Paper Title: Measuring cumulative socio-economic impacts of

coal seam gas projects in the Western Downs:

Building the case for a strategic monitoring framework

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Paper: Expansion of resource development in rural Queensland has occurred during a period of growing global recognition of the need for a 'social licence to operate'. The developments have seen resource companies as well as regulators place increasing emphasis upon considering and accounting for the needs of affected rural and regional communities in the planning and approval process (Owen & Kemp 2012, Department of Infrastructure and Planning (DIP) 2010). Such shifts call for a change in social impact assessment (SIA) methods to capture community concerns and respond to relatively rapid development of multiple, large resource projects in a single region, as has occurred with coal seam gas (CSG) development in southern Queensland. However, this shift in focus not only requires a change in SIA methods, but it also requires improved mechanisms to manage and measure cumulative socio-economic impacts. Such mechanisms require an adaptive and shared management approach that addresses these impacts at a town level.

This paper will discuss the current literature on cumulative impacts and resource projects and the measured socio-economic impacts of Queensland's CSG projects as an introduction to the topic. It will also highlight the limitations in the current regulatory process for assessing, predicting and measuring impacts in resource development SIAs, which practitioners, operators and approval authorities will face. It will argue that through the use of indicators developed in the University of Queensland's (UQ) BoomTown Toolkit©, SIA practitioners will have increased capability to consider and adapt to impacts as they occur over time, using the comparison of predicted data and real data collected during and post-CSG development. Furthermore, it will argue that the interrogation of the data at the town level, through the UQ BoomTown Toolkit©, improves understanding of how cumulative impacts are experienced by towns across a regional. Finally, it will argue for the coordination of a shared management approach to the management and measurement of cumulative socio-economic impacts of multiple resource projects in a region.

Acknowledgements: This research was financially supported by industry funding provided via The University of Queensland Centre for Coal Seam Gas (www.ccsg.uq.edu.au).

Accounting for multiple project cumulative impacts

Traditional 'assess-and-manage' approaches to the development of projects can work well when there is a single major influence (the project) and the potential impacts on local communities are relatively predictable and based on precedent. However, more often there can be multiple resource projects of similar scale impacting the same region (referred to as cumulative impacts), and there can be little precedence from which to predict the impacts.

Cumulative impacts are defined by Franks, Brereton and Moran (2010, p. 300) as, 'the successive, incremental and combined impacts of one, or more, activities on society, the economy, and the environment.' Cumulative impacts can result from the aggregation of impacts, and they can vary in temporal and spatial extent reflecting the complexity of multiple, simultaneous initiatives undertaken by different companies. This 'nonlinearity' means that cumulative impacts may trigger or be associated with tipping points, where a small additional impact can create a much larger, systemic change to environmental, social and economic systems (Franks, Brereton & Moran 2010, Uhlmann et al. 2014). Cumulative impacts also result from the interactions of new impacts with existing processes and practices, such as new gas development in an existing agricultural region experiencing drought and flood.

Franks et al. (2010, p. 3) and Franks (2012) identify examples of potential socio-economic impacts from resource development projects, specifically, impacts that may be cumulative:

Negative impacts

- Price inflation (housing and rents)
- Overloading of existing social services
- Perceived and real loss of community due to demographic change
- Amenity-based impacts (increased noise, dust, reduced water quality and quantity)
- Traffic congestion
- Increased crime and changes in social norms
- Increased demands on infrastructure.

Positive impacts

- Increased employment and economic investment
- Community and regional development benefits
- Local business development
- Population increases that create a critical mass for better infrastructure and services
- Development of human capital (skills, employment and training).

Impacts may be experienced differently by different towns, different businesses, and different households (Rifkin et al. 2015). Cumulative socio-economic impacts caused by rapid resource development are challenging for regulators and industry, and they can have lasting negative or positive impacts on communities depending on how they are managed (Centre for Coal Seam Gas (CCSG) 2015). To date, the management of these impacts in the resource industry - notably in Queensland has been through individual Social Impact Management Plans (SIMPs) for particular developments at individual locations. The SIMP's effectiveness can be hindered by the complexity of interactions of cumulative impacts (Franks et al. 2010). Franks et al. (2010) and Rifkin et al. (2015) note that coordination among industry operators and government is required to respond to uncertainties in potential cumulative impacts

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and to manage resulting negative social outcomes from resource development. Negative outcomes might include increases in opportunistic crime when equipment is stolen from industry trucks that are accidentally left unlocked in towns (Rifkin et al. 2015).

Cumulative impacts of coal seam gas projects in Queensland

In recent years, increased community concern has been highlighted in the media and in community forums, leading to a focus on the assessment of potential long-term impacts of CSG production (IESC 2014). The complexities of assessing and managing multiple impacts across different CSG projects are viewed as challenging, given the variation in land use, infrastructure required, geology, hydrodynamics, gas production and gas monitoring practices (Gas Industry Social and Environmental Research Alliance (GISERA) 2014). GISERA (2014) identify that potential environmental impacts primarily relate to water use, quantity, quality, treatment, and disposal, as well as the scale of CSG infrastructure on the property. Social issues resulting from CSG development observed to date are related to land and water access agreements, demands on human capital and social infrastructure (e.g., healthcare facilities, roads) and challenges placed on rural community lifestyles (Rifkin et al. 2015, Walton et al. 2014). Potential social impacts can be positive in terms of economic growth on a regional scale. However they may also be negative at the local scale in the short term, creating amenity-based impacts, (for example, noise, dust and visible construction), increased local traffic and the effect on communities of an influx of non-resident workers on safety and wellbeing in communities (Rifkin et al. 2015). Such outcomes make impacts both complex and cumulative across projects.

In the Western Downs region of Queensland, four major companies each initiated large projects to extract, transport and convert coal seam gas to liquefied natural gas (LNG). These projects are at various stages of development, but all include major phases of exploration and construction of the necessary infrastructure (that is, wells, pipelines and access roads) before becoming fully operational. Communities within the smaller towns near the CSG development have been the most noticeably impacted by the cumulative impacts of the projects, with rapid population growth during the exploration and construction phases creating immediate demands for services, housing and infrastructure that can be seen to have been beyond the township's capacity (Uhlmann et al. 2014). Such rapid change can lead to a reduction of community cohesiveness, social instability and the perception that personal wellbeing is in decline (Jacquet 2009; Smith, Krannich & Hunter 2001; Rifkin et al. 2015).

Queensland SIA regulatory context

The Queensland Government's approval process under the *State Development and Public Works Organisation Act 1971* (SDPWO Act) requires an environmental impact statement (EIS) for all large projects in Queensland. The definition of 'environment' under the *Environmental Protection Act 1994* (EP Act) includes social impacts (Department of State Development, Infrastructure and Planning (DSDIP) 2013). The EIS processes, set out under the Acts, require an EIS Terms of Reference that includes an SIA developed with community consultation to characterise the potential socio-economic impacts and benefits for affected areas.

SIAs typically lead to the development of SIMPs. A SIMP outlines strategies that the company will take to mitigate predicted negative impacts of their project. It also

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specifies how they will measure and monitor any changes in these impacts over time. Often the SIMP management strategies prepared at the development application phase remain static throughout the life cycle of a project. However, where monitoring feedback is obtained, it can sometimes enable a plan to be adapted in response to observed changes. The use of indicators and monitoring methods incorporated within SIMPs can provide proponents with the evidence required to demonstrate that they have achieved - or at least made satisfactory progress toward - the desired social outcomes at the conclusion of a project.

Shortcomings of regulatory mechanisms

At present, the current SIA analysis and review process under Queensland legislation, undertaken individually by companies for their own single project, needs development to more effectively address cumulative socio-economic impacts that arise from multiple projects. Some would argue that it is inadequate in addressing community expectations of benefits, costs and risk in the face of the rapid social changes that can occur, such as when over 50 per cent of a town's population changes in a five-year period, as occurred in the Queensland gasfields (ABS 2015).

The major federal planning statute, the *Environment Protection and Biodiversity Conservation Act 1999*, which recognises water resources in relation to coal seam gas development as a Matter of National Environmental Significance, acknowledges the need to consider social and economic as well as cumulative impacts. It defines the direct, indirect and reasonably foreseeable consequence of an action as an impact (Franks, Brereton & Moran 2010). Importantly, the Act does not require that the minister consider the cumulative impacts of projects that are not under the proponent's control (Section 527E).

Similarly, the DSDIP (2013, p. 16) *Social impact assessment guidelines* define cumulative impacts as 'successive, incremental and combined impacts (both beneficial and detrimental) of an activity or multiple activities on communities of interest'. The guideline states that the SIA will assess cumulative impacts with other developments regionally. However, proponents are only required to *mitigate* impacts that are directly attributed to their own project. Furthermore, the guidelines state that mitigation measures are not required for existing issues and legacy issues that are not attributed to the project in question.

Assessing cumulative impacts

SIA practitioners face a number of challenges when assessing and predicting cumulative impacts, particularly in relation to data access. SIAs rely on the best available information at the time of writing, including primary data from proponents and stakeholder consultation, publicly available secondary data (i.e. census data, published reports and case studies) and professional experiences — though not all of these sources are readily accessed and current.

Furthermore, under the EP Act the SIA, as part of the EIS, is displayed for public comment. As a result, limitations are often experienced in relation to the public release of the proponent's own data because commercial interests and business strategy are closely guarded. For the same reasons, practitioners also experience difficulties in accessing data about neighbouring projects by other proponents.

As SIA practitioners also operate within the bounded context of the legislation (as noted above), there is a practical limitation in the assessment process for major developments in addressing cumulative impacts of multiple projects.

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Operating within these limitations brings into question the extent to which predictions made in a pre-project SIA match an analysis of cumulative, post-project outcomes.

Is it possible to improve prediction, quantification, and management of cumulative impacts using a more adaptive assessment approach?

To address this question, researchers at the University of Queensland's Centre for Social Responsibility in Mining (CSRM) have been studying the cumulative socio-economic impacts of CSG development in the Western Downs region of Queensland. The research team — with input from industry, government, and the community — selected a set of indicators to monitor changes in affected communities in an 'adaptive assessment' approach.

Indicator selection was based on:

- the Australian Bureau of Statistics (ABS) definition of an indicator as 'a direct and valid statistical measure which monitors levels and changes over time' (ABS 2001, p. 9)
- literature on community and sustainable development and case-studies from North American (U.S.) communities experiencing similar energy resource development (e.g., Haggerty et al. 2014; Smith, Krannich & Hunter 2001; Jacquet 2009; Headwater Economics 2009)
- the indicators' suitability for
    - understanding change within a community in terms that are understandable to non-specialists
    - enabling understanding across sectors — community, government, and industry
    - determining where there has been or could be a resulting cumulative impact of CSG development.

The approach has been captured in the 'UQ Boomtown Toolkit©', which identifies key indicators that can be used to monitor changes in valued community 'assets' as a result of resource development (Rifkin et al. 2015).

Indicator themes include (see Figure 1):

- Population
- Income
- Employment
- Housing
- Education and skills
- Community safety and wellbeing
- External influences — rainfall and petrol prices.

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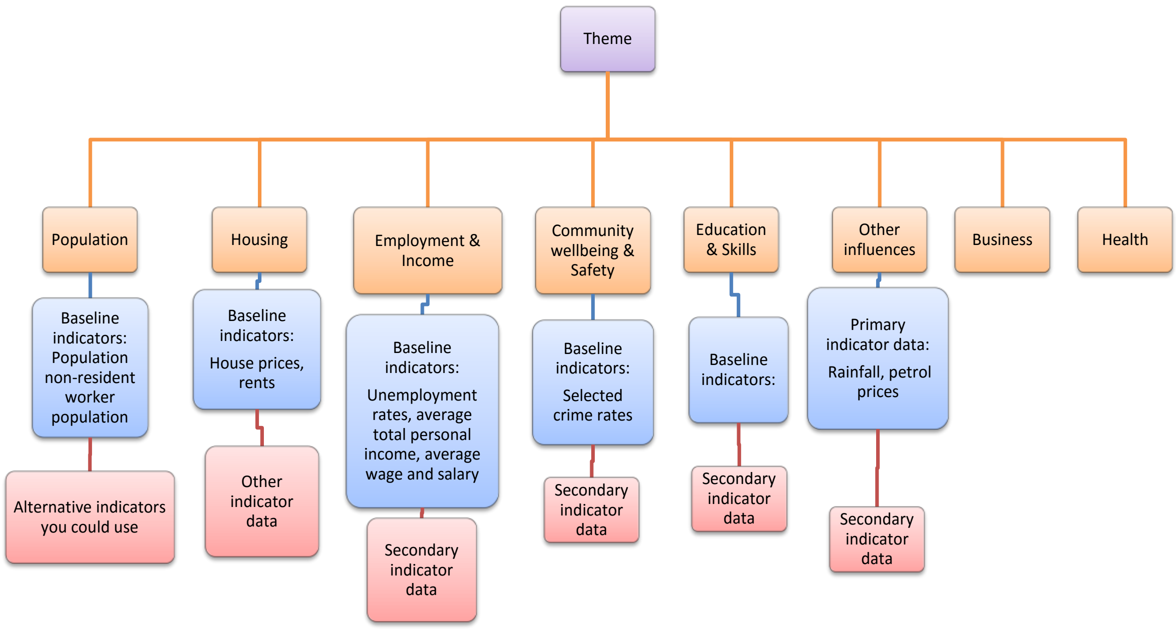

Figure 1 **Toolkit indicator themes** (Source: UQ Boomtown Toolkit ©)

Primary indicators were prioritised from a long list of indicator themes by representatives of the community, industry and government. Community members, for example, selected to track overall population changes rather than the population of young families, despite a widely cited value for having more young families in the region. These choices formed the basis of an 'agreed' set of indicators for application in the toolkit. Figure 1 shows the indicator themes and baseline indicators selected under each theme. Secondary or alternative indicators were developed for each of the themes to provide additional data to 'drill down', exploring data in detail where interesting and important dynamics seemed to be occurring. For example, with personal income data, the research team also explored net business income in key towns. This flexibility in response to demand or importance is one of the salient features of an 'adaptive assessment' approach.

The raw data collected at the baseline level with the primary (and secondary) indicators may not provide the full picture of important trends. Some trends are only visible over time. 'Rapid population growth', for example, might more easily be identified using a derivative calculation, for example, by considering percentage change in population per year over a period of five years. Additionally, an area of focus, like a growing flow of non-resident workers (e.g., fly-in/fly-out), can cause data to be gathered that was not initially available or not available publicly. Flexibility to incorporate newly available data is also a hallmark of the 'adaptive assessment' process.

Data for each of these indicator themes can be collected from publicly accessible sources using the online UQ BoomTown toolkit© and the services offered by the research team. Analysis of 15-year trends illustrates patterns of change for periods prior to, during, and after construction of resource development projects.

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Predicted socio-economic impact outcomes of CSG projects

A sample SIA for one of the CSG projects in the Western Downs region reported a large number of potential socio-economic impacts. The main potential impacts predicted in the SIA included an increase in:

a. Demand for housing
b. Demand for employment
c. Population growth.

The predicted socio-economic impacts can be compared with the measured outcomes of the CSG projects in the areas of housing, employment and population to illustrate the nature of the cumulative impacts and the difficulty in predicting their magnitude and timing. A further explanation of each of these indicator themes, and their link to predicted impacts of CSG projects, are detailed below.

a. Housing

For towns experiencing rapid population growth in a resource boom, demand for housing can exceed existing 'supply'. Housing becomes scarce, and house prices and rents increase. Case studies from U.S. towns experiencing rapid energy development show house prices and rents usually doubling to tripling during peak conditions (Smith, Krannich & Hunter 2001). For people on lower incomes, housing costs use up a greater proportion of income, leaving less for other essentials. Called 'housing affordability stress', such effects are usually measured by a 30/40 rule. This rule refers to those in the bottom 40 per cent of the income range that are experiencing financial stress as they are spending more than 30 per cent of their income on housing (Australian Housing and Urban Research Institute (AHURI) 2015). Alternatively, home owners wishing to sell may benefit from elevated prices. These scenarios can lead to accelerated outward migration of some long-term residents. A drop in housing prices may indicate the end of a resource sector boom within a town. Certain indicators can gauge the higher housing costs associated with a resource boom, including median house prices, median rents, and increased development approvals.

b. Employment

Economic growth and investment are significant factors with resource development. Construction projects and ongoing resource operations can generate significant economic input for companies involved and for the resource sector. However, the degree to which these financial flows influence the local economy is highly varied. U.S. case studies referenced during the indicator development and data on the Western Downs region of Queensland suggest both negative and positive effects on the local community (Smith, Krannich & Hunter 2001; Rifkin et al. 2015). A rapid growth in population — i.e., more than 5 per cent in a single year — may require more businesses to service the greater population, resulting in more employment opportunities for local residents. However, the need for labour may create skills shortages. New employment opportunities may also be provided by resource companies at higher salary rates than typically available in rural towns.

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c. Population

Population figures are considered a primary indicator as they provide a clear indication of whether the town and district are growing or shrinking. How population is changing and has changed historically will provide the first measure of how a community is being affected by development. A rise in total population (permanent residents and non-resident workers) can be seen as an indicator of economic growth. An increase in available employment opportunities through economic growth increases the attractiveness of a particular location to new residents. U.S. case studies suggest that rapid population growth in the resource industry is not uncommon as a result of the presence of construction and resource companies with their often non-resident (e.g. fly-in/fly-out) workforce. Rapid population growth is considered an indicator of potential cumulative impacts. Such growth is associated with social issues, such as fear of crime, declining trust in others, community dissatisfaction and stresses on social services (Smith, Krannich & Hunter 2001, Jacquet 2009).

Predicted outcomes versus measured outcomes

Table 1 shows how the UQ Boomtown Toolkit© indicators for cumulative impact assessment were applied to the SIA predictions for housing and employment for one CSG project in the region. They are matched with the outcomes measured using the adaptive assessment methodology in the Toolkit.

Figures 2 to 5 show how the population, housing and employment statistics of the Western Downs Regional Council (WDRC) Local Government Area (LGA) and key townships were affected by CSG projects. It is illustrated in the context of trends over a 15-year period.

That period covers the exploration phase (2001–2010), the construction phase (2010–2013) and the start of the operational phase of the region's CSG projects' (2013 onwards).

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Table 1 UQ Boomtown Toolkit © indicators and measures

UQ Boomtown Toolkit © indicator	**Housing and accommodation** **Predicted outcomes of one CSG project**	**Measured outcomes**

Primary: Median house price, Median rent for a 3-bedroom house
Secondary: Development approvals
	• Demand for approximately 250 dwellings by 2014, impacting on housing availability and affordability
	• Cumulative demands of multiple projects on housing, potentially resulting in increased housing stress for low income households and requiring some households to relocate away from the region
	• Low income households may experience increasing difficulty in maintaining secure housing
		• Median house price in the WDRC LGA increased during the construction phase (2010–2013), with the house prices dropping slightly in 2014 (see Figure 2). This increase was not reflected in the overall figures for Queensland for 2010–2012, although prices have started to rise since 2013.
		  o House prices in Tara and Dalby were slightly elevated above pre-construction levels and relatively stable during 2010–2013.
		• The highest and most rapid increases in house prices were in Miles, Chinchilla and Wandoan (2010–2013). Prices have since declined in Miles, Chinchilla and Wandoan.
		• A rapid increase of up to 230% in rents in particular in Miles/ Wandoan (2011–2013) (Figure 3). Increases were also observed in Chinchilla, Tara and Dalby, therefore rents increased within the WDRC LGA due to the demands of CSG projects, potentially marginalising some low income communities.
		  o Conversely, during this period rents in Queensland remained relatively stable.

UQ Boomtown Toolkit © indicator	**Employment and local business** **Predicted outcomes of one CSG project**	**Measured outcomes**

Primary: Unemployment rates
Secondary: Workforce participation rate,
	• Employment during construction (2010–2014), peaking at approximately 2,400 jobs including drilling contractors
	• Permanent employment for around 500 people in the Western Downs area, plus ongoing
		• With the exception of Tara, unemployment rates in the towns declined between 2010 and 2013 following the same pattern as rates for WDRC LGA (Figure 4).
		  o This was contrary to the Queensland rate which continued to increase during this period.
		  o Tara township experienced a slight increase in unemployment rate in 2012 and then a large drop in unemployment to 2013.

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Work by industry, Business changes	construction and jobs for future development • Cumulative impacts due to several major projects proceeding in the region, impacting on labour force availability for other business and services	• Between 2013 and 2014, all towns and the LGA reported an increase in unemployment, indicating that there had been a positive effect on local employment levels during the construction phase of multiple CSG projects, as they were lower during the construction period (2010–2013). • The unemployment rate in the WDRC LGA reported in 2014 was 3.1%, which remains lower than the pre-construction rate in 2010 of 4.0%, suggesting some level of employment has been retained. Unemployment rates of 4% or less are generally associated with skills shortages. Unemployment fell to around 2% in the region in 2013.
UQ Boomtown Toolkit © indicator	**Employment and local business** **Predicted outcomes of one CSG project**	**Measured outcomes**
Primary: Non-resident worker population, Population Secondary: Cultural diversity	• Figures derived from the Queensland Government Planning and Information Forecasting Unit in 2008 used in the SIA predicted a population growth to 31,620 in 2011 and 33,037 in 2016, an increase of 1417 • Increase in the population of WDRC LGA estimated at more than 200 households by 2014, with ongoing construction likely to lead to a further slow increase to 2020 o Approximately 5% of the non-local workforce would move to the WDRC by 2014 • Increase in the population by approximately 700 people during construction	• By 2011, the population of WDRC LGA had already increased to 32,365, higher than was predicted by the Queensland Government in 2008. The WDRC LGA increased in resident population (which excludes non-resident workers (NRWs)) further from 32,365 to 33,653 between 2011 and 2014 (Figure 5), an increase of 1288. Queensland Government Statisticians Office (QGSO) (2013) projected growth to 34,241 in 2016, representing a total increase of 1876 people between 2011 and 2016, compared with the 1417 predicted in 2008. • The rate of population change in the WDRC LGA has rapidly slowed from 1.75% in 2012 to 0.74% in 2014; however, this still represents an increase in the permanent population overall. • The estimated resident population in Miles, Wandoan and Tara continued to remain relatively stable throughout the construction phase of CSG projects. Increases in permanent population were observed in Dalby (3.27%) and Chinchilla (6.91%) in 2011; however, the rate of population in increase is now declining with 0.61% reported in Dalby and 0.96% reported in Chinchilla in 2014.

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	• Increase in permanent residents by 130 households or 400 people and employment levels likely to increase the vitality and population stability of the area • Potential for greater cultural diversity through workers from other states and countries	• As shown in Figure 5 the percentage of NRWs as a proportion of the resident population within WDRC LGA has increased significantly from 6.19% in 2011 to 27.04% in 2014. The most dramatic increase within towns was seen in Wandoan from 11.33% in 2010 to 69.70% in 2014, which significantly affected the data for the LGA. o An increase in full-time equivalent (FTE) population (i.e., population including NRWs) from 3.82% in 2010 to 22.79% 2012 was experienced in WDRC LGA. o The percentage of NRWs remained high post-construction in 2013 and 2014 in Wandoan relative to other townships within WDRC LGA. • The towns of Miles, Chinchilla and Dalby saw increases in NRWs at the start of the construction phase (2010) and are now declining in FTE population post-construction (2013–2014). o Miles experienced a rapid increase between 2011 and 2013 in FTE population and is now declining with a -4.67% change in 2014 (QGSO 2015). o The townships of Dalby and Chinchilla are also declining in FTE population, with Tara the only town in the region slowly increasing in population, although the rate of change fluctuates highly between years (QGSO 2015). • The numbers of the overseas born population are collected during the ABS Census years. The data shows between 2006 and 2011, the number of overseas born within the total population increased significantly in the WDRC LGA from 1519 to 2234 persons.

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Figure 2 Median house prices 2001–2014

Source: *UQ Cumulative Socioeconomic Impacts: Coal Seam Gas development in the Western Downs region, Queensland*, manuscript in preparation.

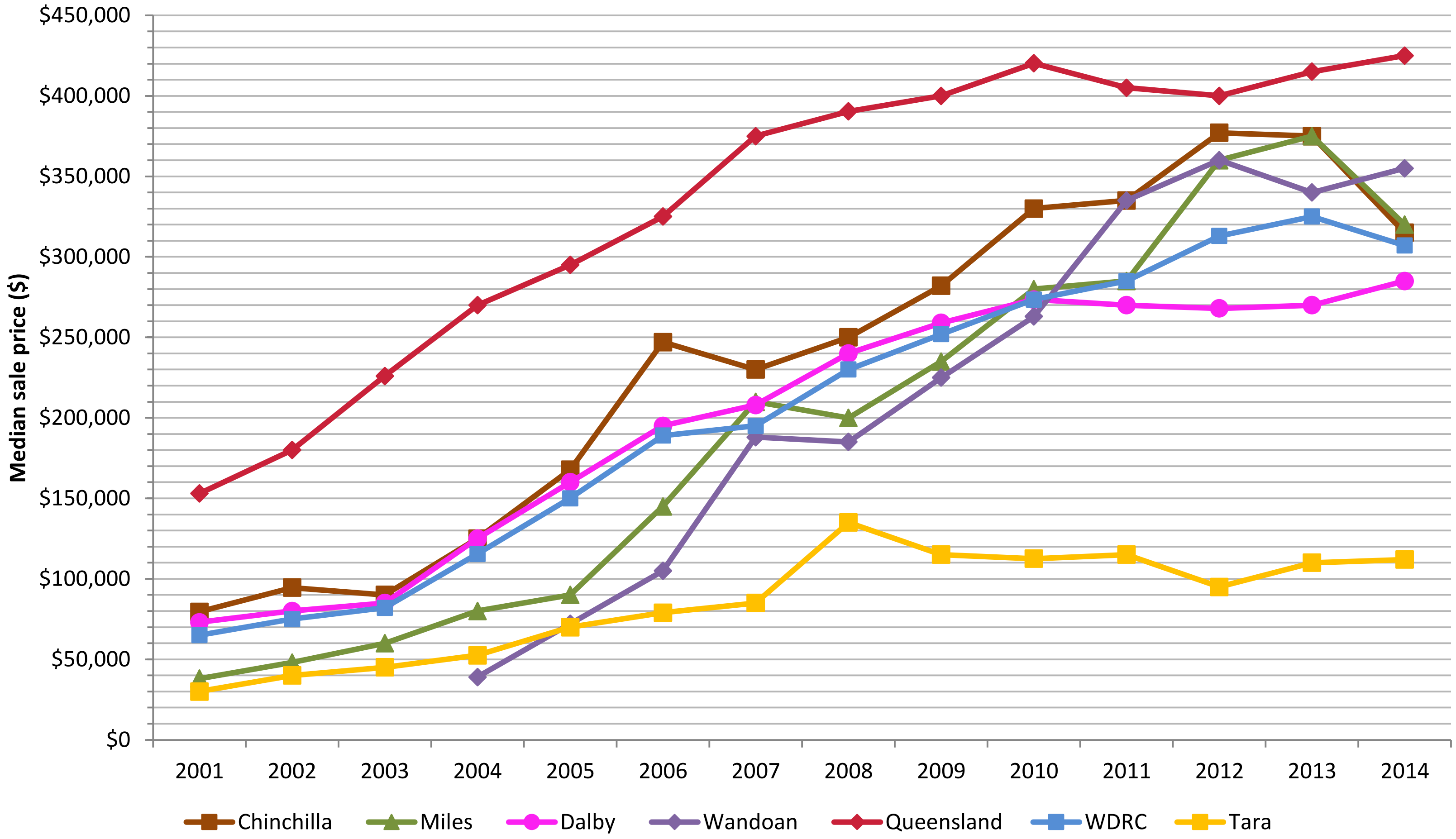

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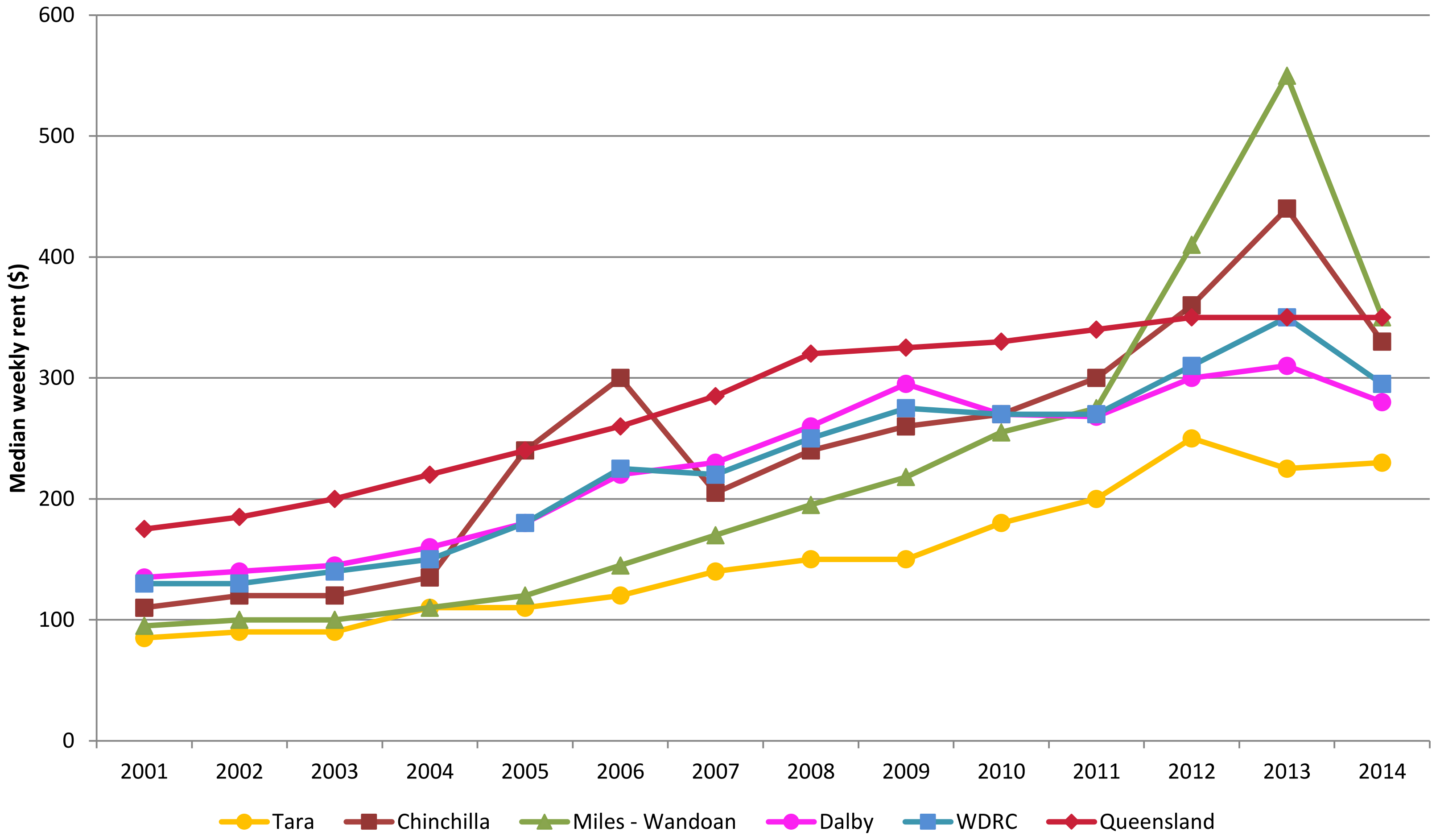
Figure 3 Median weekly rent 2001–2014

Source: *UQ Cumulative Socioeconomic Impacts: Coal Seam Gas development in the Western Downs region, Queensland*, manuscript in preparation.



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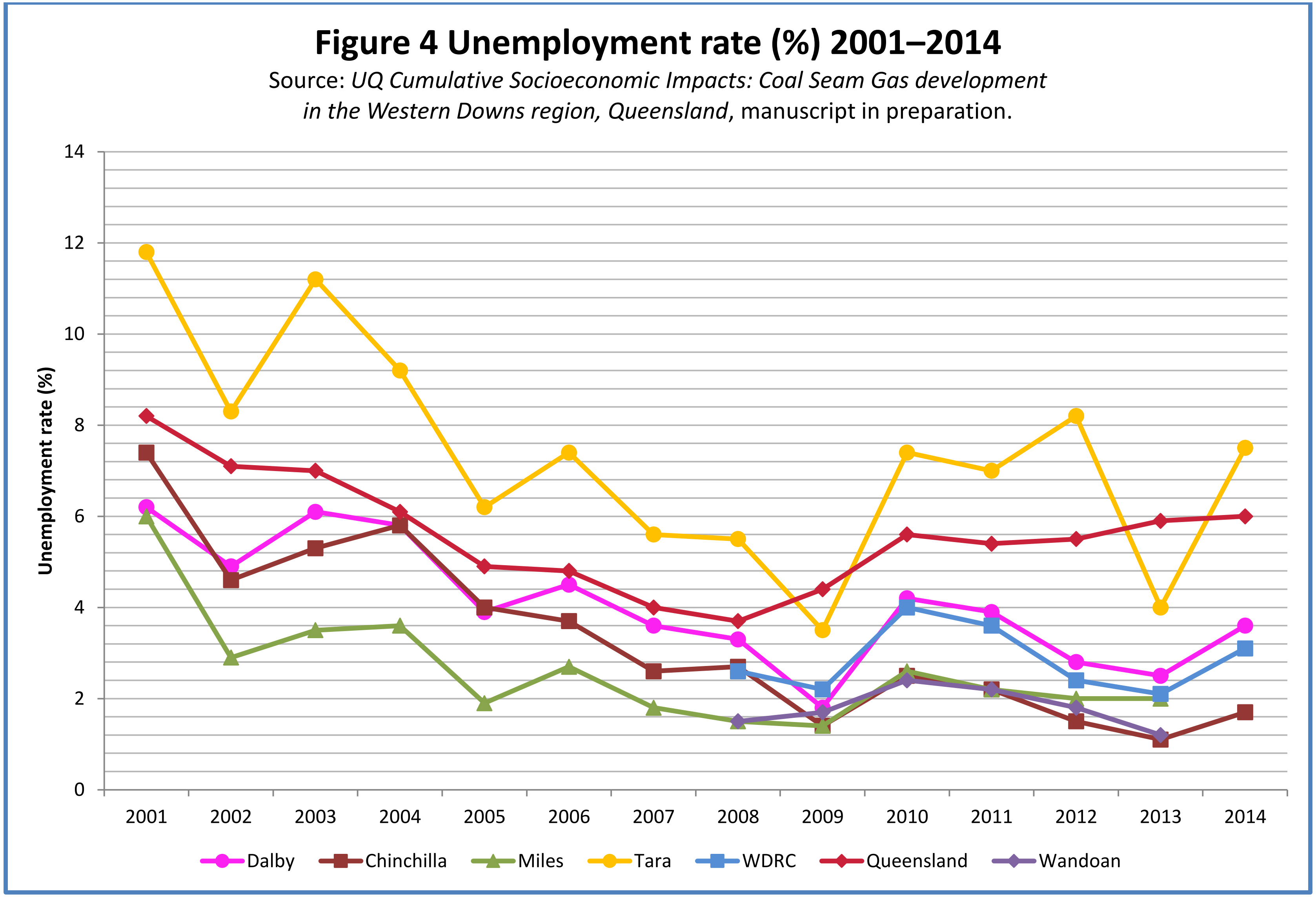

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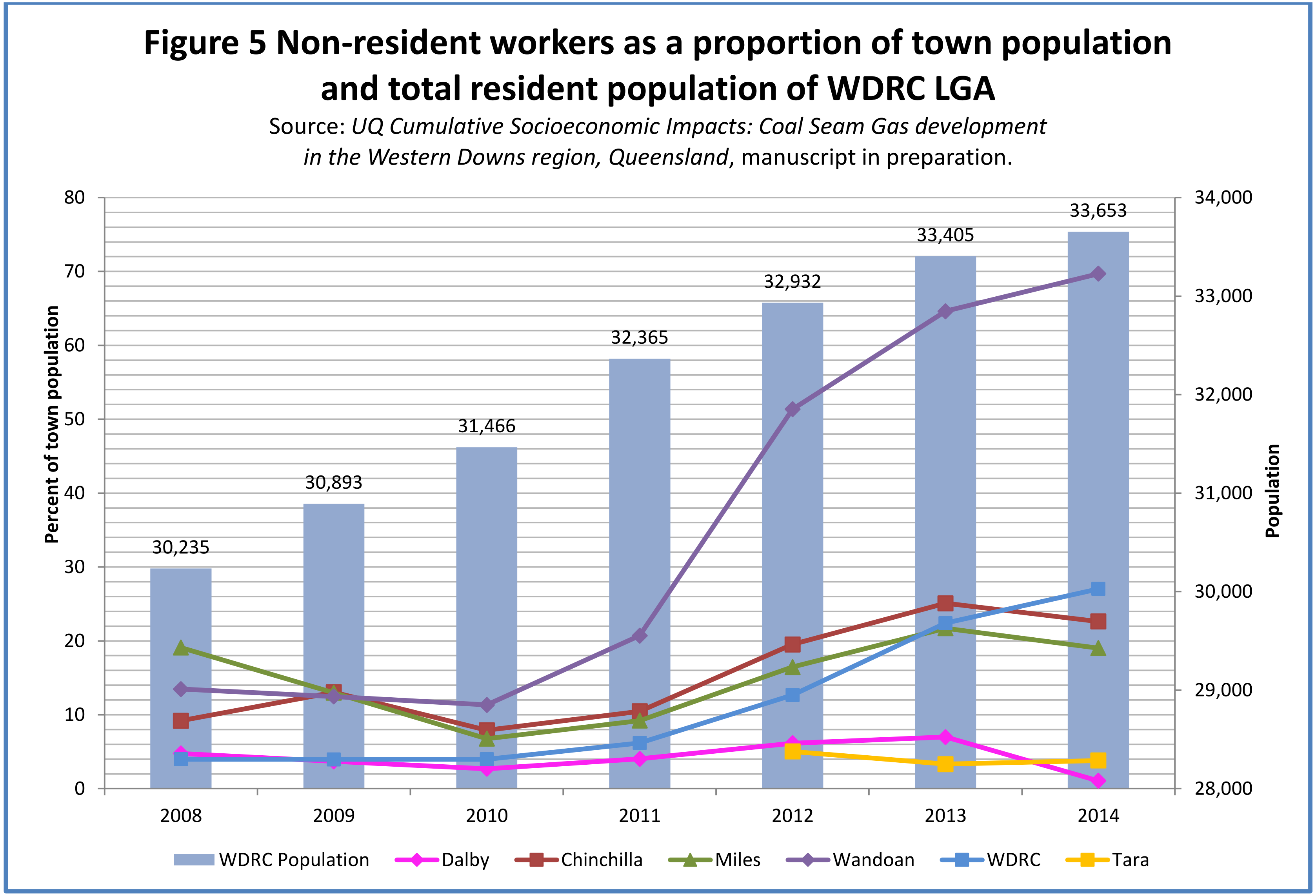

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Shared management and strategic monitoring framework

The analysis of trends in the indicators derived using the UQ BoomTown Toolkit© for the WDRC LGA and townships underline the following points in relation to the SIA for one of the projects:

1. The prediction of impacts in the SIA is generally focused on the regional level.
2. Multiple projects can alter the scale of predicted impacts and result in varied impacts across communities.
3. The importance of independent coordination of impact assessment studies across a region; such coordination can contribute to an adaptive assessment approach and shared management strategy (e.g., aiming for 'collective impact') to managing cumulative impacts of multiple projects within a region.

The trends and impacts highlighted in Figures 2–5 demonstrate that the prediction of socio-economic impacts made during the SIA process at the construction phase (2010–2013) of one CSG project in the WDRC LGA have been generally accurate. That is, there appeared to be a predicted increase in population, an increased demand for housing, and a decline in unemployment. When considering the data more closely, the experiences at the township level are highly varied when compared to the trends in the broader region and state. That highlights the need for focus on assessing cumulative impacts at the town level, rather than just at the regional level in SIA. The application of the UQ Boomtown Toolkit© indicators also show that the scale of impact on the region was larger than predicted in the individual project SIA. That indicates either that the predictions fell short (due to data limitations for example) or that there was an aggregated cumulative influence from other resource projects in the region and other factors, such as the flood in 2010 - 2011, followed by intensive reconstruction of roads and houses and an extended drought.

Furthermore, the application of the UQ Boomtown Toolkit© demonstrated that the predicted socio-economic outcomes of one project were less than originally anticipated. For example, the negative effects of an increase in unemployment rates when the construction phase ended seemed to be somewhat limited to date (only a year after the fact), which could be due to outward migration when jobs disappeared. The weekly rents have continued to remain higher than before the construction stage, as have median house prices. These shifts also indicate an aggregate socio-economic impact from multiple projects in the region during the peak construction phase between 2010 and 2014.

Had the Toolkit been available to apply prior to the development, to demonstrate a baseline case of socio-economic wellbeing at each township, pre-conditions for boom town impacts could have been identified and characterised more accurately. That would be possible by the UQ Boomtown Toolkit © draws on an extensive knowledge base embodied in indicators identified through academic research, stakeholder consultation and case studies into the socio-economic effects of resource projects.

In addition, as the development progressed through the construction phase, a more adaptive approach could have been applied to assessment of impacts predicted in the SIA's and applied in management strategies within the project SIMPs. A snap-shot of the effects of CSG projects during the construction period may have provided insight to the practitioners and industry operators as a trigger for

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undertaking further assessment (that is, enacting an adaptive assessment strategy so as to dig deeper into causes and consequences) or even to modify their SIMP strategy. Doing so in a collaborative, cross-sectoral manner could well have reduced the negative cumulative socio-economic impacts felt by townships.

Franks et al. (2010) and Rifkin et al. (2015) note that better coordination between industry operators and government is required to address uncertainty in identifying cumulative impacts and mitigating their effects on local communities. As illustrated by the CSG project used as an example in this paper, responsibility for addressing cumulative impacts can be seen as best being accepted as a shared responsibility. No one single project proponent can justifiably be held accountable for cumulative impacts; yet each contributes to a greater or lesser extent. Shared 'ownership' of cumulative impacts by the project operators is needed, with collaborative management and ongoing monitoring of their effects.

A shared management system can also enable measurement of a sector's shared outcomes, as it can foster collaborative or coordinated initiatives to achieve a region's potential (Muir 2015, Ogain et al. 2013). In the case of the CSG sector, the shared goal is minimising the negative and maximising the positive socio-economic impacts of the CSG projects on nearby communities. By considering the desired shared outcomes and adopting shared indicators, such as those in the UQ BoomTown Toolkit©, a shared management system and strategic monitoring framework can be developed to monitor the effectiveness of management strategies (Muir 2015).

Adopting a shared management system also assists in overcoming some of the limitations experienced by practitioners working within the boundaries of the legislated SIA process. For example, if all industry operators are participating, then an agreement can be reached on the level of information that is shared in transparent manner, minimising the effects of competitive pressures for secrecy. The amount of information shared is then agreed with a common outcome in mind. However, there would still need to be sufficient independent action to address the requirements of the shared indicators to be effective. A third party, such as an academic institution or a government body, independent of the operators, could also be employed to facilitate data transfer and transparency.

Concluding remarks

The UQ Boomtown Toolkit© is an example of an adaptive assessment approach to SIA practice, which uses an agreed set of 'indicators' to help practitioners, industry operators and governments in addressing cumulative socio-economic impacts. While the UQ Boomtown Toolkit © has been developed in the context of CSG development, it can be applied to many types of regional development with the potential to identify strategies to achieve significant positive social changes for local communities. Applying it to development assessment provides a shift of focus away from the individual projects and the competitive nature of the business to a more strategic approach centred on regional development as a result of impact mitigation and social investment. Finally, the application of the UQ Boomtown Toolkit © to CSG development in the WDRC LGA highlights the need for a coordinated shared management approach to the monitoring and management of cumulative socio-economic impacts of multiple resource projects in a region.

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