills and social and housing infrastructure are dealt with to a lesser extent³. The Taskforce has also commissioned a Queensland Coal Industry Strategic Plan to determine future infrastructure needs of the state (Qld DIP, 2008a).

The Queensland Government has also embarked on initiatives at the regional and local level. The government has committed to assist the Isaac Regional Council (formerly the Belyando Shire Council) to resolve issues related to the rapid growth in the mining town of Moranbah. The Minister for Environment, Local Government, Planning and Women proposed the development of the Moranbah Growth Management Group (MG²), to facilitate the resolution of acute growth issues in this purpose built mining town within the Bowen Basin. The MG² reports directly to the Coal Industry

³ An audit of the work to December 2007 indicates that the proportion of spending was as follows: rail (\$1 billion; 14%), rolling stock (such as locomotives and wagons; \$2.1 billion; 28%), ports (\$2.5 billion; 34%), water (\$445 million; 6%), energy (\$1.3 billion; 17.3%), skills (\$25 million; 0.3%), housing and planning (\$31 million; 0.4%; figures in Australian dollars; Qld DIP, 2008a). These investments have increased Queensland's coal export capabilities and improved water storage capacity servicing coal mines (including the use of recycled town wastewater by industry). In the skills area the investments consisted of a redevelopment of the Mining Industry Skills Centre, the establishment of the Queensland Minerals and Energy Academy and the development of the Central Queensland Coal Regional Skills Formation Strategy.

Taskforce and consists of representatives of the Department of Local Government Planning, Sport and Recreation, the office of the Coordinator General (Department of Infrastructure and Planning), Department of Mines and Energy, Isaac Regional Council, unions, BMA (BHP Billiton Mitsubishi Alliance) and Anglo Coal, and chaired by the state government member for the region⁴. The group led the preparation of the Moranbah preferred growth management strategy and has commissioned the development of a Moranbah Strategic Plan. The Queensland Government has also convened Land Access Forums to coordinate issues related the impacts of exploration on landowners, chaired by the Director General of the Queensland Department of Mines and Energy. Initiatives under discussion include a standard code of conduct for explorers, standard compensation agreements, and common corridors for easement.

A broader framework to inform an approach relevant for all Queensland mining towns is outlined in the Sustainable Futures Framework for Queensland Mining Towns, published in July 2006. The framework aims to “guide communities toward orderly and proper planning of towns impacted by mining projects” (Qld DLGPSR, 2006, 2). The framework reviewed measures adopted in response to mining expansion and potential planning models; summarised population projections and the status of planning schemes; undertook consultation to determine the range of mining impacts on towns; scanned growth management issues for each of resource towns of the Bowen and Surat Basins and planning considerations, responsibilities, and current actions for each issue identified. The framework developed a series of principles to guide a sustainable future for resource towns, including: leadership, collaboration, corporate social responsibility, sustainability, communication and engagement.

The Queensland Government has since consolidated many of these initiatives into the Sustainable Resource Communities Policy released in September of 2008. A key object of the policy is the better management of the cumulative and regional impacts of multiple concurrent and overlapping proposals for new and expanded mining development (Qld DTRDI, 2008, 1). The policy is complemented by a multi-stakeholder partnership between the State government, the Local Government Association of Queensland (LGAQ) and the QRC. In addition to the establishment of a social impact assessment function within government (discussed above) the policy aims for improved state-wide and regional coordination through the formation of a partnership group, that includes representatives of the State government, the regional councils of Roma, Dalby, Banana, Isaac, and Central Highlands, the LGAQ and the QRC. The partnership group will 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 leadership groups will “act as a ‘sounding board’ for resource companies and will focus on regional planning, and developing projects that address the cumulative effects of resource developments” (Qld DIP, 2008b, 19). They will provide ongoing engagement, identify preferred strategies and programs to manage, avoid, enhance and mitigate impacts, and will link to regional planning. Brereton et al. (2008) have recommended a similar high level consultative forum and a regional multi-stakeholder organisation be established in the Hunter Valley. The recommendations come out of a 3 year Australian Coal Association Research Program study of the cumulative impacts of mining in the town of Muswellbrook (the study is discussed in greater depth below).

The Sustainable Resource Communities policy also introduces Social Impact Plans (SIP) to facilitate ongoing management of impacts identified through the EIS process. The plans will “outline the forecast changes to communities in terms of local and cumulative effects, the agreed strategies for mitigating the effects and the responsibility of various parties in relation to the strategies” and will be implemented as a condition of granting mining tenure (Qld DTRDI, 2008, 3). SIPs will be required for all new mines and major expansions above 2 Mt production per year (Qld DIP, 2008b). Regional

⁴ The state government does not believe growth management groups should be the standard approach to the management of issues for resource towns. Intensive growth management groups will only be considered in cases of severe pressure and crisis.

planning will also command greater attention under the policy. Draft statutory regional plans have been recently developed for Central West, South West, and Maranoa Districts, and further plans will be prioritised to provide guidance to resource and community development. A \$100 million three year program will support the policy by providing physical and social infrastructure, such as upgraded roads, health facilities and schools in resource communities. As a demonstration of the difficulty of planning in regions of transition, in December 2008, two months after the announcement of the program, \$25 million of the \$100 million committed was brought forward and re-allocated toward capital projects in locations where mining jobs have been lost in response to a downturn in the industry. The funds had originally been intended to be invested in infrastructure to manage growth.

The New South Wales Government too has made major reforms of its planning instruments. Prior to the introduction of major legislative and procedural reforms in 2005, there were some significant structural impediments to consistent planning. A notable limitation was that the Department of Planning was responsible for granting planning approvals for new mines, but control of rehabilitation and post-mining land use was the responsibility of another area of government, the Department of Primary Industries. Similarly, approval and regulation of biodiversity offsets was the responsibility of the Department of Conservation and Environment. Not surprisingly, this division of responsibility presented some significant coordination challenges. The 2005 reforms have removed these impediments by clearly defining the Department of Planning as the pre-eminent planning body for NSW. In the case of mining, the powers of the Department now include the right to determine what offsets and rehabilitation will be required for new mining developments and the shape of final voids. The reforms were also designed to simplify planning controls and improve development assessment processes.

Industry led collaborative planning initiatives are less common but are increasing in number. Industry spending on community development is now generally better coordinated with community priorities and identified needs at a site and regional level. BMA has created the Community Partnerships Program to support its operations in the Bowen Basin (around \$5 million per annum). Funds are provided for partnership programs with community and local government aligned to studies of community needs. At an operations level Anglo Coal's German Creek operation, near Middlesmoot, in the Bowen Basin, has identified priority issues through their social assessment and community engagement activities and incorporated these into a community development plan (CSRM, 2007). Activities include building and upgrading housing to accommodate staff, development of commercial properties and renovation of the town shopping centre. Mining companies in Middlesmoot also recently pooled resources to fund a town dentist.

In Clermont, also in the Bowen Basin, Rio Tinto has responded to local government requests for infrastructure development by facilitating a community strategic planning initiative called the Clermont Preferred Futures. The requests for infrastructure followed the decision by Rio Tinto to open a second mine (Clermont Coal mine) near the existing Blair Athol mine, which is due to close in 2012, and the potential additional impacts that would arise from these transitions. 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, 2007). The planning exercise is an example of a single company initiative to manage the impacts of multiple operations within its portfolio.

Cross company co-ordination is less common as companies are familiar with competing for physical and human resources (CSRM, 2007). Regional industry associations are a good example of the possibilities that cross industry coordination can bring to the management of issues. In Western Australia the Kwinana Industries Council has facilitated the identification of operational synergies among aluminium, natural gas, and cement industries among others. A similar organisation, the Gladstone Area Industrial Network, exists in Queensland. In the coal industry Rio Tinto Coal and BMA

have collaborated to fund an economic development officer based in Emerald and in Muswellbrook, in the Hunter Valley, Mt Arthur Coal and Drayton Coal have a water sharing arrangement (Brereton et al., 2008). Other more advanced areas where coordination between companies could assist cumulative management would be in the location and timing of operations. There are more examples of cross-company collaboration in the areas of research, mitigation and enhancement programs, advocacy, networks and forums.

Research

Research helps to understand the processes of impact generation, accumulation and interaction. Research can identify scientifically defined system thresholds, social limits, triggers to changes in system state, non-linear functional relationships, synergism and pathways of effects. Through understanding the cause and effect relationships of impacts management can be tailored to achieve specific outcomes⁵.

The Australian Coal Association Research Program (ACARP) is an industry-wide research program administered by the Australian Coal Association. The program is funded by a per-tonne levy on all coal production (5 cents/tonne). Research projects have traditionally been very technical in nature but the program has begun to expand its remit to fund social and economic research⁶. Brereton et al. (2008) undertook a 3 year ACARP funded research project that explores cumulative impact assessment of multiple mining operations, using the town of Muswellbrook in the Hunter Valley as a case study. Muswellbrook is surrounded by 5 coal mines (Mt Arthur Coal, Drayton, Bengalla, Muswellbrook Coal and Dartbrook), established vineyards, horse studs, irrigation and tourism industries. Impacts were prioritised through community consultation and the research quantified and analysed visual amenity impacts, economic impacts, social impacts and water quality. The project itself is an example of cross-company collaboration, as access to information was provided by the mining operations. The research developed and tested a framework for assessing, monitoring and reporting on the cumulative impacts of coal mining where multiple mines operate and refined methodological approaches.

At a regional scale the surface and groundwater study of the Namoi Valley Catchment in the Gunnedah Basin is a good example of a multi-stakeholder approach. The aim of the research is to better understand the relationship between groundwater and surface water systems and the potential impacts coal mining development. Participants of the Water Study Working Group include the Caroon Coal Action Group, NSW Farmers, Namoi Water, NSW Minerals Council, NSW Department of Primary Industries, the Commonwealth Department of the Environment, Water, Heritage and the Arts and BHP Billiton. The Australian Federal Government announced in December 2008 that they would commit \$1.5 million for the study. The NSW government has yet to commit funds for the study and the terms of reference for the study have yet to be developed.

In Central Queensland the MCA, the QRC and Central Queensland University have initiated the Central Queensland Regional Development Pilot Program. The partnership research will explore community development challenges in the Bowen Basin. A baseline study is currently underway. Rio Tinto Coal has also commissioned regional baseline studies in the Hunter and Bowen Basin, with the information to be used to inform assessments and closure plans for their multiple operations in both

⁵ The use of multi-stakeholder committees to research and agree on limits and thresholds has been pioneered by the Cumulative Environmental Management Association (CEMA), based in Fort McMurray, Alberta, Canada. While the scale of oil sands development is challenging CEMA is a working example of the successes and limitations of multi-stakeholder cumulative management (Spaling et al., 2000; Severson-Baker et al., 2008).

⁶ ACARP funded research project topics have included: monitoring the impact of coal mining on local communities, socio-economic impact assessment and community engagement to reduce conflict, understanding of blue-green algae impacts, fine particle air pollution, the contribution of mining emissions and dust to regional air quality, water and salt management practices, mined land rehabilitation and revegetation, post-mining land use, mine site greenhouse measurement and mitigation techniques, acid mine drainage and salinity, groundwater, subsidence, and the reuse of fly ash (ACARP, 2008).

regions. At a local scale the Moranbah Town Sustainable Management Framework, a project of the Moranbah Growth Management Group, researched and defined thresholds for future mining growth and Anglo Coal and BMA have collaborated to analyse potential mine subsidence in the vicinity of the Issac River in the Bowen Basin.

Information and Data Sharing

Regional planning, monitoring and management rely on good quality baseline and trend information. In situations of rapid transition (boom and bust) information is at a premium. The availability and currency of data about system behaviour and characteristics can be problematic for many topics but with coordination issues of data consistency and constraints on data sharing can be overcome. Data protocols and standardised methodologies need to be defined at the onset of collection, particularly if data is to be useful at different scales. The definition of system boundaries should also be prescribed. The 'unit of analysis' for measuring and managing cumulative impacts will vary, depending on what is being impacted on and the location. For example, the unit of analysis for scenic amenity is likely to be a town or a specific locality, for water quality the unit will be waterways and catchments, and for air quality the unit will be local, regional or global air sheds. When data is incompatible knowledge systems and data hubs can be a means by which explicit links to multiple sources of data can be made.

Information on current and future development trends can be useful to assist government and corporate planning. Company data from multiple mining operations is difficult to collate but issues of commercial confidentiality can be overcome by reporting on aggregated data. Peak industry bodies can play a key role in the collection of information from multiple mining operations. The QRC, for example, has commissioned surveys to collect information on targeted issues in the Bowen Basin⁷.

Information sharing also refers to the provision of information to the public and the communication of concerns to industry and government. The mining industry in Australia has developed well established community consultation arrangements, including formal committees. Brereton et al. (2008) has recommended the trialling of joint multi-mine engagement mechanisms in Muswellbrook, Hunter Valley, to address issues more collectively. Informal coordination across mining operations in the Bowen Basin on the timing of community consultation initiatives already occurs, and while the overlapping phases of mining development may restrict such approaches they can be a means to overcome consultation fatigue.

Government, too, has undertaken consultation with community on resource development. In November 2008 the Deputy Premier of Queensland and Minister for Infrastructure and Planning convened a series of three resource summits (one in each of the Bowen and Surat Basins and the Northwest minerals province) to invite public discussion on the impacts of mining expansion on regional communities and environments. The events were the first time Ministerial level summits have been held to address the social and economic impacts of resource development⁸.

⁷ This is a similar function to that of the Oil Sands Developers Group (formerly the Athabasca Regional Issues Working Group), in Alberta, Canada, which surveys industry on an ongoing basis to forecast future needs and priorities and provide this information to government and other stakeholders (Athabasca Regional Issues Working Group, 2007a, 2007b).

⁸ The summit in the Bowen Basin was held in Dysart on the 20th November and was attended by approximately 140 people, including the Minister for Mines and Energy, the Mayors of the Isaac Regional Council and the Whitsunday Regional Council and representatives of the LGAQ, the QRC, AgForce, and the Australian Petroleum Production and Exploration Association. Summit sessions highlighted the need to bring stakeholders together to address the cumulative impacts of multiple mining projects from mine to port and for better collaboration between planning and assessment agencies. Participants requested data from mining companies to assist in the projection of demand for services, and more accurate projections of future mine developments. The summits signalled an attempt to improve the flow of information between stakeholders and announce coordination and planning initiatives (Qld DIP, 2008b).

Mitigation and Enhancement Programs

Efforts to mitigate negative cumulative impacts and enhance positive impacts are numerous and include: market based instruments, information and awareness (suasive) programs, environmental management and rehabilitation programs, technology improvements, training, community development, and regulation.

An important mitigation initiative specific to the Hunter region is the Hunter River Salinity Trading Scheme (HRSTS). The geological composition of the upper Hunter Valley is naturally high in salt, and the potential for mining to increase the salinity of Hunter catchment has been a cause for concern in the local community. The disturbance of ground containing salt increases the potential for that salt to become dissolved in groundwater, and later enter the catchment system. 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. Following a pilot scheme, in operation from 1995, the HRSTS was implemented in 2003 through a NSW Environment Protection Authority regulation (NSW EPA, 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, so long as the salinity does not exceed 900 Electrical Conductance Units (NSW EPA, 2003)⁹. The HRSTS provides an excellent example of how partnerships can be developed between key stakeholder groups to encourage cooperation to mitigate cumulative impacts. This scheme was initiated in an attempt to restore the Hunter Valley waterways to an “unprecedented level of freshness” (NSW EPA 2003, 2). Stakeholders recognised that they would all benefit through cooperating to control the salinity in the Hunter River; environmental outcomes would be able to be achieved at the least cost to the community.

Another multi-stakeholder program is the Upper Hunter River Rehabilitation Initiative. The five year program, completed in 2007, trialled river rehabilitation methods in the 10 km reach of the Hunter River south of Muswellbrook. The research was funded by the Australian Research Council, the NSW Department of Natural Resources, NSW Department of Primary Industries, the Hunter-Central Rivers Catchment Management Authority, NSW Department of Lands, Newcastle Ports Corporation, Mt Arthur Coal, Bengalla Mining Company (Coal and Allied) and Macquarie Generation (Hunter-Central Rivers CMA, 2008).

Offsets are promising area for the mitigation of biodiversity and vegetation impacts. The BioBanking scheme in NSW (NSW DECC, 2007) and Eco-exchange in Queensland provide opportunities for biodiversity and vegetation loss, due to development, to be offset with protection of equivalent ecological communities. Individual mining companies have also developed offsets strategies, for example, Mt Owen in the Hunter Valley (Charnock, 2005). The Fitzroy Basin Association catchment group in Queensland has also been working with BMA, Xstrata Coal, Anglo Coal, Rio Tinto Coal Australia and the QRC to examine approaches to address biodiversity impacts in the Bowen Basin (FBA, 2008).

A significant national program relevant to the coal industry is the forthcoming Commonwealth Government Carbon Pollution Reduction Scheme (due to begin in 2010). The ‘cap and trade’ scheme will require emitters to acquit permits if they wish to release greenhouse gases to the atmosphere (Commonwealth of Australia, 2008). The mining industry is also trialling carbon capture and storage technologies. Programs include: the Cooperative Research Centre for Greenhouse Gas Technologies

⁹ 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 (1 credit allows the holder to contribute 0.1% 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).

(supported by a series of university, government and mining industry partners); the ZeroGen, Callide Oxyfuel and the Munmorah post-combustion capture pilot projects; and an industry fund, the Coal 21 fund, to support the development of low emissions technologies (the fund is based on a voluntary industry levy of members of the Australian Coal Association).

In the mining industry more generally partnership programs exist in the area of Indigenous employment and participation. A memorandum of understanding (signed in 2006) between the MCA and the Commonwealth Government aims to improve indigenous outcomes from mining, and a memorandum of understanding signed between the QRC and the Queensland State Government will target indigenous employment and enterprise development (CSR, 2007). The Australian Employment Covenant, a joint industry and Commonwealth Government scheme, aims to generate an additional 50,000 long term jobs for Indigenous people within a two year period. The Pilbara Industry's Community Council (PICC), an industry led multi-stakeholder body, also has an indigenous employment program in addition to an alternate stream on improving towns (CME, 2008)¹⁰.

Numerous examples exist of community development and skills training partnerships. By way of example the Gladstone Schools Engineering Skills Centre (GSESC) is a training program co-located within the NRG Gladstone Power Station. The centre prepares secondary school students for engineering trades. The program is funded by the Rio Tinto Australia Community Fund, the NRG Gladstone power station, Australian National Training Authority (ANTA) and local schools, in conjunction with Education Queensland (CSR, 2007).

Other Management Approaches

Networks and forums, coordinated advocacy and joint monitoring and reporting are also useful approaches to managing cumulative impacts. Informal and formal networks can provide important opportunities to exchange experiences at the operational level. Informal networks between environment and community relations practitioners are common both within and between companies. Rio Tinto, for example, has internal professional networking for exchange of ideas and advice. The Muswellbrook Mine Managers Forum, in the Hunter Valley, is a more formal network to discuss common issues. Environmental officers in Muswellbrook also meet regularly.

Coordinated advocacy can generate collective positions, pool resources, and assist planning and information exchange. Peak industry bodies, such as the QRC, New South Wales Mineral Council, and MCA are beginning to be augmented by regional and sub-regional organisations such as the PICC in Western Australia. Brereton et al. (2008) recommended the establishment of a regional industry association in Muswellbrook to represent the companies of the region, co-ordinate social spend, communicate with stakeholders, identify collective research needs, commission studies, agree on data standards and coordinate information exchange. Opportunities also exist in regions such as Muswellbrook to undertake joint monitoring at a local and regional scale. Existing regional monitoring efforts, such as the Hunter Valley Research Foundation's 'wellbeing watch survey' could be tailored to provide data relevant for Muswellbrook. Collective community and environment reporting and communication to the community through joint newsletters can be a way to reduce overlap and provide information on cumulative impacts relevant to the community¹¹.

¹⁰ PICC consists of BHP Billiton Iron Ore, Chevron Australia, Fortescue Metals Group, North West Shelf venture, Rio Tinto Iron Ore, Woodside, the Commonwealth, Western Australian and local Governments, Pilbara communities, and the Chamber of Minerals and Energy Western Australia (CME, 2008).

¹¹ The Regional Aquatics Monitoring Program (RAMP) and the Wood Buffalo Environment Association (WBEA), Fort McMurray, Canada are good examples of multi-stakeholder monitoring programs. RAMP undertakes water quality monitoring, and WBEA monitors air quality, in the oil sands region. Data is made available to the community through joint community reports (CEMA, RAMP and WBEA, 2006).

Conclusion

In this paper we have investigated cumulative impacts arising from multiple coal mining operations in Australia and detailed management and assessment practices drawn from working examples that aim to enhance positive, and avoid and mitigate negative impacts. The management and assessment approaches included: project based cumulative assessment, strategic assessment, coordination and planning, research, information and data sharing, mitigation and enhancement programs, collective monitoring, advocacy, networks and forums. These initiatives took multiple institutional forms ranging from, single company, cross-industry partnerships and networking, multi-stakeholder committees led by government and by industry, and formal industry and government led organisations.

Partnerships between mining companies, government and community stakeholders have increased over the past decade. While multi-company approaches are less common examples do exist to build on and improve. Addressing the cumulative impacts of a single operation, or multiple operations within the portfolio of a single company, may be an easy starting point. There are a number of relatively straightforward cumulative impact management approaches that are commonly practiced in the mining industry, these include: networking, information exchange, advocacy on common issues and pooling of resources to support specific initiatives and programs. More advanced approaches, such as coordination of industry responses to impacts of high concern to stakeholders, tailored assessment methodologies (e.g. scenario analysis and pathways of effects), facilitation of synergies, data sharing and collective data management, and proactive management (timing and location of proposals) require greater coordination and investment of resources and are yet to become commonplace within the industry.

Communities and local governments in Australia will continue to raise the profile of cumulative impacts and demand greater attention be paid within assessments and management. As many of the initiatives outlined in this paper are relatively recent it remains to be seen how effective they will be at addressing cumulative impacts. Early indications are positive that proactive management and assessment has the potential to benefit regional environments and communities and strengthen the industry's social license to operate.

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