CHAPTER 1: INTRODUCTION

1.1 Introduction

The thesis examines whether mine lifecycle planning can assist in the generation of enduring value for remote communities affected by mining. Davies et al., 2012, p. 2 defined enduring community value from mining as the provision of a 'lasting or persistent benefit to groups of people and entities who have a stake in this economic activity'. The focus for this thesis is on socio-economic value to mine affected communities.[1] Previous research, as outlined in the Chapter 2, hypothesises that communities need to have diversified economies and be "normalised" or open to non-mining staff and others to join to ensure that mining can have enduring value. However, because this literature has been of a *post hoc* nature, this thesis adds to this literature by examining existing communities and the planning that has occurred and how the planning can deliver enduring value. The thesis does this by comparing the evolution of two remote community locations that have both been affected by mining but which have had different planning regimes applied: one having the experience of being closed to those not associated with mining and the other open.

The case study sites selected are Leigh Creek and Roxby Downs mining communities in South Australia. These sites were selected as Leigh Creek and Roxby Downs are communities that were developed to accommodate workers for the mine and ancillary support services. At the time of the establishment of the research project, Leigh Creek was heading into a phase of ceasing operations whereas the Olympic Dam mine operation at Roxby Downs was scheduled for a major expansion by BHP Billiton. Expansion plans were placed on hold in August 2012 due to BHP Billiton investigating less capital intensive designs of the open pit expansion of Olympic Dam to improve the economic viability of the project. Under the terms of the Roxby Downs indenture agreement with the South Australian Government, the expansion was to have been approved by December 2012 (BHP Billiton, 2012). Subsequently, the South Australian Government granted an extension until October 2016 for BHP Billiton to trigger the amended indenture agreement (Government of South Australia Department for Manufacturing, 2012).

[1] Environmental impacts are not within the scope of this thesis.

1.2 Project setting

The research was funded by the Cooperative Research Centre for Remote Economic Participation (CRC-REP) and the University of New England and forms part of the research outputs for the CRC-REP Enduring Community Value (ECV) from Mining Project. The objective of the CRC-REP ECV Mining Project is to 'analyse the benefits flowing from mining and how they can be translated into enduring value to the communities in which mines operate, both during and beyond the mine's life. It will also generate strategies that remote communities can use to deal with sudden shocks and global changes.' (Cooperative Research Centre for Remote Economic Participation, 2012, p. 1).

Mine lifecycle planning has been identified by the CRC-REP as a gap in knowledge which may help remote communities achieve enduring value from mining. The thesis refines and explores this gap in knowledge.

1.3 Thesis Aims and Objectives

The thesis establishes what mine lifecycle planning is and how mine lifecycle planning can create enduring value for remote communities. Using a comparative case study approach, the thesis assesses the degree of dependence that affected communities and the region more generally, have upon a mine and its related economic centre for a range of goods, services and infrastructure. It analyses the social and infrastructure benefits and negatives of the mine-based communities for the residents and surrounding communities and assesses the perceptions of the viability of both communities, along with assessing the impact planning policies of the mining companies and Government have upon the viability of the communities post mining.

The main outcomes of the thesis will provide mining companies and governments with research evidence to support the theory that mine lifecycle planning is required to generate enduring value from mining.

1.4 Research Question and Significance

The key research question for this thesis is:

> *Can mine lifecycle planning assist in the generation of enduring value for remote communities?*

The thesis and its primary research question are significant for at least three reasons. Firstly, the thesis addresses the problem that to date there is no published nor longitudinal research that either supports, or does not support, the hypothesis that mine lifecycle planning can generate enduring community value. In fact, previous research that has examined the effects of mining and mine closure on communities has been largely of a *post-hoc* nature.

Previous research has shown there have been significant negative effects from the boom and bust cycle of mining (Bradbury, 1988; D. Brown, 1984; R. Brown et al., 1989; Freudenburg & Wilson, 2002; Hegadoren & Day, 1981; Krannich & Greider, 1984; O'Faircheallaigh, 1992; Wilkinson et al., 1982). Prior research indicates planning for closure should occur in the earliest stages of the mine lifecycle (Franks, 2012; O'Faircheallaigh, 1992; Stacey et al., 2010). Furthermore, there is a larger impact of mine closure on remote communities dependent on a single resource than less remote and dependent communities (Bradbury, 1988; Browne et al., 2011; Haney & Shkaratan, 2003; Hegadoren & Day, 1981; Johnston et al., 2004; Pini et al., 2010). This research has shown for remote single resource-dependent communities to be sustainable or to have enduring value from mining, certain conditions must be met such as being an open community with a diversified economy (O'Faircheallaigh, 1992; Veiga et al., 2001). Further details of this previous research are provided in Chapter 2 (Robertson & Blackwell, 2014).

Secondly, the thesis is also significant because of the current state of disadvantage in remote Australia (Australian Bureau of Statistics, 2010; Haberkorn et al., 1999; Steering Committee for the Review of Service Provision, 2011), combined with the contrasting existence of a booming mining industry adjacent to this poverty. Mine lifecycle planning may provide a bridge between the fruits of a booming mining industry and the disadvantaged state of nearby remote communities. In addition to harnessing the fruits of mining in remote locations, mine lifecycle planning also offers a way to reduce inefficient or costly community impacts from mine lifecycle events such as closure. Ultimately, mine lifecycle planning may help to create a more even flow of benefits and a reduction of costs to remote communities over time; presenting an opportunity to alleviate the current state of poverty and hardship.

Thirdly, the thesis and its included publications have developed unique insights into remote peoples' perceptions, expectations and options for the future with and without mining. Just prior to submission of thesis for examination, the South Australian government announced the closure of Leigh Creek coal mine and the thesis and the publications contained within have been used by the Department of State Development (DSD) in its deliberations, particularly for Leigh Creek, over the future of remote mining towns following closure (see citations within Lomax-Smith & Heneker 2016). Direct feedback from DSD officials through CRC REP presentations was that the work contained within this thesis was highly useful to informing and developing government transitional policy and planning (Chambers, A., 2016, Pers. Comms, DSD, Adelaide, 27 Nov 2016). The thesis is therefore contributes to the CRC REP meeting its Commonwealth oblications of delivering research outputs that provide impact for industry, government and remote peoples.

1.5 Originality

There is no existing work that considers the research question in the context of Australian communities, particularly remote communities, which are affected by mining. Current and previous research has examined the economic, social and environmental impacts of mining on communities. As noted above previous research investigating sustainability or enduring value for communities has been *post-hoc*. By undertaking an investigation of Australian communities that are currently in different stages of their mine lifecycle, this research will make a unique and original contribution to knowledge.

1.6 Methods and methodology

The thesis utilises a constructivist ontology, interpretive epistemology and comparative case study method using an embedded multiple case design (Thomas, 2011; Yin, 2003) to examine two mines which are at different stages of the mine lifecycle, ranging from the start-up or major expansion phase through to a mine which is planning for imminent closure. The use of a constructivist ontology and interpretive epistemology for this research was used because the research involved undertaking a study within a variety of complex social settings involving a diverse range of participants, including mine workers, local business owners, farmers and farm workers, indigenous and non-indigenous community members. This diverse

range of participants has different meanings for social phenomena which they may develop, change or maintain through numerous social interactions (Bryman & Bell, 2011).

A case study methodology was utilised for this research because it allowed the comparison of two mining communities at different stages of their lifecycle. Case study methodology has become an accepted tool to develop theory within the social sciences (Eisenhardt 1989, Gillham 2010, Woodside 2010, Welch, Piekkari et al. 2011). The case study utilised a mixed methods approach. As Bryman & Bell (2011, p. 637) note 'researchers want to gather two kinds of data: qualitative data that will allow them to gain access to the perspectives of the people they are studying; and quantitative data that will allow them to explore specific issues in which they are interested'(see also Jonsen and Jehn 2009, Yin 2009, Gillham 2010).

The research utilised a triangulation of primary source materials; including archived materials, quantitative data via surveys' and qualitative data via semi structured interviews', resulting in a high level of internal validity for these case studies (Eisenhardt 1989, Yin 2003, Jonsen and Jehn 2009, Gillham 2010, Welch, Piekkari et al. 2011). Whilst there are recognised strengths and weakness of using the case study method to develop theory, particularly around the generalisability of the theory developed (Eisenhardt 1989, Gillham 2010, Welch, Piekkari et al. 2011). I consider the triangulation of source materials has made these case studies generalisable to remote communities in western democratic societies with broad application to non-western democratic societies.

Semi-structured interviews and surveys were conducted with local residents within the defined catchment area, in addition to business and mining companies and their employees to assess how communities interface with mines and the corporations that operate them. A review of government records, via the State Archives of South Australia, was undertaken to assess the rationale of the establishment of and the development of the existing structure of the communities developed to support the mines. Assessments of demographic data were conducted with a focus upon the changes in the workforce mobility, and employment characteristics.

Using the mixed methods approach allowed the case study to examine economic and social impacts and changes along with how these changes are impacting on the social structure and relationships between the mining companies, government and the communities of the case study sites.

Aboriginal Community Researchers (ACR's) from Ninti One were utilised to assist in the engagement with and data gathering from the Aboriginal communities within the case study area. The ACR's were able to increase the participation of Indigenous respondents in the survey, the level of data obtained via the interviews was not as rich as anticipated. Discussions with the ACR's during their data collection highlighted the culture preference of not being recorded either visually or by audio resulting in the ACR's manually recording the information. The recorded information was brief and not in the contextual conversational mode as desired. That being said the information gained was able to be utilised. Whilst the ACR's are trained in both qualitative and quantitative research techniques and can provide authentic engagement, consideration of community values and overcome the dynamics that often inhibit external researchers (Ninti One Ltd, 2012).

The survey was developed to gather information to ascertain the level of use and potential dependency of surrounding communities on Leigh Creek and Roxby Downs for a range of good and services. Further questions in the survey were developed to build a view of the amenity and the perceived future of both communities by the respondents. Questions were asked to initially gauge an insight to the spending patterns of the respondents upon a series of goods and services. This data was not utilised in any analysis as detailed examination of the responses indicated an unacceptable level of reliability in the data. There was a high of non-response and a level of drop out by respondents at this stage of the survey. The data for the participants who dropped out of the survey at this stage was retained as analysis of the responses and online survey metadata indicated the participants did not retake the survey. Also, it was felt that pertinent data would not be included and there would be no detriment to the validity and reliability of the data.

A paper version of the survey was distributed in the communities surrounding Leigh Creek and Roxby Downs, the link to the online survey via survey monkey was also provided in the information page for respondents. Each survey included a reply paid

envelope address to the researcher. The paper surveys were distributed via local progress associations and post office boxes mail box drops. Returned paper surveys were manually coded into survey monkey by the researcher to create one central database of results.

In Leigh Creek flyers were initially distributed via town services and the progress association with the information also included in the local newsletter. Follow up distribution of the flyer to all households was undertaken within 12 months of the original distribution of the survey. The Facebook page of the local café/information centre was used to distribute the information. Aboriginal community researchers from Ninti One Pty Ltd were engaged to conduct the surveys within the local Aboriginal communities. The Aboriginal researchers used Isurvey on Ipads to record the surveys. These results were later coded into survey monkey by the researcher.

For Roxby Downs adverts promoting the project and survey were placed in a local newspaper and during a local market day flyers promoting the survey were distributed. The Roxby Council placed information on the project and a link to the survey on their community Facebook page twice at an interval of six months. The project was further promoted via an interview on the ABC Radio South Australia North and West mornings' program, the link to the survey was provided on the programs Facebook page.

Interview participants were recruited via a self-selection by responding to a final question in the survey and via snowball effect where further interview participants were recommended. The majority of the interviews conduct by the researcher where audio recorded and professionally transcribed. The transcriptions were reviewed by the researcher particularly where there were queries by the transcriber. The transcriptions were coded with MAXQDA Plus software initially into broad themes then further reviewed with the themes collapsed to have at least 5 responses in each theme and coded to match the themes raised within the survey data.

Quantitative data was analysed using SPSS. Within SPSS non-parametric test were undertaking with the Fisher Exact, Wilcoxon and Kruskal Wallis procedures utilised to highlight and control any concerns in relation to the reliability and validity of the results. These procedures were utilised as a result of there being in some cross wise

analysis zero observations. The researcher is satisfied that the use of these procedures have controlled for any loss of internal reliability and validity in the data.

1.7 Case study site selection

Leigh Creek and Roxby Downs are located in the mid North and East of South Australia. Leigh Creek is located on the Western Edge of the Northern Flinders Ranges. Roxby Downs is approximately 144 kilometres due west of Leigh Creek. The Lake Torrens basin is between the two communities with the travel distance between Leigh Creek and Roxby Downs being 324 kilometres predominately via unsealed road. Both communities are remote and located approximately 560 kilometres north from Adelaide which is the capital city of South Australia. See figure 1.1

Figure 1.1:

Location of Roxby Downs and Leigh Creek, South Australia. (Source: Government of South Australia Department for Communities and Social Inclusion 2013)

Another feature involved in the selection of Leigh Creek and Roxby Downs is the structure of the title and governance of the communities. Leigh Creek is a "closed community". The township is managed and maintained by Alinta Energy. There is no freehold title to property in Leigh Creek and to gain residency, people are required to work at least 20 hours per week in the town (Australian Mine and Metals Association, 2013; Matulick, 2011).

In contrast, Roxby Downs is an open town with freehold title with a structure of local government for service provision. There are no directly elected local government officials for Roxby council, and the town administrator is appointed by the South Australian Government (Roxby Downs Council, 2013). The communities

surrounding Leigh Creek and Roxby Downs are administered by the South Australian Government Outback Communities Authority (OCA).

The local governance structures in the area surrounding Leigh Creek and Roxby Downs are unique in that each small community have a local progress association which act a liaison with the OCA on the need of services and assist with community needs and priorities and well as undertake town management tasks. The OCA has responsibility for provision of limited local governance throughout the area (Outback Communities Authority 2013). This structure potentially inhibits the development and expansion of industry within the case study area as there is no one body responsible for the promotion and development of the broader region.

1.8 Case study site background

1.8.1 Leigh Creek Coalfield

The first European mention of coal in the Leigh Creek area was in 1860 when a witness before a South Australian Parliament select committee on mineral resources made reference to the discovery of coal in the area but the location was kept secret (Mincham, 1965). It was not until 1884 that coal was rediscovered during the construction of a new railway dam near the train siding called Leigh's Creek. The deposit was inspected by the Government Geologist in 1889 and Leigh's Creek Coal Mining Company commenced operations (Klaassen, 1997). Operations ceased in 1903 as the company was not able to find a market for the coal due to the low quality compared with coal from Newcastle in New South Wales (Klaassen, 1997). The mine was sold in 1906 with some operations continuing until 1910 when the lease was cancelled. Small scale mining operations and testing of the coal continued in the area until the 1940's (Klaassen, 1997).

South Australia was dependent upon coal imported from NSW and other centres and countries from the beginning of the settlement of Adelaide. Upon the commencement of World War 2 there was a shortage of coal in South Australia due to disruptions to shipping and miners strikes in NSW (Klaassen, 1997). As a result, the South Australian Government started developing the Leigh Creek coal field. In 1942 the Premier of South Australia, Tom Playford, introduced the *Leigh Creek Coalfield Act 1942*. The Bill allowed for the Government to spend up to £200,000 to develop and mine the deposit, and sell or otherwise dispose of the coal (Klaassen, 1997). This was

the start of the full development of the Leigh Creek Coalfield and the town of Leigh Creek.

To assist in his aim to secure a large and permanent customer for Leigh Creek coal, the Premier of South Australia appointed a Royal Commission to investigate the operations of the private company Adelaide Electric Supply Company (AESCO) that generated most of the electricity for Adelaide. In August 1945 the Royal Commission recommended that public ownership of power generation would better serve the public interest (Klaassen, 1997). Following this recommendation the South Australian Government introduced the Electricity Trust of South Australia Bill in October 1945 to nationalise AESCO and form the Electricity Trust of South Australia (ETSA) (Klaassen, 1997). The Bill was initially rejected by the Upper House of the South Australian Parliament before it was finally passed in April 1946 with further amendments in November 1946 (Klaassen, 1997).

From February 1948, the Leigh Creek coalfield was transferred to the control of ETSA with the *Leigh Creek Coalfield Act* 1942 repealed within the *Electricity Trust of South Australia Act Amendment Act*, 1946. Section 43d (2) of the Act sets out that ETSA may:

(a) erect houses, buildings and other improvements,

and grant leases or tenancies of, or rights to

use or occupy, any land, house or building

belonging to the trust:

(b) construct, repair and maintain streets and roads:

(c) plant, develop, improve and maintain public

parks, squares, recreation grounds and other

places of public resort:

(d) construct, acquire, maintain and manage sewerage

systems and provide sewers and drainage for

any premises:

(e) construct, acquire, maintain and manage waterworks,

buy water, and sell and supply water:

(f) generate, sell and supply electricity:

(g) acquire or dispose of property of any kind:

(h) construct any works:

(i) make reasonable charges for any commodity or

service sold or supplied by the trust:

(j) do or execute any other act, matter or thing, or

enter into and carry out any transaction.

The passing of the *Electricity Trust of South Australia Act Amendment Act* 1946 enabled the establishment of the Leigh Creek coalfield and passed control of the township of Leigh Creek to ETSA.

The *Electricity Trust of South Australia Act, 1946* was repealed by the *Electricity Corporations Act, 1994*. The *Electricity Corporations Act (Restructuring and Disposal), 1999* was introduced to allow for the privatisation of the South Australian electricity generation and distribution networks which included the township of Leigh Creek.

1.8.2 Leigh Creek Township and surrounding area

The original train siding constructed in 1881 was called Leigh's Creek as it was located on the southern back of Leigh's Creek and near the Leigh's Creek sheep and cattle station. In 1883 a Post Office was built at the siding followed in 1884 by a Hotel. With the discovery of the coal field and the nearby copper mines, the community expanded. In 1891 the Government surveyed the community surrounding Leigh's Creek siding which was officially named Copley, with a school opening in 1895 (Klaassen, 1997; Mincham, 1965).

With the passing of the *Leigh Creek Coalfield Act* in 1942 the South Australian Government developed plans to build a model mining community for the workers and their families near the Telford railway siding to the north of Copley with the first home for married workers completed in 1944. Blocks of land were set aside for Post Office, Banks, Churches and a School which opened in March 1947 (Klaassen, 1997).

In 1974, the Electricity Trust of South Australia (ETSA) who had responsibility for the running of the Leigh Creek mine and town decided that the community needed to be moved to allow for the expansion of the coalfield (State Records of South Australia, 1974). In 1978, a South Australian Parliament committee, The Leigh Creek Fact Finding Committee, was formed. During 1978 the committee visited Leigh Creek and Copley to take submissions (State Records of South Australia, 1978b). The overwhelming opinion expressed to the committee was that the town should remain closed and only people who worked for ETSA or support services should be allowed to live in the town (Klaassen, 1997). However, the committee recommended that the relocated township be an open township in line with the stated Government policy of having an open or 'normalised' township with the provision of welfare or Aboriginal housing (State Records of South Australia, 1978b). The South Australian Government as a result of threatened industrial action maintained the closed status of the Leigh Creek, even though State development plans record the need for Leigh Creek to be an normalised community to act as a service centre for the North Flinders Ranges (State Records of South Australia, 1978a, 1978c).

The township of Leigh Creek is managed commercially by Alinta Energy who took over operations in 2007 (Alinta Energy, 2013). The physical infrastructure of Leigh Creek is owned by the South Australian Government and leased to Alinta Energy through the Generation Lessor Corporation, a subsidiary of the South Australian Government Treasurer (Collins Anderson Management, 2007). Buildings such as the School and Hospital are owned and maintained by the South Australian Minister of Infrastructure (Collins Anderson Management, 2007). The population of Leigh Creek as recorded by the 2011 census is 505 (Australian Bureau of Statistics, 2013a) which is a decrease from 549 residents in the 2006 census (Australian Bureau of Statistics, 2008a).

The Northern Flinders ranges first European settlers were graziers moving north from Adelaide. The farming station, Leigh's Creek, in the area of Leigh creek was first established in 1856 (Mincham, 1965). Copper was discovered near the town of Beltana in 1856 and an extensive copper deposit was discovered at Blinman in 1859 (Mincham, 1965). Mining continued at a mine near Blinman with intermittent closures until 1908, because of the prohibitive cost of transporting the ore to Port Augusta and the prohibitive cost of building the necessary infrastructure (Mincham,

1965). The main mine near Beltana stopped operations around the same time due to flooding of the mine. Small scale mining of the copper in the region has continued without much success with the latest operation being placed into care and maintenance in 2011 whilst further testing has been conducted into more efficient recovery of the copper ore (Phoenix Copper Limited, 2012).

The Beverly Uranium mine is within the radius of the study area. There are other active mining and exploration leases within the study area. Figure 1.1 shows current and historic mining and current exploration near Leigh Creek.

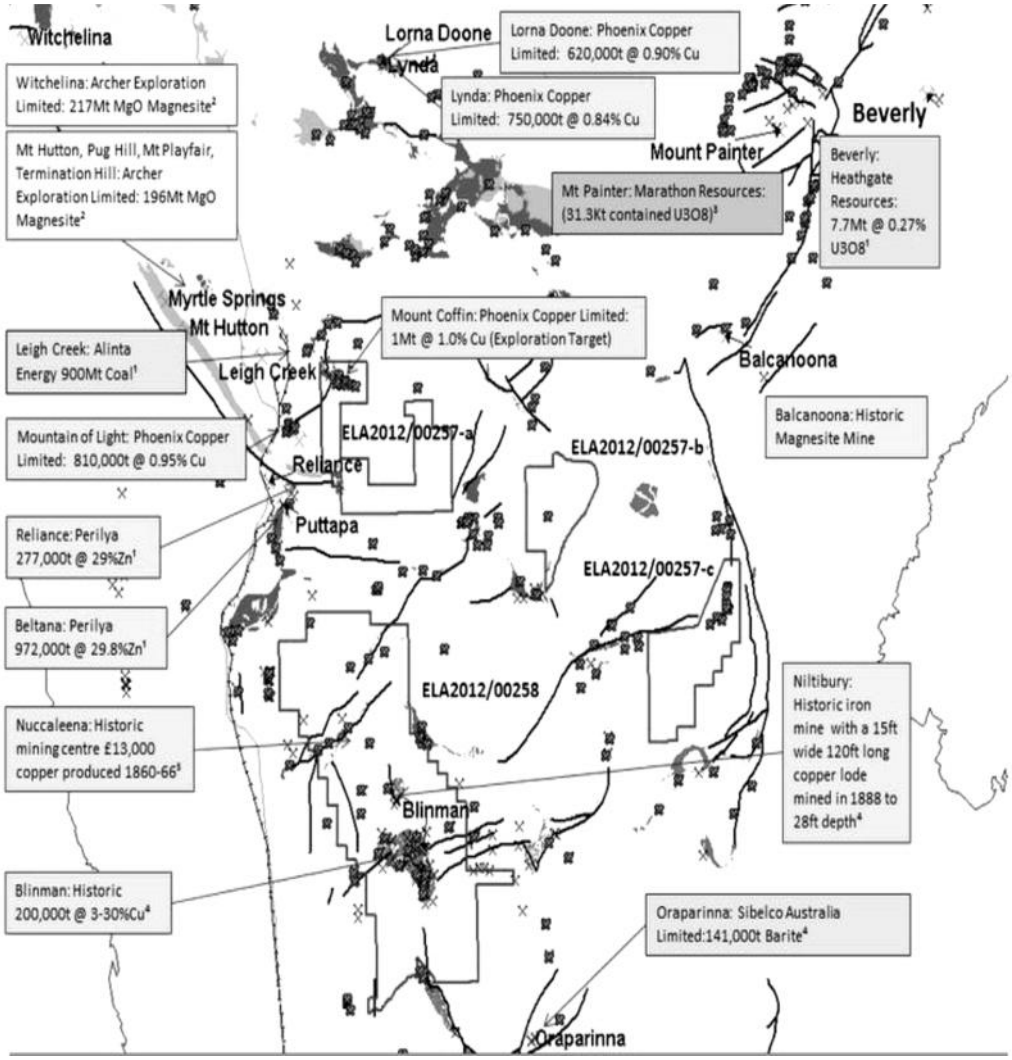

Figure 1.2: Current and historic mining and exploration leases
(Source: Phoenix Copper Limited, 2013)

1.8.3 Traditional owners

The Adnyamathanha people are the traditional owners of the land in the Northern Flinders ranges and the area surrounding Leigh Creek as determined by the Native Title Tribunal on 30 March 2009. Most of the area falls within the study area's 140 Kilometre radius from Leigh Creek. The Adnyamathanha people receive royalties from more recent mining activities such as the Beverley Uranium mine. However they do not receive any royalties from the Leigh Creek coal mine. The royalty income stream has allowed the Adnyamathanha Tribal Lands Association to invest in pastoral leases and tourism ventures such as the iconic Wilpena Pound to enable the community to have an income stream following the cessation of mining in the region. The Adnyamathanha people were made up of five tribes, the Kuyani, Wailpi, Yadliaura, Pilatapa and Pangkala. Prior to European settlement the Adnyamathanha

people accessed the country south to Port Augusta and east to Broken Hill (Nepabunna Community Inc, 2012). After the establishment of pastoral leases the Adnyamathanha were forced to camp together, originally at Damper Hill, then Ram Paddock. They were forced to move from these sites due to pressure from the graziers. In the 1930's a community was established at Nepabunna (Nepabunna Community Inc, 2012).

1.8.4 Olympic Dam Mine

The discovery of the ore body that forms the Olympic Dam mine was a result of research by a Western Mining Corporation geologist who identified certain geological structures that result in copper deposits (Johns, 2010). These structures were identified in the Roxby Downs area even though the structures were covered by a deep layer of sediment. Western Mining Corporation applied for an exploration license over part of Roxby Downs Pastoral Station in February 1975. The Exploration License was granted in May 1975 and covered 2358 square kilometres with the first exploration hole drilled in June 1975 in the area of a stock watering point called Olympic Dam (Johns, 2010). Subsequent drilling confirmed the richness and mix of minerals within the deposit. There was significant debate within the community and State and Federal governments over the development of the Olympic Dam mine due to the presence of uranium ore within the mineral deposit (Johns, 2010). Negotiations for an indenture agreement for the establishment of the mine and required community infrastructure started in 1980 between the South Australian Government and Western Mining Corporation, with final agreement reached in February 1982. The *Roxby Downs (Indenture Ratification) Act 1982* came into operation in June 1982 (Johns, 2010). The environmental impact study for Olympic Dam was approved in June 1983 which allowed further feasibility studies and mining to confirm the viability of the project. In May 1986 Western Mining Corporation and their partners notified the South Australian Government of their intent to proceed with the Olympic Dam project (Johns, 2010). The area covered by the Olympic Dam mining lease and the Roxby Downs Municipality was originally in the Woomera Prohibited Area. During the exploration stage the boundaries of the Woomera Prohibited Area were changed to enable the development of the Olympic Dam mine and the Roxby Downs community (Johns, 2010). In 2005 Western Mining Corporation was purchased by BHP Billiton.

1.8.5 Roxby Downs Township and surrounding areas

The *Roxby Downs (Indenture Ratification) Act 1982* also set out the structure of the community to be built to support the workforce for the Olympic Dam mine. The Municipality of Roxby Downs was established under the *Act*. The Roxby Council has the same powers and functions as any other local government under the South Australian *Local Government Act 1934* except for the election of Councillors and a Mayor. An Administrator appointed by the South Australian Government runs the Municipality. Another notable exception from usual local government areas is that the budget for Roxy Council has to be approved by the South Australian Government and BHP Billiton. Power and water for Roxby Downs is supplied and run by separate authorities which are run as self-contained business units within the council (Roxby Council, 2012a, 2012b).

In 1987 construction of the Roxby Downs Township commenced with land clearing and road construction. The initial plan was for the community to house 8,000 residents though the first stage development catered for 3,500 residents. In 1997 there was a second stage of development to increase the capacity of the town to cater for 4,000 residents. Roxby Downs has increased in size with the 2011 census recording 4702 residents (Australian Bureau of Statistics, 2013b) in the Roxby Downs Municipality compared to 3847 residents in the 2006 census (Australian Bureau of Statistics, 2008b).

Northeast of Roxby Downs is the opal mining community of Andamooka. Opal was discovered in the early 1930's by two workers on Andamooka station. Andamooka's population increased in the 1950's with migrants from Europe being attracted to the largely ungoverned community (Andamooka Progress Association, 2011). The only other community of size is Woomera which was established to provide accommodation for Department of Defence workers and researchers at the Woomera rocket range in 1947 (Hofmeier, 2013; Iwanicki & Jones, 2012). Until 1982 Woomera was a completely closed town with no public access. Residents of Woomera are unable to purchase property in the town (Hofmeier, 2013; Woomera, 2013).

The only other non-opal mining operation near Olympic Dam is the Prominent Hill mine which is located within the Woomera Prohibited Area. An Australian

Government review into the Woomera Prohibited Area has recommended that restrictions on the explorations of mineral resources in the area be amended to allow more exploration (Australian Government, 2011). Oz Minerals is currently doing exploration drilling for a resource body called Carapateena 100 kilometres south east of Roxby Downs (Oz Minerals, 2013). There is also exploration occurring to the north of Roxby Downs by Tasman Resources and to the south by Core Exploration with further confirmed ore bodies at Acropolis and Wirrda Well. These exploration and mining areas are within the same geophysical formation as the Olympic Dam Ore body (Core Exploration, 2012; Porter GeoConsultancy, 2010; Tasman Resources, 2013).

1.8.6 Traditional Owners

The Kokatha people have been associated with the land from the north of Port Augusta between Lake Torrens in the east to the Gawler Ranges in West (Kokatha, 2013). The Kokatha people have lodged a Native Title claim in 2009 for the areas they have been associated with; Roxby Downs and Olympic Dam are within the claim area along with the Woomera Protected Area (Kokatha, 2013).

1.9 Mine Lifecycle Planning and Community Value

Mine lifecycle planning is the name given to the planning process involved in the development of a potential mineral extraction operation. Bhattacharya (2007), suggests mine lifecycle planning does not just involve the development of the ore deposits, it also must take into consideration the wider macroeconomic and socio-economic implications of the mine. It is this broader area that this research focuses on.

The literature in the main focuses on the stages of the mine Lifecycle and highlights the importance of engaging with communities as a part of the company's corporate social responsibility and social licence to operate (Franks 2012, Meehan 2012, Nakagawa, Bahr et al. 2013), for a more detailed review see Robertson and Blackwell (2014). However, with the shortened lifespan of modern mines along with changes in market conditions suddenly making mines temporarily unviable creates difficulties for long term planning for mine related communities as this research and others such as Pini, Mayes et al. (2010) and McDonald, Mayes et al.(2012) noted.

These events which are unable to be fully planned for add complexity to being able to generate enduring value for mine related communities. The literature indicates that for mine related communities to successfully endure post mining they need to develop a diversified economic base (see Robertson and Blackwell 2014 for a detailed review). The literature on new regionalism (see MacLeod 2009 for a review), suggest away forward for mine related communities in non-remote areas, with towns able to become residential bases for new mines and new industries (for example Freudenburg and Wilson 2002, Wilson 2004). However, in more remote areas the ability to diversify the economic base and the benefits derived through intra- regional cooperation are difficult to achieve. The case sites in this research fall into this category, being very remote with low population and a pseudo local government structure that inhibits diversification or even the development of alternate industry. These more remote communities, as this research highlights will endure post mining though with a reduction in services as they are important service centres for a broad region. The royalty stream from mining activities to traditional owners is an avenue for those broad social communities to generate enduring value from mining, as noted previously in the Adnyamathanha Tribal Lands Association has invested the royalty stream into business to allow the community to own the leasehold upon the land they also have native title upon and invest in businesses that will generate an ongoing revenue stream for the community once mining has ceased.

1.10 Thesis Outline

Chapter two, (Robertson & Blackwell, 2014), reviews the literature, defining and examining what is meant by the mine lifecycle and the concept of enduring value. Literature on the socio economic impacts of mining, particularly, the impact of unplanned shutdowns and cyclical downturns upon mine related communities is reviewed. Along with, the importance of having a diversified economic base to ensure a community is able to remain viable post mining. The process of normalisation of closed mining communities is examined, highlighting the need to have a normalised community to enable the process of developing a diversified economic base. The concept of Corporate Social Responsibility (CSR) and Social License to Operate (SLO) are introduced and their importance to the process of mine lifecycle planning. see (Buitrago & Robertson, 2014). Buitrago and Robertson (2014) also highlight the utilising the Sustainable Livelihoods Framework (SLF) as a

method of developing and maintaining SLO particularly in developing nations. This chapter through examining the literature builds the framework of the research and highlights the importance of planning a mine's lifecycle to minimise the impact upon dependant communities.

Chapter three, Buitrago and Robertson (2014), highlights the use the Sustainable Livelihoods Framework (SLF) as a method of developing and maintaining SLO particularly in developing nations. The examples from Colombia are utilised to highlight the opportunity to utilise SLF in Leigh Creek as part of the planning for the future of the community and its surrounds post mining. By examining SLF the chapter provides the a framework for the ongoing development of Leigh Creek and Roxby Downs in light of the research findings presented in the following chapters.

Chapter four, Robertson & Argent, (2016), examines the evolution of Roxby Downs and Leigh Creek along with the changes in and mobility of the resident populations. It examines the concept of lifecycle planning in more detail and how the planning can affect the makeup and mobility of a mine centred communities population. The findings of the case study are introduced, highlighting the impact of operational decisions by mine management upon the mobility and level of workers choosing to reside within the communities. The effect of these lifecycle planning decisions upon these communities and their surrounds are examined in greater detail in the following chapters.

Chapter five, (Robertson & Blackwell, 2015), analyses the results of the survey undertaken in the case study area to ascertain the level of use of the services and infrastructure in Leigh Creek and Roxby Downs. Determining the level of dependency upon the services available in these towns by residents and members of surrounding communities highlights their importance. Assessing the impact of the loss of these services and infrastructure upon any closure of the town upon the hinterland residents is an important aspect in determining the importance of lifecycle planning to ensure mine based communities are able to be sustainable post mining. The findings indicate in the case of Leigh Creek that there is a high level of dependency upon the town by the hinterland residents, whom will be faced with extended travel to Port Augusta to access the similar level of service provided in Leigh Creek. In the case of Roxby Downs the results indicate a similar level of

dependency has yet to develop allowing actions to be taken to ensure there is not a continuation of a loss of services in the main hinterland community of Andamooka.

Following from chapter five which examined the level of dependency upon the services in Leigh Creek and Roxby Downs chapter six examines the perceived social and infrastructure benefits the two case study communities provide. The results indicate that Leigh Creek and Roxby Downs provide benefits to the residents and hinterland communities that make both communities satisfying places to reside in. However, the loss of population in Leigh Creek and the move to a DIDO workforce has caused a reduction in the social and infrastructure benefits. The reduction of benefits includes the loss of sporting and social clubs along with the reduction in subject options for students in secondary school. Roxby Downs has not had a reduction in sporting and social activities, however, there has been a reduction in services available with the closing of many small independent retailers. The transience of the workforce, as highlighted in chapter three was reported as being a negative as well as a benefit. For example, being easier to make friends with everyone with the converse being a reluctance to make friends as the repeated loss of attachment to people over time becomes emotionally wearing.

After examining the need for planning, workforce mobility, the dependency upon and benefits/negatives of the case study community, chapter seven examines the perceptions of the respondents on the future viability of both communities. Overall, the results indicate that the respondents do not believe Leigh Creek and Roxby Downs will remain viable post mining unless there is continued mining or alternate industry developed. The view of the respondents reflects the literature on the need for alternate industry to ensure mine based communities are able to endure post mining. The findings of chapters five and six highlight the benefits of these communities, whilst these results indicate the respondents, whilst enjoying the benefits of these communities, do not consider those benefits will exist post mining.

Concluding remarks will be presented in chapter eight, which will tie together the findings of the previous chapters to highlight the need for planning to ensure a normalised and diversified economic base ensuring the enduring value for remote mining communities. However, in the context of Leigh Creek the planning for and move to a normalised community with a diversified economic base has not occurred. The future of the provision of services and the social and infrastructure benefits of

Leigh Creek are at risk following the closure of the Leigh Creek mine. In the case of Roxby Downs there is the potential for planning to diversify the economic base, however, as seen the halt to the open cut expansion at Olympic Dam market conditions can change affecting the viability of the mine and thence the town of Roxby Downs.

1.11 Conclusion

In this chapter, the significance and originality of the thesis has been established, particularly in light of the published research being *post hoc* in nature. Utilising the case study method with a triangulation of primary sources and data collection methodologies has maintained the internal validity of the research which will enable the thesis findings to be applied to remote mining communities in a variety of societies globally.

The background to the case study sites highlights the uniqueness of this thesis in being able to compare and contrast two mines and their related remote communities at different stages of the mine life cycle. These sites with different residence and governance structures have provided a broad view of options for the planning and development of remote mining operations. The thesis will be able to form the basis of further longitudinal studies into these communities to further develop the concept of mining lifecycle planning and the generation of enduring value for remote communities.

References

Alinta Energy. (2013). Leigh Creek coal mine. Retrieved 08 February 2013, from http://alintaenergy.com.au/Everything-Alinta-Energy/Power-Generation/leigh-creek

Andamooka Progress Association. (2011). Andamooka history. Retrieved 18 April 2013, from http://andamooka.sa.au/andamooka-history

Australian Bureau of Statistics. (2008a). 2006 census community profiles: Leigh Creek (SA) -basic community profile Retrieved 27 June 2013, from http://www.censusdata.abs.gov.au/ABSNavigation/prenav/ProductSearch?&areacode=SSC43971&producttype=Community%20Profiles&action=401

Australian Bureau of Statistics. (2008b). 2006 census community profiles: Roxby Downs - time series profile Retrieved 27June 2013, from http://www.censusdata.abs.gov.au/ABSNavigation/prenav/ProductSearch?&areacode=435256970&producttype=Community%20Profiles&action=401

Australian Bureau of Statistics. (2010). The city and the bush: indigenous wellbeing across remoteness areas. *Australian Social Trends 4102.0*. Retrieved from www.abs.gov.au/AUSSTATS/abs@.nsf/Lookup/4102.0Main+Features10Sep+2010

Australian Bureau of Statistics. (2013a). 2011 census community profiles: Leigh Creek SA (GL) -basic community profile Retrieved 20 June 2013, from http://www.censusdata.abs.gov.au/census_services/getproduct/census/2011/communityprofile/GL_SA720?opendocument&navpos=230

Australian Bureau of Statistics. (2013b). 2011 census community profiles:Roxby Downs SA (GL) -basic community profile Retrieved 10 August 2014, from http://www.censusdata.abs.gov.au/census_services/getproduct/census/2011/communityprofile/GL_SA1219?opendocument&navpos=230

Australian Government. (2011). Review of the Woomera prohibited area final report. Canberra: Department of Defence.

Australian Mine and Metals Association. (2013). Key industry locations: Leigh Creek, South Australia. Retrieved 20 April 2013, from http://www.miningoilgasjobs.com.au/life-in-australia/the-land,-people-and-information/key-industry-locations/leigh-creek-sa.aspx

BHP Billiton. (2012). Olympic Dam update. *Company Press Release* Retrieved 12 August 2014, from http://www.bhpbilliton.com/home/investors/news/Pages/Articles/Olympic-Dam.aspx

Bradbury, J. (1988). Living with boom and bust cycles: New towns on the resource frontier in Canada, 1945-1986. In T.B. Brealey, Neil C.C., Newtown, P.W (Ed.), *Resource Communities: Settlement and Workforce issues* (pp. 3-20). Melbourne: CSIRO Australia.

Brown, D. (1984). The Atikokan story: life in small community that suffers economic collapse. In M.J Wojciechowski (Ed.), *Mining Communities: Hard Lessons for the Future*. Ontario: Queens University.

Brown, R., Geertson, H., & Krannich, R. (1989). Community satisfaction and social integration in a boomtown: A longitudinal analysis. *Rural Sociology, 54*(4), 568-586.

Browne, A., Stehlik, D., & Buckley, A. (2011). Social licences to operate: for better not for worse; for richer not for poorer? The impacts of unplanned mining closure for "fence line" residential communities. *Local Environment, 16*(7), 707-725.

Buitrago, I., & Robertson, S. (2014). *Mine lifecycle planning: creating lasting value for communities* Paper presented at the Life of Mine 2014 Conference, Pullman Brisbane King George Square, Brisbane.

Collins Anderson Management. (2007). Leigh Creek - regional servce centre report. Adelaide: Northern Regional Development Board.

Cooperative Research Centre for Remote Economic Participation. (2012). Community benefits from mining Retrieved 08 April 2013, from http://crc-rep.com/research/regional-economies/enduring-community-value-mining

Davies, J., Maru, Y., & May, T. (2012). Enduring community value from mining: conceptual framework. Alice Springs: Ninti One Limited.

Franks, D. (2012). Social impact assessment of resource projects. *Mining for Development: Guide to Australian Practice* Perth: International Mining for Development Centre.

Freudenburg, W. , & Wilson, L. (2002). Mining the data: Analyzing the economic implications of mining for nonmetropolitan regions. *Sociological Inquiry, 72*(4), 549-575.

Government of South Australia Department for Manufacturing, Innovation, Trade, Resources and Energy. (2012). Olympic Dam Retrieved 14 March 2013, from http://outernode.pir.sa.gov.au/minerals/mines__and__developing_projects/approved_mines/olympic_dam

Haberkorn, G., Hugo, G., Fisher, M., & Aylwar, R. . (1999). *Country matters: A social atlas of rural and regional Australia*. Canberra: Bureau of Rural Sciences.

Haney, M., & Shkaratan, M. (2003). Mine closure and its impact on the community: five years after mine closure in Romania, Russia and Ukraine *World Bank Policy Research Working Paper 3083, June 2003*. Washington World Bank

Hegadoren, D., & Day, J. (1981). Socioeconomic mine termination policies: A case study of mine closure in Ontario. *Resources Policy, 7*(4), 265-272.

Hofmeier, S. (2013). History Woomera Travellers Village and Caravan Park. Retrieved 20 April 2013, from http://www.woomera.com/#!/p/about-woomera.html

Iwanicki, I., & Jones, D. (2012). *Learning from arid planning and design history and practice: from Woomera to creating the new Roxby Downs communities*. Paper presented at the Planning Institute of Australia 2012 National Congress, Adelaide.

Johns, K. (2010). *A mirage in the desert ? The discovery, evaluation and development of the Olympic Dam ore body at Roxby Downs, South Australia, 1975-88*. Adelaide: O'Neil Historical & Editorial Services.

Johnston, M., Lorch, B., & Challen, D. (2004). Views of community sustainability after a mine closure: a case study of Manitouwadge, Ontario. *Environments, 32*(1), 15-29.

Klaassen, N. (1997). *Leigh Creek an oasis in the desert*. Eden Hills South Australia: Flinders Ranges Research.

Kokatha. (2013). Kokatha Retrieved 19 April 2013, from http://www.kokatha.com.au/

Krannich, R., & Greider, T. (1984). Personal well-being in rapid growth and stable communities: Multiple indicators and contrasting results. . *Rural Sociology, 49* (4), 541-552.

Lomax-Smith, J., & Heneker, K. (2016). *Leigh Creek Futures*. Retrieved from South Australian Government, Department of State Development, Adelaide: http://www.statedevelopment.sa.gov.au/upload/usg-outback/Leigh-Creek-Report.pdf

Matulick, L. (2011). Leigh Creek visitor information outlet - Town history Retrieved 22 January 2013, from http://www.loccleighcreek.com.au/page4.php

Mincham, H. (1965). *The story of the Flinders Ranges*. Adelaide: Rogby Limited.

Nepabunna Community Inc. (2012). Our story - Nepabunna tourism Retrieved 18 April 2013, from http://www.nepabunnatourism.com.au/ourstory.php

O'Faircheallaigh, C. (1992). Mine closures in remote regions: policy options and implications. In C. Neil, Tykkyläinen., M and Bradbury, J. (Ed.), *Coping with Closure An international comparison of mine town experiences.* London: Routledge.

Oz Minerals. (2013). Carrapateena project Retrieved 19 April 2013, from http://www.ozminerals.com/Operations/Carrapateena.html

Phoenix Copper Limited. (2012). Phoenix copper limited: Profitable past, exciting future Retrieved 20 April 2013, from http://www.phoenixcopper.com.au/mining.html

Pini, B., Mayes, R., & McDonald, P. (2010). The emotional geography of a mine closure: a study of the Ravensthorpe nickel mine in Western Australia. *Social & Cultural Geography, 11*(6), 559-574.

Robertson, S., & Argent, N. (2016). The potential value of lifecycle planning for resource communities and planning for the enduring community value from mining. In F McKenzie (Ed.), *Labour force mobility in the Australian resources industry: Socio-economic and regional impact*. Melbourne: Springer.

Robertson, S., & Blackwell, B. (2014). Mine lifecycle planning and enduring value for remote communities. [mining; lifecycle; planning; enduring value; remote communities; diversification]. *International Journal of Rural Law and Policy*(1).

Robertson, S., & Blackwell, B. (2015). Remote Mining Towns on the Rangelands: Determining Dependency within the Hinterland. *The Rangeland Journal, 37*(6), 583-596. doi: http://dx.doi.org/10.1071/RJ15046

Roxby Council. (2012a). Roxby Power Retrieved 20 December 2014, from http://www.roxbydowns.com/Power/p-home.html

Roxby Council. (2012b). Roxby Water Retrieved 20 December 2014, from http://www.roxbydowns.com/Water/w-home.html

Roxby Downs Council. (2013). Roxby Council Retrieved 13 January 2013, from http://www.roxbydowns.com/Council/m-Home.html

Stacey, J., Naude, M., Hermanus, M., & Frankel, P. (2010). The socio-economic aspects of mine closure and sustainable development-guideline for the socio-economic aspects of closure: Report 2. *The Journal of The Southern African Institute of Minng and Metalurgy, 110*, 395-415.

State Records of South Australia. (1974). GRS 2701/1/d 2/73 - 6/86 New LC The Electricity Trust of South Australia, Letter to Chairman from General Manger, 11 December 1974.

State Records of South Australia. (1978a). GRS 468/1/ 1971 - 1982 Correspondence files, annual single number - State Planning Office, Department of Environment and Conservation and successors, HURA 297/77 relocation of the Leigh Creek township, memo to Acting Director General Premiers Department from Director General Planning 14 September 1978

State Records of South Australia. (1978b). GRS 468/1/ 1971 - 1982 Correspondence files, annual single number - State Planning Office, Department of Environment and Conservation and successors, HURA 297/77 relocation of the Leigh Creek township, memo to Minister of Planning from the Chairman, Leigh Creek fact finding committee 22 August 1978

State Records of South Australia. (1978c). GRS 2701/1/d 10/75 - 2/84 N167-N171, N167 Leigh Creek Township (new) Correspondence Liaison Internal The Electricity Trust of South Australia, Supplementary Development Plan – Leigh Creek South Community Involvement, Notice from Manager Leigh Creek 27 June 1978.

Steering Committee for the Review of Service Provision. (2011). Overcoming indigenous disadvantage: Key indicators 2011. Canberra: Productivity Commission.

Veiga, M., Scoble, M., & McAllister, M. (2001). Mining with communities. *Natural Resources Forum, 25*, 191-202.

Wilkinson, K., Reynolds, J., Thompson, J., & Ostresh, L. (1982). Local social disruption and western energy development. *Pacific Sociological Review 25*, 275-296.

Woomera. (2013). Woomera Retrieved 27 April 2013, from http://www.woomera.com/p/about-woomera.html

CHAPTER 2:

Robertson, S., & Blackwell, B. (2014). Mine lifecycle planning and enduring value for remote communities. *International Journal of Rural Law and Policy*(1).

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CHAPTER 3:

Buitrago, I., & Robertson, S. (2014). *Mine lifecycle planning: creating lasting value for communities* Paper presented at the Life of Mine 2014 Conference, Pullman Brisbane King George Square, Brisbane.

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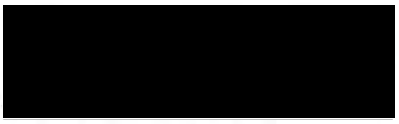

Principal Supervisor

Dr Boyd Blackwell 24/02/2106

CHAPTER 4:

Robertson, S., & Argent, N. (*in press*). The potential value of lifecycle planning for resource communities and planning for the enduring community value from mining. In F McKenzie (Ed.), *Labour force mobility in the Australian resources industry: Socio-economic and regional impact*. Melbourne: Springer.

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Stuart Robertson 24/02/2016

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Robertson, S., & Blackwell, B. (2015). Remote Mining Towns on the Rangelands: Determining Dependency within the Hinterland. *The Rangeland Journal, 37*(6), 583-596. doi: http://dx.doi.org/10.1071/RJ15046

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CHAPTER 6

Perceptions of the built and social infrastructure benefits and costs of remote mining communities

Abstract

The built infrastructure of remote mining communities can bring social benefits and costs to the surrounding area and neighbouring communities. Benefits include increased availability of services and social amenity, whereas costs include the loss of existing key services from closure of the mining town as a major service centre. Numerous Australian studies have highlighted further social costs associated with mining developments including: increased housing costs, itinerant workforces and gender imbalances in the resident populations.

Community respondents in the towns and hinterlands of Roxby Downs and Leigh Creek in remote South Australia were surveyed to ascertain their views on mining-related built and social infrastructure for the region. Whilst communities have enjoyed the benefits associated with increased infrastructure, hinterland community services have declined with the heightened dependency on the mining towns for key services. With mine closure, these dependencies highlight the urgent need for ongoing service provision, particularly in the case of Leigh Creek whose mine closed in November 2015.

CHAPTER 7

Viability of remote mining communities: Lessons from community perceptions, Leigh Creek and Roxby Downs.

Abstract

This paper examines the community perceptions on the viability post mining of the remote communities of Leigh Creek and Roxby Downs in the remote North-East of South Australia. This analysis applies a "what if" scenario, questioning the communities' viability post mining and using respondents' opinions to form a judgement on this matter. The results indicate that the respondents have grave concerns over the viability for Leigh Creek and Roxby Downs to exist as communities post mining. Tourism was nominated as an alternative industry. However, these areas may not be suitable or have the natural attractions to entice visitors in sufficient numbers to sustain the industry locally. Continuation of mining and the development of new mining operations were proposed as methods of ensuring the long term viability of the communities. However, these propositions result in the towns still being dependent upon a single industry. In the case of Leigh Creek, moving the community to an open status was indicated as being a way forward to ensuring the communities viability. Unfortunately, since the data was collected, the Leigh Creek coal mine has closed, jeopardising the ability of the community to transition and develop into an open service centre for the Northern Flinders Ranges and increasing the need for the State Government to intervene.

CHAPTER 8: CONCLUSION

8.1 Introduction

This chapter considers the results of the case study research in the context of the thesis aims and objectives, stated in chapter 1. Furthermore, the major themes of mine lifecycle planning, enduring community value, socioeconomic impacts and the concepts of having a normalised community with a diversified economy presented in chapter 2 are examined in light of the findings from the case studies. The limitations and recommendations for further research are presented followed by recommendations for policy makers. The chapter concludes with some final comments.

The aims and objectives of the study were to:

- assess the degree of dependence that affected communities, and the region more generally, have upon a mine and its related economic centre for a range of goods, services and infrastructure;
- analyse the social and infrastructure benefits and costs of the mine-based communities for the residents and surrounding communities;
- assess the perceptions of the viability of both communities; and
- assess the impact that planning policies of the mining companies and Government have upon the viability of the communities post mining.

8.2 Aims and Objectives

8.2.1 Degree of dependence

The level of dependence upon the Leigh Creek and Roxby Downs by the communities in their hinterlands for a range of goods and services was addressed in chapter 5. This has been achieved by the analysis of the reported utilisation of services by the respondents. The results highlight the dependency by the surrounding communities upon Leigh Creek as the services in those communities have either not been developed or allowed to deteriorate over time as Leigh Creek became more important as the major service centre. The findings indicate the increased travel burden that members of the hinterland communities will have contend with if/when the services become unavailable in Leigh Creek once the current arrangement to

provide services until June 2018 expires. The loss of services and decline in population has continued and increased since the mine closure in November 2015, as seen with the closure of the Leigh Creek café in December 2015. As noted in chapter 4, many of the residents in the hinterland of Leigh Creek are not able to or willing to relocate for cultural and business reasons. The remaining population in the Leigh Creek area will be faced with traveling to Port Augusta, a distance of over 300 kilometres to the south to obtain services when they are no longer available in Leigh Creek.

In the case of Roxby Downs and its hinterland towns there has not been the same level of dependency develop as seen in the Leigh Creek area. The two hinterland communities of Andamooka and Woomera still provided services such as supermarket, fuel outlet, post office and hotels. However, these services are in jeopardy in the longer term as seen by the closure of a roadhouse in Andamooka and the closure of the Woomera hospital. The loss of these services has the potential of these communities developing a greater dependency upon Roxby Downs. That Andamooka and Woomera have not developed a high level of dependency upon Roxby Downs may in part be resultant from the relatively young age of Roxby Downs compared to Leigh Creek and there being more service established in Andamooka and Woomera prior to the establishment of Roxby Downs.

The findings highlight the impact upon the residents of the main communities and hinterlands if the essential services offered in Leigh Creek and Roxby Downs are lost via a failure to plan for the viability of the services. As noted the loss of services in Roxby Downs due to reported lack of business viability via high rent and the move to online shopping can impact upon the dependency residents have upon a town even whilst mining operations are still been undertaken.

8.2.2 Social and infrastructure

The objective of analysing the social and infrastructure benefits of mine based communities was addressed in chapter six. The analysis of respondents' perceptions of the highlighted the benefits and negatives along with the importance of the case study towns in providing opportunities for residents to lead fulfilling lives.

The infrastructure provided by Leigh Creek was seen as important, particularly to the hinterland residents. However, the social benefits attributed to Leigh Creek via

service and sporting clubs has declined over time with the reduction in population. This population reduction and inability to remain in the community post retirement has led to the loss of service and sporting clubs which has reduced the social amenity of Leigh Creek. The significant infrastructure in Leigh Creek and the benefits it brings to the hinterland communities is in jeopardy following the closure of the Leigh Creek mine. Similarly, the social benefits that Leigh Creek provides through its role as a major service centre in the region, and the focus of sporting, social and cultural events is at risk following the mine closure.

Overall Roxby Downs was seen as providing social and infrastructure benefits to the area. These benefits included strong social and sporting clubs along with the ability for residents to mix with people from a variety of cultures due to the transient nature of the Roxby Downs community. However, there are risks to the infrastructure of Roxby Downs, particularly water and electricity, as they are supplied via the Olympic Dam mine. Therefore, any unforeseen shutdown of the mine places the supply of these essential services at risk.

At the current stage in the lifecycle of Olympic Dam, Roxby Downs is benefiting from a relatively large population with concomitantly strong sporting and service clubs. A similar strength in sporting and service clubs was seen in Leigh Creek at the same stage in the Leigh Creek coal mine lifecycle (see Klaassen, 1997). The potential for a similar trajectory for Roxby Downs highlights the importance of the concept of lifecycle.

8.2.3 Viability

The perception of the viability of Leigh Creek and Roxby Downs was addressed in chapter seven. The overall perception of the respondents is that Leigh Creek and Roxby Downs would not be able to remain viable once mining has ceased.

When asked what was required to ensure the viability of Leigh Creek the respondents indicated the need for alternate industry, either education, tourism, or new mining operations. Of note were the respondents indicating that Leigh Creek needed to be an open community to endure. This finding is crucial in the light of the South Australian Government's November 2015 request for industry and communities to provide information on the utilisation of Leigh Creek. It suggests that the respondents understand instinctively what the literature highlights: that to be able to endure a

community needs to be open to enable generational community living. The Roxby Downs respondents provided similar results to Leigh Creek, with the need to have alternate industry or an expanded mining industry.

However, as noted in chapter 7, there are concerns about the ability to expand the tourism industry in the Leigh Creek and Roxby Downs areas. The climatic conditions between December and March result in the closure of the Desert National Parks which limit the tourist trade during this period. Whilst natural events, such as the filling of Lake Eyre, create booms in the tourism trade these flooding events are unreliable and only occur every 10 to 25 years. Tourism is also subjected to booms and busts depending upon international and domestic conditions, as noted by Schmallegger et al. (2011). These factors are recognised by some of the Leigh Creek respondents, though these respondents have had some involvement with the tourism industry. In the case of Roxby Downs, the nearby township of Andamooka being an opal mining area has the potential of tourism. As was noted by some respondents since the road to Roxby Downs was sealed from the Stuart Highway (the main north south route through Australia) tourism in Andamooka has increased in Andamooka. One respondent suggested creating an all-weather road from Andamooka, to the bottom of Lake Eyre and around to Maree then down to Leigh Creek would create a loop road for caravan tourism. However, this would require substantial investment by government.

Similarly, whilst educational services were presented as an option by some respondents there is again the matter of the isolated location of Leigh Creek which may prohibit it being a viable permanent campus of an educational institution. However, there is scope for increasing the existing utilisation of Leigh Creek as a research field station for mining, archaeology and environmental education. However, for Roxby Downs there was no indication from respondents that educational services could become a viable alternative industry.

The differences reported on the potential viability of the two communities are a reflection of the role the towns take in supporting the surrounding areas. Leigh Creek, being a service hub for the Northern Flinders Ranges, has a focus on tourism and education along with the surrounding communities and pastoral properties that are not dependent upon mining for employment. On the other hand, Roxby Downs is effectively only a service centre the mine and related services, with few pastoral

properties in its hinterlands and only one neighbouring community that has not yet developed a full dependence upon Roxby Downs. The focus on Roxby Downs being an industrial rather than a service town is reflected in the responses, that overwhelming noted, that heavy industry or increased mining were the key to enabling Roxby Downs remain viable.

As a result of Leigh Creek's remote location and the region's extreme climatic conditions over summer, diversification into tourism or education would seem to be unrealistic. For both communities the only realistic scenario for ongoing economic viability maybe to have alternative mining operations occur nearby. As noted in figure 1.1 there are additional mineral resources in the area.

Overall, the findings are in line with the literature that highlights that mine-dependent towns that have been able to remain viable or endure are those that have been able to diversify their economies to provide employment for residents post mining. The results indicate the need for planning and intervention particularly by government to support the development of diversified industry in the case study communities.

8.2.4 Planning

The planning policies or lack thereof of mining companies and Government is addressed in chapters four, five, six and seven. The impact of a lack of any planning to ensure the future of these communities is highlighted throughout and reinforces the need for planning to ensure that remote mining communities have a normalised local government structure and a diversified economic base. However, there are difficulties in maintaining services in remote low population areas as they likely to be economically unviable. Increased automation and fluctuating mineral markets present long term planning difficulties for a population and services around a mining venture. As has been seen in other countries, remote extractive industries are staffed via FIFO operations instead of communities being developed to become residential and service hubs co-located with the mining operation.

As noted, the decision by Alinta Energy to move the workforce from a four days on with four days off, to a seven days on with seven days off roster cycle had a negative impact on the number of residential workers. A large number of workers chose to move to a DIDO arrangement, reducing the local resident population with deleterious

consequences for businesses, social and sporting clubs in Leigh Creek and surrounding communities. This decision was taken to increase the productivity and thence the lifespan of the mine. Ensuring a return on the investment and ensuring that subsequent electricity produced for a profit was the primary focus of Alinta Energy. The circumstance of having to take on the responsibility of running the Leigh Creek Township was a unique situation for a private power generation company. Hence is it unclear if any weight was placed upon the effect on the community of the move to a seven day on, seven day off shift cycle. Respondents reported that the reason cited by many families to leave Leigh Creek following the shift change was the lack of activities in the community for the workers off shift, along with the difficulties of providing a quite home environment for workers doing the nightshift.

Similarly, there was a significant impact upon Roxby Downs and Andamooka following BHP Billiton's decision to halt the planned open cut expansion of the Olympic Dam mine. Whilst the reduction of housing rent costs has been seen as a positive by some the reduction in property values has been seen as a negative by others. The loss of small businesses in Roxby Downs following the September 2012 decision has had an impact on the town's economic diversity.

The crossover point as to what will be the best benefit-cost outcome for the company and what will create the minimal impact for the community brings Corporate Social Responsibility (CSR) into focus in planning decisions. It is at this juncture that the SA State Government should have become involved in planning for the future of the Leigh Creek township and the services it provided for the surrounding communities along with the future of Roxby Downs. The basic research undertaken by the SA State Government following Alinta's closure announcement highlighted the lack understanding of the importance of Leigh Creek to the wider area.

As part of good planning practice for the future of a mining community it is recommended that five yearly development plans are reviewed to determine the level of, if any, impact upon changes in the mining operation are having on the community and if there needs to be amendments to the development of alternate industry to support the community. As noted in chapter 7 the tourism industry and providers need to regularly review what they are providing to meet the needs of the market. Similarly, strategic economic development plans (as typically prepared by local governments) need to be reviewed to ensure the attracted industries are not facing

viability concerns and new and different industry and employment opportunities need to be introduced on a regular basis to enhance the ability of the communities to weather the shocks that can occur in fast moving economic environments.

In the case of Leigh Creek, the South Australian Government has committed to ensure the current Government service provision in Leigh Creek will be maintained to July 2018. However, there is no guarantee for private services like the supermarket, newsagent and postal agency, which due to the small surrounding population may be unviable unless some other industry is attracted to area that will utilise Leigh Creek as a residential base.

The South Australian Government in late 2015 began a process of requesting expressions of interest upon the future of Leigh Creek, however at the time of writing there are is no definitive plan for Leigh Creek post July 2018. This lack of planning has the potential of being a self-fulfilling prophecy for Leigh Creek as those residents in Leigh Creek and surrounds who are not tied to the area for cultural and economic reasons are likely to continue the exodus to the inner regional areas that has occurred throughout remote and outer regional Australia over that last 30 or so years.

Whilst the decisions by Alinta Energy and BHP Billiton to change their operations were in response to unforeseen market conditions and, thus, difficult to plan for, underlying planning to ensure the communities could adjust to the changes without major negative impacts is essential. In the case of Leigh Creek the failure by the South Australian Government to move the community from being “closed” to “open” when the town was relocated in 1981 and again when ETSA was privatised in the 1990s ensured the town was unable to adjust effectively to the change in roster and remain viable post-mine closure. Whilst Roxby Downs is an “open” community it is effectively closed by there being no other major industry or employer based in Roxby Downs. Thus unless you are working within the Olympic Dam mine or supporting the mine in some capacity there is no reason to reside in Roxby Downs. Again, it can be considered a failure of planning not to develop and encourage alternative industry to establish in Roxby Downs, particularly from the initial development of Roxby Downs. The failure to plan for a diversified economic base to ensure the long term viability of Roxby Downs may stem from the predicted long life span of the Olympic Dam mine. However, as shown in 2012 market conditions can change and the loss of services within Roxby Downs that has occurred since has the

potential to reduce the attractiveness of being a residential worker, further increasing LDC and creating a negative feedback loop with a further reduction in services.

8.3 Lifecycle Planning and Enduring Value

Lifecycle planning and enduring value were defined in chapter two (Robertson & Blackwell, 2014). As Franks (2012) suggests, a mine plan should aim to enhance the post mine future of the region surrounding the mine project. The focus on generating enduring value from mining is in part related to the developing focus on mining companies to behave in a socially responsible manner and to gain and maintain a Social License to Operate (SLO), particularly in developing regions (Robertson & Blackwell, 2014). As a result there is a push from mining associations throughout the world such as the ICMM and the MCA to ensure that companies engage with nearby communities and that planning for the closure of a mine is undertaken during the initial planning stage (International Council for Mining and Metals, 2003; Minerals Council Australia, 2006). The benefits to mining companies include: reducing the extent and cost of final remediation; lowering the risk of future strict regulation; reducing tension and conflict with local communities; and improving the reputation of the company (Warhurst & Noronha, 2000).

The concept of mine lifecycle planning extending to sustainable benefits for dependent and surrounding regions is a relatively new concept, starting with Veiga et al (2001). As such, limited research has been undertaken on the impact of mine lifecycle planning on generating enduring value for mining communities. Warhurst & Noronha (2000) reported that planning for mine closure can benefit both the local community or region as well as the mining company. Some of the benefits for the community include developing viable economic alternatives, transforming mined land for the use of cash crops and timing new mining projects to follow consecutively (Warhurst & Noronha, 2000). The implications of failure to plan for a sustainable community post mining can be drawn from research into the impacts of mining on communities upon the closure of a mine (Browne et al., 2011; Centre for Sustainabilty in Mining and Industry, 2010; Haney & Shkaratan, 2003; Hegadoren & Day, 1981; Johnston et al., 2004; Pini et al., 2010). Along with studies undertaken in communities during the bust cycle of the resources boom that showed mine dependent communities did not achieve sustainable development (Clemenson, 1992; Haney & Shkaratan, 2003; Johnston, et al., 2004; Randall & Ironside, 1996; Smith et

al., 2001; Wilson, 2004), Smith et al. (2001, p. 421) stated that "none of the western boomtowns studied during the 1970s and 1980s have exhibited sustained growth".

Unplanned mine closures, or sudden placement of a mine operation into a care and maintenance operational mode, can have negative effects on the communities surrounding the mine because of their dependence on the mine for livelihoods (Warhurst & Noronha, 2000). In studies after the Ravensthorpe, Western Australia nickel mine was placed in to a care and maintenance mode of operation communities surrounding the mine reported concerns over the loss of population, unoccupied housing, reduced housing values and the closing of businesses that were encouraged to open in the communities (Browne et al., 2009; Browne, et al., 2011; Pini, et al., 2010). In a case study of a South African mine planning for closure was only undertaken after the decision to close the mine was made. Some of the results of the delayed planning were failed job creation projects, and infrastructure left unused and ultimately vandalised (Centre for Sustainabilty in Mining and Industry, 2010 (CSMI)). CSMI (2010) used this case study as an example of an unplanned closure and highlighted several points which led to the failure of the closure: stakeholder engagement commenced too late, which led to uncertainty in the community and the resultant vandalism and theft of infrastructure, efforts to create economic diversification started too late along with skills development and empowerment of the community and no reliable socio-economic assessment had been conducted resulting in the closure plan being developed on unreliable data.

There are similarities between the CSMI case study and Leigh Creek in relation to the post-hoc nature of planning for the closure. In the case of Leigh Creek, the 11 June 2015 announcement by Alinta Energy (Booth, 2015) to close the mine and related power station 12 years earlier than planned was unexpected. The original announced closure date was not before March 2016, however on 8 October 2015 the closure date for the mine was brought forward to 17 November 2015 (Australian Broadcasting Corporation, 2015). There were no plans for the future of Leigh Creek post mining with the South Australian Government only engaging with the affected communities on 12 June 2015 (Department of State Development, 2015a). The South Australian Government only announced a process of requesting information for opportunities for the utilisation of the Leigh Creek on 13 October 2015, after Alinta Energy again brought forward the closure date (Department of State Development,

2015c). Under the lease terms for Leigh Creek Alinta Energy has to maintain the town services and infrastructure until 30 June 2018. However, water has been turned off to vacant houses, raising the concerns of remaining residents and members of the Copley community about the loss of established fruit trees and gardens (Pers. Coms. A. Taranto 22 December 2015) that would maintain the amenity of Leigh Creek for any potential future residents. Though the workforce has been allowed to remain in Leigh Creek under their current housing conditions for 12 months, many residents have already left. This will impact upon the ability of the private businesses to remain viable (see chapter six). The Leigh Creek Area school is expected to have only 46 students at the start of 2016, mainly residents of the surrounding communities, down from approximately 150 students in 2015 (Pers. Coms. A. Taranto 22 December 2015). As noted in chapter four (Robertson & Argent, 2016) and chapter five (Robertson & Blackwell, 2015) there have been opportunities to change the status of Leigh Creek to an open community in the 1980's and again in 1999 when the mine and township were privatised and to commence the planning for the future of Leigh Creek post mining. Unfortunately this planning or changing of the status of Leigh Creek has not been undertaken. This lack of planning will affect the enduring value of the mine to the surrounding area. Chapter six highlighted the importance of Leigh Creek to its hinterlands for the provision of services and infrastructure with chapter four (Robertson & Argent, *in press*) noting the lack of mobility of residents in the hinterland area who have become dependent upon Leigh Creek for services. It is of note that there are no royalties from the Leigh Creek mine paid to the Native Title holders in the area. Royalties from other mining operations in the broader region are paid to these Native Title holders which have been invested in businesses and pastoral leases in the Northern Flinders Ranges to ensure a long term enduring benefit to the community (pers comms T. Coultard September 2013). There is scope to utilise the Sustainable Livelihoods Framework (Buitrago & Robertson, 2014) to assist the surrounding communities to transition into a post Leigh Creek future, building upon the processes already being undertaken by the Native Title holders.

Whilst the Olympic Dam mine has an anticipated recoverable resource to enable operations for a further 200 years (BHP Billiton, 2014) it may seem that planning for closure is not yet needed. However, as can be seen with Ravensthorpe, Western

Australia and the halt to the open cut expansion at Olympic Dam in September 2012 (BHP Billiton, 2012; Browne, et al., 2009; Pini, et al., 2010) market conditions can change, affecting the profitability of the mining operation resulting either in a change in the planned operations or the mine being placed into care and maintenance, which can negatively affect the associated communities. As noted in chapter six the halt to the open cut expansion resulted in a loss of confidence in Roxby Downs, loss of population and loss of shops and services. However, the reduction in rents and property values were considered either a positive or negative, depending upon whether you were a renter or an investor (Evans, 2015; Martin, 2015). Whilst there are some enduring benefits to the hinterland from Roxby Downs and the Olympic Dam mine such as a sealed road to Andamooka from the Stuart Highway and the supply of water to Andamooka, there are risks to existing services, as noted in chapter six (Robertson & Blackwell, 2015). The impact of the expansion halt at Olympic Dam upon Roxby Downs and the closure of Leigh Creek coal mine highlights the need for communities to have a diversified economy.

8.4 Diversification and Normalisation

It has been recognised from the 1970's, with Lucas's (1971) work, that single resource towns require a diversified economic base to remain viable. Mine based communities that have been able to remain viable following mine closures or downturns have tended to be non-remote communities (Freudenburg & Wilson, 2002; Wilson, 2004). For example, in Canada Sudbury, Ontario was established as a mining community, but with its accessible location it has been able to become a large diversified community. Similarly, in Australia, the communities of Bendigo, Victoria and Bathurst, New South Wales have been able to diversify and become thriving centres. Batchelor in the Northern Territory of Australia is an example of a closed mining community that has been able to diversify and remain viable. However, Batchelor is within close proximity to Darwin, the Territory's capital. Tennant Creek, Northern Territory and Broken Hill, New South Wales are two remote mine based communities that have been able to diversify their economic base in Australia. In the case of Tennant Creek it was a conscious decision by the Government to aid in the diversification of the economy to establish Tennant Creek as a service centre for the Barkly Tablelands region (O'Faircheallaigh, 1992). O'Faircheallaigh (1992) also reported on the experience of Atikokan in Ontario Canada where there was time to

develop alternative employment opportunities after a closure announcement. Atikokan, Ontario was in a region of extensive forestry resources and a substantial increase in the timber processing industry occurred after the closure of the mines. The development of community facilities and upgraded regional infrastructure including the construction of a power station along with scenic wilderness areas popular for hunting and canoeing enabled the community to develop as a tourist and retirement centre (see also Brown, 1984 for a further discussion on Atikokan).

Neither Leigh Creek nor Roxby Downs have a diversified economy. As reported in chapter seven, the communities are there to support the mine and the perception of the respondents is that both communities would not be viable post mining without having an alternate industry or continued mining. However, in the case of Leigh Creek the State Development plans have the aim of Leigh Creek being a service centre for the Northern Flinders Ranges with surrounding communities being dependent upon it. Leigh Creek is located on the route to several iconic Australian desert roads ideally placed to be a service and tourism centre. Similar to Atikokan, Ontario, Leigh Creek has potential to diversify into energy production along with expanding the tourism potential (Leigh Creek Energy Limited, 2015). However, the tourism market is not sufficient to replace the economic inputs that occurred via mining as noted in chapter seven. Roxby Downs' location on what is effectively a dead end road means that there is limited tourism and through traffic. This limits its ability to become a service centre especially given the only other communities are Andamooka which, as shown in chapter five, is not yet dependent upon Roxby Downs and Woomera, a small community providing services to the Australian Defence Force Woomera Prohibited Area.

The process of normalisation did not occur in Leigh Creek prior to the mine closure. The failure to transform Leigh Creek into an open community will generate difficulties in establishing a new cohort of residents to ensure the viability of the services provided within Leigh Creek into the future. Whilst Roxby Downs is an open community, albeit with a modified local government structure, it operates as a de facto closed community in that the supply of electricity and water is dependent upon the continued operation of the Olympic Dam mine. BHP Billiton owns the power network that connects the Olympic Dam mine from the national power grid in Port Augusta. BHP Billiton then supplies the electricity to the Roxby Downs

township via a Roxby Council entity Roxby Power (Roxby Council, 2012a). Similarly, the water is supplied via BHP Billiton from their licensed extraction bores and desalination plant and then supplied to the Council entity Roxby Water (Roxby Council, 2012b). Another aspect of being open in name only is that there is no particular reason to reside in Roxby Downs unless you are working for the mine or a related support service. As Storey (2010) noted, when given an option of FIFO or residing locally potential mining workforces have opted predominantly for FIFO in remote locations. The reduction in the residential workforce can lead to a loss of services and social activities provided within the community. This effect was seen in Leigh Creek with the change in the roster in September 2012 which led to a reduction in people contributing to the social aspects of the community and impacting upon the viability of services within the community.

The purpose of the normalisation of the Pilbara communities of , Western Australia was in part to enable them to develop a diversified economic base by attracting new services and industry. Along with a desire of the mining companies to reduce their responsibility of maintaining and providing services in these remote communities (Bradbury, 1988; Pilgram, 1988; Robinson & Newton, 1988). However, similar to Roxby Downs, there is no incentive to move to these communities unless you are involved with the mining industry.

As Baum et al. (2005) and Tonts et al. (2012) show in their studies on the economic impact of mining in remote Australia, mining is the economic base and main category of employment in affected Local Government Areas. This situation reinforces the point that these communities' raison d'etre is to support the mining industry. Whilst they argue that this shows the benefits that mining brings to these regions it also highlights the dependency that those LGAs have upon mining and the potential impact upon the viability of these communities once mining ceases. The shutdown of mining operations, particularly in remote regions, can have a significant negative impact upon the mine based community and any surrounding towns.

8.5 Socioeconomic impacts

As highlighted in chapter five the level of dependency upon Leigh Creek by the surrounding communities is significant and closure and loss of services will involve the residents having to undertake greatly increased travel to access the same services.

The social and infrastructure benefits shown in chapter six highlight the positive impact of developing a community such as Leigh Creek in a remote location. As a result of its closed nature Leigh Creek has avoided some of the negative economic impacts that can occur in open towns via the boom/bust nature of the mining industry, such as fluctuations in housing costs, high wages and cost of living making it difficult for non-mining employers to attract and retain staff. However, the transient nature of the population and the decline in social activities that occurs when the population decreases is unable to be avoided.

However, Roxby Downs has been subjected to the socioeconomic impacts that affect open communities, either purpose built or those that have had mining operations developed nearby. Some of the impacts are housing price fluctuations and loss of small service businesses (Carrington & Hogg, 2011; Carrington & Pereira, 2011; Haslam McKenzie et al., 2009; Lockie et al., 2009; Petkova et al., 2009). These communities are also impacted by the Fly Over effect of a mobile workforce (Storey, 2010). However, as noted by respondents in chapter five, there are benefits for long-term residents in the rental market as their cost of living has reduced. The booms and busts that occur within the housing markets in open mine based communities such as Roxby Downs are difficult to control, unless the community becomes closed or the community is separated from the mine with the mine's workforce only residing in residential camps which can lead to the Fly Over effect and the local area 'missing out' of the perceived short term economic boost from the mine.

8.6 Differences and similarities between Leigh Creek and Roxby Downs

There were more similarities than differences between the two communities, a phrase I coined for Roxby Downs was that it was a closed community in all but name. Leigh Creek being a closed town with reasonably strict residency requirements and no local government is different in structure to Roxby Downs being an open town with the ability to own private property and a minimalistic local government structure. Similar to Leigh Creek, particularly in relation to properties owned by BHP Billiton if you ceased employment with BHP Billiton you were no longer able to maintain your tenancy. The cost of private rental also prohibited the ability to remain in Roxby Downs if your local employment ceased.

Whilst Roxby Downs enables residents to purchase their own property, the respondents that were property owners had purchased property primarily to provide themselves with tenure and not be subject to having to move house on the whim of the company or landlords. Those respondents indicated that they were owning the property for their duration in Roxby Downs with no intent of remaining after retirement or loss of employment. This is an acknowledgement that there are limited employment opportunities in Roxby Downs outside of mine related or service industry work. The actual effect is similar to Leigh Creek, were workers effectively have to leave the town if they retire or are no longer employed.

There was a perception within both communities that the residents had almost no involvement in the running and direction of the communities. In Leigh Creek there is progress association which act as the community voice and in Roxby Downs there are several forums to enable to the community to have some potential involvement in the community. However, through the interviews with respondents it became clear that residents felt alienated from the process of planning for the future in both communities. It should be noted that the respondents to the survey and interviews were general people actively engaged with the community. Some of these respondents acknowledged that a large proportion of the community were not engaged or cared about the future of Roxby Downs and they were there only for work and often with a goal of remaining only for a short time. This reflected the experience of Leigh Creek

Whilst Leigh Creek's social and community groups had dissipated with the reduction in population there was evidence from respondents that when Leigh Creek had a larger population during the 1980s and 1990s there was a similar level of community and social engagement that is evident in Roxby Downs. This reinforces the need to have a critical mass of population to ensure there is a wide range of community and social groups to increase the social amenity of a remote mining community.

8.7 Limitations and Further Research

A primary limitation of the research was the distance between the University of New England and the two case study areas. However, with the study areas being in close proximity to each other field trips to both communities were able to occur during the same travel period. The inability to spend more time in each community may have

impacted upon the response rates, though there seemed to be a degree of disengagement with residents wishing to be involved with the study. As a result there was a self-selection bias within the respondents with only actively engaged residents participating in the surveys and follow up interviews. The self-selection bias, however, adds weight to the reported negative perception about the future viability of both Roxby Downs and Leigh Creek. Another limitation was the fullness of the responses of the interviews conducted by the Aboriginal Community Researchers, the responses were either monosyllabic or short form sentences.

The findings of Baum et al. (2005) and Tonts et al. (2012), along with Hajkowicz et al. (2011), suggest in those communities there is potential to undertake a similar survey to this study to gauge the perceptions of social benefits or costs and the future of these communities post mining in line with the reported economic benefits mining has brought to those regions. Findings from such a study would enable companies and Government to develop plans to assist these communities during the inevitable mining bust or mine closure.

With the closure of the Leigh Creek mine and the South Australian Government's eventual engagement with planning for the future of Leigh Creek there is scope to follow the development of Leigh Creek and the hinterlands post mining, especially if the SLF is utilised. A follow up study is indicated for Roxby Downs to track any changes within the community over time, as BHP Billiton implements proposed new plans for the mining of the Olympic Dam Ore body. In the event the South Australian Government assists/promotes opportunities in developing a diversified economic base in Roxby Downs this current study will make an ideal baseline of community sentiment.

To broaden the international aspect of this study there are opportunities to follow a similar methodology in Indonesia, Mongolia and South Africa where large scales resource extractions have resulted in communities being developed to support the industry.

In the Australian context, this research has created the opportunity to undertake a more detailed and broader view of the impacts of the boom bust nature of mining on regional and remote communities. The socioeconomic indicators are able to be applied over the numerous resource impacted Local Government Areas (LGA) over

the long running Australian mining boom form 1991 to 2016. By examining LGA's and the socioeconomic changes whilst considering local planning decisions on employment and housing practices, additional information can be gleaned on how to minimise the boom bust effect upon remote and regional communities into the future.

There is scope to utilise this research as a base to examine service delivery and dependency upon services in remote and regional Australia. The focus of future research would be upon the ability to deliver services in a cost effective manner in the remote and regional communities that have been affected by a net negative population migration.

Furthermore, the data collected can be utilised to undertake a travel cost study to estimate the economic value of remote dependency. Regression equations can be developed which help explain (rather the correlate) the role that mining plays in these remote communities for comparison with communities with less of a dependence on mining

8.8 Recommendations

The ideal for lifecycle planning generating enduring value from mining is to alleviate the impact of the boom/bust nature of the mining industry upon communities. As shown by these case studies, being a closed community reduces the impacts of housing market fluctuations. However, in the case of Leigh Creek, by being developed as a service centre for the region and not a fully closed community, for example, Woomera prior to 1982 (Woomera, 2013), the surrounding communities have lost or not developed their own services and thus have become dependent upon Leigh Creek for services. These services are now in jeopardy through a failure to plan for the future of these services post mining. Roxby Downs, has highlighted the impacts private market forces can have on housing and business costs in an open community with the subsequent loss of businesses during a downturn.

The finding of chapter seven, being neither community is perceived to be viable post mining suggests the attraction of developing purely fly-in fly-out mining operations in the developed world. This would save the impact of the mine and town closure upon the surrounding communities that have become dependent upon the mine and subsequent waste of the infrastructure that was developed to support a township when the community becomes unviable.

However, for the developing world where the ideal of developing a community around a remote mining site is part of the ongoing development of the country the lessons learned from Leigh Creek and Roxby Downs are invaluable. The objectives of the community would need to be established during the planning process (Tuck et al., 2005). For example, is the community to be developed to become a major service centre, as Leigh Creek and Roxby Downs were, or to just support the mine whilst in operation? If the community is being developed to just support the mine then a FIFO option is desirable. Alternatively, if a residential community is desired then a closed town that has a short life expectancy could be created, with no illusion of becoming an ongoing service centre such as Radium Hill, South Australia (Kakoschke, 2007). If the community being developed also had the objective of being a service centre for a region then a diversified industry base needs to be developed alongside the mine. The development of diversified industry needs to be ongoing to aid in the minimisation of booms and busts and to ensure on going enduring community value.

8.9 Concluding Comments

The future of Leigh Creek is in flux with the closure of the mine in November 2015. The process of requesting information which started in October 2015 post the closure announcement is an indicator that the South Australian Government had no plans for the future of Leigh Creek once mining was completed (Department of State Development, 2015b). A similar thought pattern seems to be in place for Roxby Downs, with the expectation that mining will continue for many years to come, so there is no need for planning to occur for the vision of Roxby Downs post mining. However, to ensure Roxby Downs will become an enduring community, planning for and developing a diversified economic base needs to occur in the near future if not immediately.

The findings of the case studies support and add weight to the previous research that mine based communities need a normalised local government structure and diversified economic base. Along with examples from the literature that highlight when planning occurred the communities endured post mining. Leigh Creek has unfortunately provided another example of the negative impact upon the host and subsequent dependent communities when there is a failure to plan for an enduring community post mining – thus supporting the research hypothesis that mine lifecycle planning can assist in the generation of enduring value for remote communities.

References

Australian Broadcasting Corporation. (2015). Alinta's Leigh Creek coal mine to close next month, Port Augusta power station next March Retrieved 9 October 2015, from http://www.abc.net.au/news/2015-10-07/alinta-leigh-creek-coal-mine-to-close-next-month/6833402

Baum, S., O'Connor, K., & Stimson, R. (2005). *Fault lines exposed: Advantage and disadvantage across Australia's settlement system*, Clayton.

BHP Billiton. (2012). Olympic Dam update. *Company Press Release* Retrieved 12 August 2014, from http://www.bhpbilliton.com/home/investors/news/Pages/Articles/Olympic-Dam.aspx

BHP Billiton. (2014). BHP Billiton results for the year ended 30 June 2014 Retrieved 20 December 2014, from http://www.bhpbilliton.com/investors/reports/bhp-billiton-results-for-the-year-ended-30-june-2014

Booth, M. (2015). Alinta jobs: Port Augusta power stations, Leigh Creek coal mine to be closed. *The Australian* Retrieved 12 June 2015, from http://www.theaustralian.com.au/business/mining-energy/alinta-jobs-port-augusta-power-stations-leigh-creek-coal-mine-to-be-closed/news-story/f1defc56cad4a5ef0e3448bc4aebc749

Bradbury, J. (1988). Living with boom and bust cycles: New towns on the resource frontier in Canada, 1945-1986. In T.B. Brealey, Neil C.C., Newtown, P.W (Ed.), *Resource Communities: Settlement and Workforce issues* (pp. 3-20). Melbourne: CSIRO Australia.

Brown, D. (1984). The Atikokan story: life in small community that suffers economic collapse. In M.J Wojciechowski (Ed.), *Mining Communities: Hard Lessons for the Future*. Ontario: Queens University.

Browne, A., Buckley, A., & Stehlik, D. (2009). *A rapid rural appraisal of the closure of the Ravensthorpe nickel operation: a focus on the social, environmental and economic impacts for Ravensthorpe, Hopetoun and Jerdacuttup, Western Australia* Perth: Research Centre for Stronger Communities, Curtin University of Technology.

Browne, A., Stehlik, D., & Buckley, A. (2011). Social licences to operate: for better not for worse; for richer not for poorer? The impacts of unplanned mining closure for "fence line" residential communities. *Local Environment, 16*(7), 707-725.

Buitrago, I., & Robertson, S. (2014). *Mine lifecycle planning: creating lasting value for communities* Paper presented at the Life of Mine 2014 Conference, Pullman Brisbane King George Square, Brisbane.

Carrington, K., & Hogg, R. (2011). Benefits and burdens of the mining boom for rural communities. *Human Rights Defender, 20*(2), 9-11.

Carrington, K., & Pereira, M. (2011). Assessing the social impacts of the resources boom on rural communities. *Rural Society, 21*(1), 2-20.

Centre for Sustainabilty in Mining and Industry. (2010). The socio economic aspects of mine closure and sustainable development: Literature overview and lessons for the socio-economic aspect of closure report 1 of 2. Johannesburg: Centre for Sustainability in Mining and Industry

Clemenson, H. (1992). Are single industry towns diversifying? A look at fishing, mining and wood-based communities. *Perspectives on labour and income, 4*(1), 50-77.

Department of State Development. (2015a). Leigh Creek Community Views - A summary Retrieved 2 December 2015, from http://www.statedevelopment.sa.gov.au/upload/usg-outback/leigh-creek-community-views.pdf

Department of State Development. (2015b). Request for information for commercial opportunities Retrieved 01 December 2015, from http://usg-outback.statedevelopment.sa.gov.au/

Department of State Development. (2015c). USG Outback: What we're doing Retrieved 1 December 2015, from http://usg-outback.statedevelopment.sa.gov.au/what-were-doing

Evans, S. (2015). The most dangerous job in Roxby Downs is not down a mine Retrieved 14 August 2015, from http://www.smh.com.au/business/the-most-dangerous-job-in-roxby-downs-is-not-down-a-mine-20150809-giv9kz.html

Franks, D. (2012). Social impact assessment of resource projects. *Mining for Development: Guide to Australian Practice* Perth: International Mining for Development Centre.

Freudenburg, W. , & Wilson, L. (2002). Mining the data: Analyzing the economic implications of mining for nonmetropolitan regions. *Sociological Inquiry, 72*(4), 549-575.

Hajkowicz, S.A., Heyenga, S., & Moffat, K. (2011). The relationship between mining and socio-economic well being in australia's regions. *Resources Policy, 1*, 30-39. doi: doi:10.1016/j.resourpol.2010.08.007

Haney, M., & Shkaratan, M. (2003). Mine closure and its impact on the community: five years after mine closure in Romania, Russia and Ukraine *World Bank Policy Research Working Paper 3083, June 2003*. Washington World Bank

Haslam McKenzie, F., Phillips, R., Rowley, S., Brereton, D., & Birdsall-Jones, C. (2009). Housing market dynamics in resource boom towns *AHURI Final Report No. 135*. Melbourne: AHURI.

Hegadoren, D., & Day, J. (1981). Socioeconomic mine termination policies: A case study of mine closure in Ontario. *Resources Policy, 7*(4), 265-272.

International Council for Mining and Metals. (2003). 10 principles of sustainable development performance. London: Intentional Council for Mining and Metals

Johnston, M., Lorch, B., & Challen, D. (2004). Views of community sustainability after a mine closure: a case study of Manitouwadge, Ontario. *Environments, 32*(1), 15-29.

Kakoschke, K. . (2007). Radium Hill: Bindi To Boom Town. *Journal of Australasian Mining History, 5*, 135-149.

Klaassen, N. (1997). *Leigh Creek an oasis in the desert*. Eden Hills South Australia: Flinders Ranges Research

Leigh Creek Energy Limited. (2015). Leigh Creek energy project Retrieved 18 December 2015, from http://www.lcke.com.au/Our-Business/Leigh-Creek-Energy-Project

Lockie, S., Franettovich, M., Petkova-Timmer, V., Rolfe, J., & Ivanova, G. (2009). Coal mining and the resource community cycle: A longitudinal assessment of the social impacts of the Coppabella coal mine. *Envronmental Impact Assessent Review, 29*, 330-339.

Lucas, A. (1971). *Minetown, milltown, railtown: life in Canadian communities of single industry*. Toronto: Universtiy of Toronto Press.

Martin, S. (2015). Downs but not out Roxby clings to rebirth of mining boom Retrieved 26 July 2014, from http://www.theaustralian.com.au/business/mining-energy/downs-but-not-out-roxby-clings-to-rebirth-of-mining-boom/news-story/d6e5683b4d5ab48e69cc30d4449fc53b

Minerals Council Australia. (2006). Leading practice sustainable development for the mining industry: Mine closure and completion. Canberra: Department Industry Tourism and Resources.

O'Faircheallaigh, C. (1992). Mine closures in remote regions: policy options and implications. In C. Neil, Tykkyläinen., M and Bradbury, J. (Ed.), *Coping with Closure An international comparison of mine town experiences.* London: Routledge.

Petkova, V., Lockie, S., Rolfe, J., & Ivanova, G. (2009). Mining developments and social impacts on communities: Bownen Basin case studies. *Rural Society, 19*(3), 211-228.

Pilgram, R. (1988). Normalisation of the Pilbara townships in Western Australia. In T.B Brealey, Neil C.C. & P.W Newtown (Eds.), *Resource Communities: settlement and workforce issues* (pp. 245-260). Melbourne: CSIRO.

Pini, B., Mayes, R., & McDonald, P. (2010). The emotional geography of a mine closure: a study of the Ravensthorpe nickel mine in Western Australia. *Social & Cultural Geography, 11*(6), 559-574.

Randall, J., & Ironside, R. (1996). Communities on the edge: An economic geography of resource-dependent communities in Canada. *Canadian Geographer, 40*(1), 17-35.

Robertson, S., & Argent, N. (*in press*). The potential value of lifecycle planning for resource communities and planning for the enduring community value from mining. In F McKenzie (Ed.), *Labour force mobility in the Australian resources industry: Socio-economic and regional impact*. Melbourne: Springer.

Robertson, S., & Blackwell, B. (2014). Mine lifecycle planning and enduring value for remote communities. [mining; lifecycle; planning; enduring value; remote communities; diversification]. *International Journal of Rural Law and Policy*(1).

Robertson, S., & Blackwell, B. (2015). Remote Mining Towns on the Rangelands: Determining Dependency within the Hinterland. *The Rangeland Journal, 37*(6), 583-596. doi: http://dx.doi.org/10.1071/RJ15046

Robinson, I., & Newton, P. (1988). Settlement options for non-renewable resource development in Canada and Austrlalia: A comparative evaluation and decision framework. In T.B Brealey, Neil C.C. & P.W Newtown (Eds.), *Resource Communities: settlement and workforce issues*. Melbourne: CSIRO.

Roxby Council. (2012a). Roxby Power Retrieved 20 December 2014, from http://www.roxbydowns.com/Power/p-home.html

Roxby Council. (2012b). Roxby Water Retrieved 20 December 2014, from http://www.roxbydowns.com/Water/w-home.html

Smith, M., Krannich, R., & Hunter, L. (2001). Growth, decline, stability, and disruption: A longitudinal analysis of social well-being in four western rural communities. *Rural Sociology, 66*(3), 425-450.

Storey, K. (2010). Fly-in/Fly-out: Implications for Community Sustainability. *Sustainability, 2*(5), 1161-1181.

Tonts, M., Plummer, P., & Lawrie, M. (2012). Socio-economic wellbeing in Australian mining towns: A comparative analysis. *Journal of Rural Studies, 28*(3), 288-301.

Tuck, J., Lowe, J., & McRae-Williams, P. (2005). *Managing community relationship, reputation and sustaining competitive advantage: The case of mining towns*. Paper presented at the 2nd Future of Australia's Country Towns Conference, Bendigo. http://www.cecc.com.au/clients/sob/research/docs/jtuck/tuck_lowe_mccrae_Country_towns.pdf

Veiga, M., Scoble, M., & McAllister, M. (2001). Mining with communities. *Natural Resources Forum, 25*, 191-202.

Warhurst, A., & Noronha, L. (2000). Corporate strategy and viable future land use: planning for closure from the outset of mining. *Natural Resources Forum, 24*(2), 153-164.

Wilson, L. (2004). Riding the resource roller coaster: Understanding socioeconomic differences between mining communities. *Rural Sociology, 69*(2), 261-281.

Woomera. (2013). Woomera Retrieved 27 April 2013, from http://www.woomera.com/p/about-woomera.html

APPENDIX 1

INFORMATION SHEET

for

PARTICIPANTS

UNE Business School
University of New England
Armidale NSW 2351
Australia
Phone 02 6773 3333
Fax 02 6773 3596
www.une.edu.au/

I wish to invite you to participate in my research project, described below.

My name is Stuart Robertson and I am conducting this research as part of my Master of Philosophy in the School of Business at the University of New England. My supervisors are Dr Boyd Blackwell, Associate Professor Neil Argent and Professor Fiona Haslam McKenzie.

Research Project	**Mine lifecycle planning and enduring value for remote communities**
Aim of the research	The research aims to explore the degree of dependence communities and the region more generally, have upon a mine and its related community for a range of goods, services and infrastructure.
Survey	I would like you to participate in the online survey located on this link https://www.surveymonkey.com/s/ECV_Survey. The survey will ask a series of questions relating to your interactions with Leigh Creek or Roxby Downs communities. The survey will take approximately 15 minutes to complete. The last page of the survey invites participants to undertake follow up interviews with the researcher.
Confidentiality	Any information or personal details gathered in the course of the study will remain confidential. No individual will be identified by name in any publication of the results. All names will be replaced by pseudonyms; this will ensure that you are not identifiable.
Participation is Voluntary	Please understand that your involvement in this study is voluntary and I respect your right to withdraw from the study at any time. You may discontinue the survey at any time without consequence and you do not need to provide any explanation if you decide not to participate or withdraw at any time.
Questions	The survey questions will not be of a sensitive nature: rather they are general, aiming to enable you to my knowledge of the degree of interaction and dependence between the region and the mine.
Use of information	I will use information from the survey as part of my thesis, which I expect to complete in November 2015. Information from the survey may also be used in journal articles and conference presentations before and after this date. At all time, I will safeguard your identity by presenting the information in way that will not allow you to be identified.
Upsetting issues	It is unlikely that this research will raise any personal or upsetting issues but if it does you may wish to contact your local Community Health

	Centre Roxby Downs 08 8671 9020 Leigh Creek 08 8678 6022.
Storage of information	I will keep hardcopies notes of the survey in a locked cabinet at the researcher's office at the University of New England's Business School. Any electronic data will be kept on a password protected computer in the same School. Only the research team will have access to the data.
Disposal of information	All the data collected in this research will be kept indefinitely. No identifiable information will be kept after the completion of the thesis. The unidentifiable data will be held in secure electronic storage by Ninti One Limited upon completion of thesis in accordance with agreements between Ninti One Limited and the University of New England.
Approval	This project has been approved by the Human Research Ethics Committee of the University of New England (Approval No. HE13-214, Valid to 02/09/2014).
Contact details	Feel free to contact me with any questions about this research by email at srobert9@une.edu.au or by phone on 02 6773 2959. You may also contact my supervisors. My Principal supervisors name is Dr Boyd Blackwell and he can be contacted at boyd.blackwell@une.edu.au or 02 6773 3279 and my Co-supervisors name is Prof Fiona Haslam McKenzie and she can be at f.mckenzie@curtin.edu.au or 08 9266 1087 or Associate Prof Neil Argent and he can be contacted at nargent@une.edu.au or 02 6773 2803.
Complaints	Should you have any complaints concerning the manner in which this research is conducted, please contact the Research Ethics Officer at: Research Services University of New England Armidale, NSW 2351 Tel: (02) 6773 3449 Fax: (02) 6773 3543 Email: ethics@une.edu.au Thank you for considering this request and I look forward to further contact with you. regards, Stuart Robertson

CONSENT FORM for PARTICIPANTS

Research Project: Mine Lifecycle Planning and Enduring Value for Remote Communities

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I, ..., have read the information contained in the Information Sheet for Participants and any questions I have asked have been answered to my satisfaction. Yes/No

I agree to participate in this activity, realising that I may withdraw at any time. Yes/No

I agree that research data gathered for the study may be published using a pseudonym Yes/No

I agree that I may be quoted using a pseudonym Yes/No

I am older than18 years of age. Yes/No

....
Participant Date

....
Researcher Date

Enduring Community Value

1. What is the name of the town/community you reside in or are closest too?

2. How long have you resided in the town you nominated in Question 1?

- ◯ Less than 1 year
- ◯ 1 to 2 years
- ◯ 3 to 5 years
- ◯ 6 to 10 years
- ◯ 11 to 15 years
- ◯ 16 to 20 years
- ◯ 21 to 25 years
- ◯ 25 to 30 years
- ◯ 31 to 40 years

3. Are you employed at

- ◯ Leigh Creek Mine
- ◯ Olympic Dam Mine
- ◯ Not employed in a mine
- ◯ Other Mine in the Area (please enter name of the mine)

4. Do you access the township of Leigh Creek for shopping,business or social purposes?

- ◯ Yes: Please proceed to next page.
- ◯ No: Please proceed to page 9 Access to Roxby Downs.

Access to Leigh Creek

The following sections will ask questions on your access to Leigh Creek, what services you use and your average weekly expenditure.

5. How frequently do you access Leigh Creek?

Daily ○ 2 to 5 times a week ○ Weekly ○ Fortnightly ○ Monthly ○

6. Thinking of your access to Leigh Creek from the list below please tick what services you use.

- ☐ Daily Groceries (bread, milk, newspapers)
- ☐ Weekly Groceries (e.g. Supermarket)
- ☐ Household items (e.g. electronics, white goods, furniture)
- ☐ Fuel
- ☐ Hardware (e.g. timber, nails, paint, landscape supplies)
- ☐ Agricultural supplies (recurrent items like seed, fertilizer)
- ☐ Agricultural equipment (capital items like tractors, motorbikes)
- ☐ Clothing
- ☐ Motor repairs and service
- ☐ Social (e.g. sporting or service club, dinner)
- ☐ Hairdresser/beautician
- ☐ Doctor
- ☐ Chemist
- ☐ Dentist
- ☐ Medical (e.g. hospital, outpatient clinics etc.)
- ☐ Banking
- ☐ Education (e.g. Children accessing School)
- ☐ Government Services (e.g. Post Office, Centrelink)
- ☐ Other (please specify)

Estimated weekly expenditure

Below are a series of questions on estimated weekly expenditure. If you would usually purchase goods and services on a monthly basis please divide the amount by four to give a weekly average.
If you do not purchase any of the listed goods and services please tick the N/A option.

7. On average how much would you spend in Leigh Creek each week?

Less than $50	$51 to $100	$101 to $200	$201 to $300	$301 to $400	$401 to $500	$501 to $600	$601 to $700	$701 to $800	$801 to $900	$901 to $1000	Over $1000	N/A
○	○	○	○	○	○	○	○	○	○	○	○	○

8. On average how much would you spend on groceries in Leigh Creek each week?

Less than $50	$51 to $100	$101 to $200	$201 to $300	$301 to $400	$401 to $500	$501 to $600	$601 to $700	$701 to $800	$801 to $900	$901 to $1000	Over $1000	N/A
○	○	○	○	○	○	○	○	○	○	○	○	○

9. On average how much would you spend on fuel in Leigh Creek each week?

Less than $50	$51 to $100	$101 to $200	$201 to $300	$301 to $400	$401 to $500	$501 to $600	$601 to $700	$701 to $800	$801 to $900	$901 to $1000	Over $1000	N/A
○	○	○	○	○	○	○	○	○	○	○	○	○

10. On average how much would you spend on motor vehicle repair and service in Leigh Creek each week?

Less than $50	$51 to $100	$101 to $200	$201 to $300	$301 to $400	$401 to $500	$501 to $600	$601 to $700	$701 to $800	$801 to $900	$901 to $1000	Over $1000	N/A
○	○	○	○	○	○	○	○	○	○	○	○	○

11. On average how much would you spend on hardware (e.g. timber, nails, paint, landscape supplies) in Leigh Creek each week?

Less than $50	$51 to $100	$101 to $200	$201 to $300	$301 to $400	$401 to $500	$501 to $600	$601 to $700	$701 to $800	$801 to $900	$901 to $1000	Over $1000	N/A
○	○	○	○	○	○	○	○	○	○	○	○	○

12. On average how much would you spend on agricultural supplies (recurrent items like seed, fertilizer) in Leigh Creek each week?

Less than $50	$51 to $100	$101 to $200	$201 to $300	$301 to $400	$401 to $500	$501 to $600	$601 to $700	$701 to $800	$801 to $900	$901 to $1000	Over $1000	N/A
○	○	○	○	○	○	○	○	○	○	○	○	○

13. On average how much would you spend on agricultural equipment (capital items like tractors, motorbikes) in Leigh Creek each week?

Less than $50	$51 to $100	$101 to $200	$201 to $300	$301 to $400	$401 to $500	$501 to $600	$601 to $700	$701 to $800	$801 to $900	$901 to $1000	Over $1000	N/A
○	○	○	○	○	○	○	○	○	○	○	○	○

14. On average how much would you spend on clothing in Leigh Creek each week?

Less than $50	$51 to $100	$101 to $200	$201 to $300	$301 to $400	$401 to $500	$501 to $600	$601 to $700	$701 to $800	$801 to $900	$901 to $1000	Over $1000	N/A
○	○	○	○	○	○	○	○	○	○	○	○	○

15. On average how much would you spend on a hairdreser/beautician in Leigh Creek each week?

Less than $50	$51 to $100	$101 to $200	$201 to $300	$301 to $400	$401 to $500	$501 to $600	$601 to $700	$701 to $800	$801 to $900	$901 to $1000	Over $1000	N/A
○	○	○	○	○	○	○	○	○	○	○	○	○

16. On average how much would you spend on medical expenses (e.g Chemist, Doctor) in Leigh Creek each week?

Less than $50	$51 to $100	$101 to $200	$201 to $300	$301 to $400	$401 to $500	$501 to $600	$601 to $700	$701 to $800	$801 to $900	$901 to $1000	Over $1000	N/A
○	○	○	○	○	○	○	○	○	○	○	○	○

17. On average how much would you spend on entertainment and social activities in Leigh Creek each week?

Less than $50	$51 to $100	$101 to $200	$201 to $300	$301 to $400	$401 to $500	$501 to $600	$601 to $700	$701 to $800	$801 to $900	$901 to $1000	Over $1000	N/A
○	○	○	○	○	○	○	○	○	○	○	○	○

18. On average how much would you spend on household (e.g. electronics, DVD's, books, white goods, furniture, crockery) items in Leigh Creek each week?

Less than $50	$51 to $100	$101 to $200	$201 to $300	$301 to $400	$401 to $500	$501 to $600	$601 to $700	$701 to $800	$801 to $900	$901 to $1000	Over $1000	N/A
○	○	○	○	○	○	○	○	○	○	○	○	○

Access to goods and service out of Leigh Creek

The next statements ask you to nominate which town or community you access if you do not use Leigh Creek for these services.

19. If you do not use Leigh Creek for these services please nominate which town you use?

Daily Groceries (bread, milk, newspapers)	
Weekly Groceries (e.g. Supermarket)	
Household items (e.g. electronics, white goods, furniture)	
Fuel	
Hardware	
Agricultural supplies (recurrent items like seed, fertilizer)	
Agricultural equipment (capital items like tractors, motorbikes)	
Clothing	
Motor repairs and service	
Social (e.g. sporting or service club, dinner)	
Hairdresser/beautician	
Doctor	
Chemist	
Dentist	
Medical (e.g. hospital, outpatient clinics etc.)	
Banking	
Education (e.g. Children accessing School)	
Government Services (e.g. Post Office, Centrelink)	

Access to goods and service out of Leigh Creek

20. Please nominate other goods and services that you are NOT able to access from Leigh Creek. (e.g. goods and services that you would access if they were available in Leigh Creek)

21. Which town do you access for the goods and services that you listed in the previous question as NOT being available in Leigh Creek?

Leigh Creek Community attributes

The next series of questions are to gain an understanding of your view of Leigh Creek as a community. Please respond to each statement.

22. How well does Leigh Creek meet the needs and interests of you and your family?

	Strongly Disagree	Disagree	Feel Neutral	Agree	Strongly Agree
This community provides ample opportunities for my family to live fulfilling lives	☐	☐	☐	☐	☐
There are ample job opportunities in this community	☐	☐	☐	☐	☐
This community provides a variety of jobs and careers	☐	☐	☐	☐	☐
There are not enough education facilities for children in this community	☐	☐	☐	☐	☐
There is always plenty of entertainment to choose form in this community	☐	☐	☐	☐	☐
This community isn't as friendly a place to visit as it used to be	☐	☐	☐	☐	☐
The sporting and service clubs in this community are very strong	☐	☐	☐	☐	☐
It is easy to make friends in this community	☐	☐	☐	☐	☐
The future of this community is bleak unless the population begins to grow	☐	☐	☐	☐	☐
Leigh Creek has no future as a community if the mine closes	☐	☐	☐	☐	☐

Leigh Creek Community attributes

23. In your opinion what would be required to ensure that Leigh Creek was to remain a viable community into the future.

24. Please proceed to page 20 Demographic Information

Access to Roxby Downs

25. Do you access the township of Roxby Downs for shopping,business or social purposes?

- ◯ Yes: Please proceed to the next page.
- ◯ No: Please proceed to page17. Access to towns other than Leigh Creek or Roxby Downs.

The following sections will ask questions on your access to Roxby Downs, what services you use and your average weekly expenditure.

26. How frequently do you access Roxby Downs?

Daily ○ 2 to 5 times a week ○ Weekly ○ Fortnightly ○ Monthly ○

27. Thinking of your access to Roxby Downs from the list below please check what services you use.

- ☐ Daily Groceries (bread, milk, newspapers)
- ☐ Weekly Groceries (e.g. Supermarket)
- ☐ Household items (e.g. electronics, white goods, furniture)
- ☐ Fuel
- ☐ Hardware (e.g. timber, nails, paint, landscape supplies)
- ☐ Agricultural supplies (recurrent items like seed, fertilizer)
- ☐ Agricultural equipment (capital items like tractors, motorbikes)
- ☐ Clothing
- ☐ Motor repairs and service
- ☐ Social (e.g. sporting or service club, dinner)
- ☐ Hairdresser/beautician
- ☐ Doctor
- ☐ Chemist
- ☐ Dentist
- ☐ Medical (e.g. hospital, outpatient clinics etc.)
- ☐ Banking
- ☐ Education (e.g. Children accessing School)
- ☐ Government Services (e.g. Post Office, Centrelink)

Estimated weekly expenditure

Below are a series of questions on estimated weekly expenditure. If you would usually purchase goods and services on a monthly basis please divide the amount by four to give a weekly average.
If you do not purchase any of the listed goods and services please tick the N/A option.

28. On average how much would you spend in Roxby Downs each week?

Less than $50	$51 to $100	$101 to $200	$201 to $300	$301 to $400	$401 to $500	$501 to $600	$601 to $700	$701 to $800	$801 to $900	$901 to $1000	Over $1000	N/A
○	○	○	○	○	○	○	○	○	○	○	○	○

29. On average how much would you spend on groceries in Roxby Downs each week?

Less than $50	$51 to $100	$101 to $200	$201 to $300	$301 to $400	$401 to $500	$501 to $600	$601 to $700	$701 to $800	$801 to $900	$901 to $1000	Over $1000	N/A
○	○	○	○	○	○	○	○	○	○	○	○	○

30. On average how much would you spend on fuel in Roxby Downs each week?

Less than $50	$51 to $100	$101 to $200	$201 to $300	$301 to $400	$401 to $500	$501 to $600	$601 to $700	$701 to $800	$801 to $900	$901 to $1000	Over $1000	N/A
○	○	○	○	○	○	○	○	○	○	○	○	○

31. On average how much would you spend on motor vehicle repair and service in Roxby Downs each week?

Less than $50	$51 to $100	$101 to $200	$201 to $300	$301 to $400	$401 to $500	$501 to $600	$601 to $700	$701 to $800	$801 to $900	$901 to $1000	Over $1000	N/A
○	○	○	○	○	○	○	○	○	○	○	○	○

32. On average how much would you spend on hardware (e.g. timber, nails, paint, landscape supplies) in Roxby Downs each week?

Less than $50	$51 to $100	$101 to $200	$201 to $300	$301 to $400	$401 to $500	$501 to $600	$601 to $700	$701 to $800	$801 to $900	$901 to $1000	Over $1000	N/A
○	○	○	○	○	○	○	○	○	○	○	○	○

33. On average how much would you spend on agricultural supplies (recurrent items like seed, fertilizer) in Roxby Downs each week?

Less than $50	$51 to $100	$101 to $200	$201 to $300	$301 to $400	$401 to $500	$501 to $600	$601 to $700	$701 to $800	$801 to $900	$901 to $1000	Over $1000	N/A
○	○	○	○	○	○	○	○	○	○	○	○	○

34. On average how much would you spend on agricultural equipment (capital items like tractors, motorbikes)in Roxby Downs each week?

Less than $50	$51 to $100	$101 to $200	$201 to $300	$301 to $400	$401 to $500	$501 to $600	$601 to $700	$701 to $800	$801 to $900	$901 to $1000	Over $1000	N/A
○	○	○	○	○	○	○	○	○	○	○	○	○

35. On average how much would you spend on clothing in Roxby Downs each week?

Less than $50	$51 to $100	$101 to $200	$201 to $300	$301 to $400	$401 to $500	$501 to $600	$601 to $700	$701 to $800	$801 to $900	$901 to $1000	Over $1000	N/A
○	○	○	○	○	○	○	○	○	○	○	○	○

36. On average how much would you spend on a hairdresser/beautician in Roxby Downs each week?

Less than $50	$51 to $100	$101 to $200	$201 to $300	$301 to $400	$401 to $500	$501 to $600	$601 to $700	$701 to $800	$801 to $900	$901 to $1000	Over $1000	N/A
○	○	○	○	○	○	○	○	○	○	○	○	○

37. On average how much would you spend on medical expenses (e.g Chemist, Doctor) in Roxby Downs each week?

Less than $50	$51 to $100	$101 to $200	$201 to $300	$301 to $400	$401 to $500	$501 to $600	$601 to $700	$701 to $800	$801 to $900	$901 to $1000	Over $1000	N/A
○	○	○	○	○	○	○	○	○	○	○	○	○

38. On average how much would you spend on entertainment and social activities in Roxby Downs each week?

Less than $50	$51 to $100	$101 to $200	$201 to $300	$301 to $400	$401 to $500	$501 to $600	$601 to $700	$701 to $800	$801 to $900	$901 to $1000	Over $1000	N/A
○	○	○	○	○	○	○	○	○	○	○	○	○

39. On average how much would you spend on household items (e.g. electronics, DVD's, books, white goods, furniture, crockery) in Roxby Downs each week?

Less than $50	$51 to $100	$101 to $200	$201 to $300	$301 to $400	$401 to $500	$501 to $600	$601 to $700	$701 to $800	$801 to $900	$901 to $1000	Over $1000	N/A
○	○	○	○	○	○	○	○	○	○	○	○	○

Access to goods and service out of Roxby Downs

The next statements ask you to nominate which town or community you access if you do not use Roxby Downs for these services.

40. If you do not use Roxby Downs for these services please nominate which town you use.

Daily Groceries (bread, milk, newspapers)	
Weekly Groceries (e.g. Supermarket)	
Household items (e.g. electronics, white goods, furniture)	
Fuel	
Hardware	
Agricultural supplies (recurrent items like seed, fertilizer)	
Agricultural equipment (capital items like tractors, motorbikes)	
Clothing	
Motor repairs and service	
Social (e.g. sporting or service club, dinner)	
Hairdresser/beautician	
Doctor	
Chemist	
Dentist	
Medical (e.g. hospital, outpatient clinics etc.)	
Banking	
Education (e.g. Children accessing School)	
Government Services (e.g. Post Office, Centrelink)	

Access to goods and service out of Roxby Downs

41. Please nominate the goods and service that you are NOT able to access from Roxby Downs. (e.g. goods and services that you would access it they were available in Roxby Downs)

42. Which town do you access for the good and services that you listed in the previous question as NOT available in Roxby Downs?

Roxby Downs Community attributes

The next series of questions are to gain an understanding of your view of the Roxby Downs as a community.

43. How well does Roxby Downs meet the needs and interests of you and your family?

	Strongly Disagree	Disagree	Feel Neutral	Agree	Strongly Agree
This community provides ample opportunities for my family to live fulfilling lives	☐	☐	☐	☐	☐
There are ample job opportunities in this community	☐	☐	☐	☐	☐
This community provides a variety of jobs and careers	☐	☐	☐	☐	☐
There are not enough education facilities for children in this community	☐	☐	☐	☐	☐
There is always plenty of entertainment to choose form in this community	☐	☐	☐	☐	☐
This community isn't as friendly a place to visit as it used to be	☐	☐	☐	☐	☐
The sporting and service clubs in this community are very strong	☐	☐	☐	☐	☐
It is easy to make friends in this community	☐	☐	☐	☐	☐
The future of this community is bleak unless the population begins to grow	☐	☐	☐	☐	☐
Roxby Downs has a future as a community without mining	☐	☐	☐	☐	☐

Roxby Downs Community attributes

44. In your opinion what would be required to ensure that Roxby Downs was to remain a viable community into the future.

45. Please proceed to page 20 Demographic Information

Access to towns other than Leigh Creek or Roxby Downs

The following sections ask a series of questions on what services and communities you access if you do not regularly access Leigh Creek and Roxby Downs

46. Please state a reason why you do not access Leigh Creek.

47. Please state a reason why you do not access Roxby Downs.

48. What town/community do you usually access?

49. How frequently do you access the town you nominated above?

Daily	2 to 5 time a week	Weekly	Fortnightly	Monthly
○	○	○	○	○

Enduring Community Value

50. Thinking of your access to the town you nominated from the list below please check what services you use.

- [ ] Daily Groceries (bread, milk, newspapers)
- [ ] Weekly Groceries (e.g. Supermarket)
- [ ] Household items (e.g. electronics, white goods, furniture)
- [ ] Fuel
- [ ] Hardware
- [ ] Agricultural supplies (recurrent items like seed, fertilizer)
- [ ] Agricultural equipment (capital items like tractors, motorbikes)
- [ ] Clothing
- [ ] Motor repairs and service
- [ ] Social (e.g. sporting or service club, dinner)
- [ ] Hairdresser/beautician
- [ ] Doctor
- [ ] Chemist
- [ ] Dentist
- [ ] Medical (e.g. hospital, outpatient clinics etc.)
- [ ] Banking
- [ ] Education (e.g. Children accessing School)
- [ ] Government Services (e.g. Post Office, Centrelink)

51. If you do not use the town you nominated for these services please nominate which town you use.

Casual Groceries (bread, milk, newspapers)	
Weekly Groceries (e.g. Supermarket)	
Household items (e.g. electronics, white goods, furniture)	
Education (e.g. Children accessing School)	
Banking	
Fuel	
Hardware	
Agricultural supplies	
Agricultural equipment	
Clothing	
Motor repairs and service	
Doctor	
Chemist	
Government Services (e.g. Post Office, Centrelink)	
Medical (e.g. Hospital outpatients, dental etc.)	
Social (e.g. sporting or service club, dinner)	
Hairdresser/beautician	

Demographic Information

52. Are you

- ☐ Male
- ☐ Female

53. Do you identify as Aboriginal or Torres Strait Islander?

- ☐ Yes
- ☐ No

54. Which category below includes your age?

- ○ 18-24
- ○ 25-29
- ○ 30-34
- ○ 35-39
- ○ 40-44
- ○ 45-49
- ○ 50-54
- ○ 55-59
- ○ 60-64
- ○ 65-69
- ○ 70 or older

55. How many people currently live in your household?

56. Are you employed in (if you are employed in more than one category please select all relevant categories)

- [ ] the mining sector
- [ ] a government service role
- [ ] non-government service role
- [ ] the retail/service industry
- [ ] the agricultural sector
- [ ] the tourism sector
- [ ] not in currently particpating in paid work
- [ ] other sector

57. Please nominate the percentage of your income earned in each category

the mining sector	
a government service role	
non-government service role	
the retail/service industry	
the agricultural sector	
the tourism sector	
Not currently particpating in paid work	

58. What type of work category are you employed in?

- [ ] Manager
- [ ] Professional
- [ ] Community or Personal Service Worker
- [ ] Clerical or Administrative Worker
- [ ] Sales Worker
- [ ] Hospitality Worker
- [ ] Technician or Trade Worker
- [ ] Machinery Operator and Driver
- [ ] Labourer
- [ ] Not currently particpating in paid work

59. What is the highest level of education you have completed?

- [ ] Did not attend school
- [ ] Year 9 or below
- [ ] Year 10 or equivalent
- [ ] Year 12 or equivalent
- [ ] Trade certificate course at TAFE
- [ ] Diploma or advanced diploma at TAFE
- [ ] University degree
- [ ] University postgraduate certificate or diploma
- [ ] University postgraduate degree

60. Looking at the income categories below, please select which income bracket best fits your household GROSS income. (Gross income includes wages, salaries, pensions, unemployment benefits, family payments, maintenance/child support, interest received, business or farm income, dividends or payments from land use agreements. Please do not deduct Tax.)

- [ ] Nil income
- [ ] Less than $384 per week (less than $19,999 per year)
- [ ] $385 - $999 per week ($20,000 - $51,999 per year)
- [ ] $1000 - $1499 per week ($52,000 - $77,999 per year)
- [ ] $1500 - $1999 per week ($78,000 - $103,999 per year)
- [ ] $2000 - $2999 per week ($104,000 - $155,999 per year)
- [ ] $3000 - $3999 per week ($156,000 - $207,999 per year)
- [ ] $4000 - $4999 per week ($208,000 - $259,999 per year)
- [ ] $5000 - $9,999 per week ($260,000 - $519,999 per year)
- [ ] $10,00 or more per week ($520,000 or more per year)

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Final Page

Thank you for participating in this survey.

If you would like to participate in follow up interviews with the researcher please provide contact details below.

The interview will ask questions about your views of Leigh Creek or Roxby Downs and further explore your interactions both socially and economically with either community and their hinterlands.

This information will be stored separately from the survey upon receipt of the survey responses.

61. Did you wish to be involved in follow up interviews?

◯ Yes

◯ No

62. If you wish to participate in follow up interviews please provide contact details below.

Name	
Phone	
Email	
Preferred contact method	

Postal return of Survey to:

Stuart Robertson
UNE Business School
University of New England
Armidale NSW 2351

APPENDIX 2

Enduring Community Value from Mining Interview Questions: Leigh Creek

1. How long have you lived in the area?
2. Do you identify as being Aboriginal?
3. What industry do you work in?
4. What changes have you seen in the community since you have lived here?
5. What are your preferred aspects of the community?
6. What are your least preferred aspects of the community?
7. What aspects of Leigh Creek do you feel are important to the surrounding area and communities?
8. What are your views of the mining industry? What benefits or negatives does the industry bring to the area?
9. Would you remain in the area if the mine closed? What would be required to happen for you to remain in the area?
10. Do you think Leigh Creek would be able to remain viable upon closure of the mine?
11. What do you think is required to ensure that Leigh Creek remains a viable community?
12. What industry would you think suitable to use the mine site upon closure of the mine?
13. What level of remediation do you think should be done at the mine site?
14. How much information have/do you receive in relation to the operation of the mine?
15. How much information have/do you receive in relation to the future of the mine?
16. How involved is the community in any planning for changes in the operation/future of the mine?

APPENDIX 3

Enduring Community Value from Mining Interview Questions: Roxby Downs

1. How long have you lived in the area?
2. What industry do you work in?
3. What changes have you seen in the community since you have lived here?
4. What are your preferred aspects of the community?
5. What are your least preferred aspects of the community?
6. What aspects of Roxby Downs do you feel are important to the surrounding area and communities?
7. What are your views of the mining industry? What benefits or negatives does the industry bring to the area?
8. Would you remain in the area if the mine closed? What would be required to happen for you to remain in the area?
9. Do you think Roxby Downs would be able to remain viable upon closure of the mine?
10. What do you think is required to ensure that Roxby Downs remains a viable community?
11. How much information have/do you receive in relation to the operation of the mine?
12. How much information have/do you receive in relation to the future of the mine?
13. How involved is the community in any planning for changes in the operation/future of the mine?