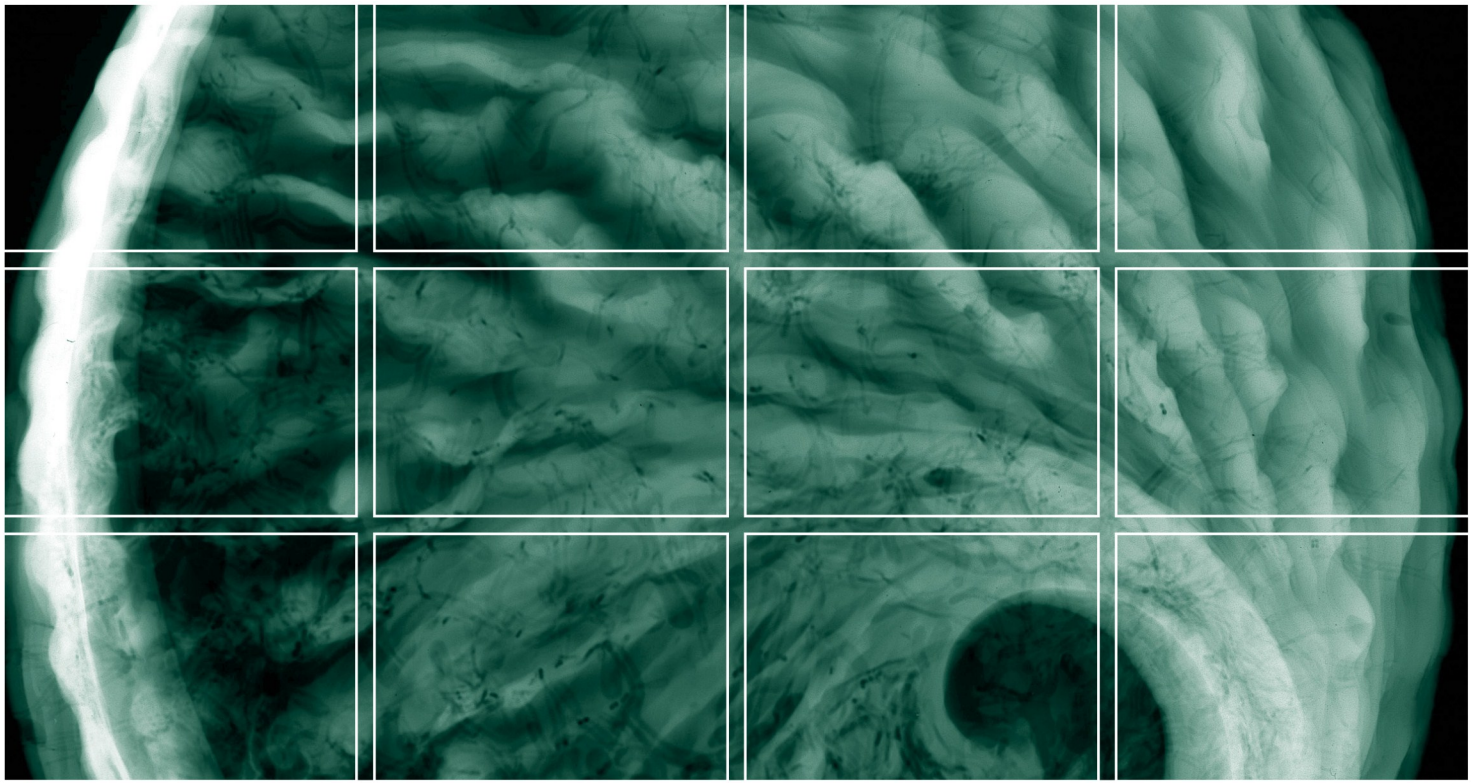

PART D

CONCLUSION

27 *SOCIAL IMPACT ASSESSMENT*

This chapter provides an overview of the demographic indicators for Wollongong and assesses the social impacts of the Project.

27.1 *STUDY AREA*

The communities within the immediate vicinity of the NRE No.1 Colliery are Russell Vale and Bellambi to the east and Corrimal to the south. These communities are those most likely to experience any direct negative impacts as a result of the Project. The nearest residence is located on West Street, directly adjacent to the Russell Vale site.

The wider population of Wollongong is most likely to experience both direct and indirect, service demand and socio-economic impacts resulting from the proposal, due to the stronger capacity and availability of social services and networks in these locations.

Three different geographical scales were selected in order to compare trends across places. The study area is focused around the local communities of Russell Vale, Bellambi and Corrimal, which are located within the Wollongong LGA. Fourteen Census Collection Districts (CCDs) have been used to build the profile of the Local Community immediately surrounding the site: 1190504, 1190509, 1190511, 1190515, 1190602, 1190701, 1190705, 1190706, 1190708, 1190709, 1190710, 1190712, 1190713 and 1190714. These CCDs will herein be referred to as the 'Local Community' (*Figure 27.1*).

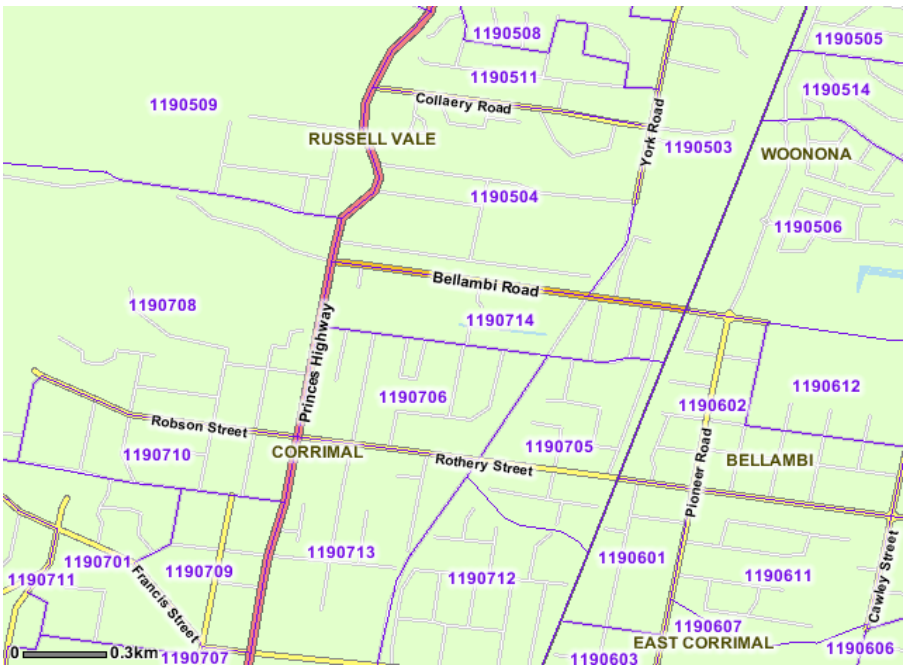

Figure 27.1 Map of Census Collection Districts in Local Community (Source: ABS 2006a)

The CCDs of the Local Community are located within the Wollongong LGA, which is the next geographical scale for comparison. *Figure 27.2* shows the Local Community CCDs in relation to the broader Wollongong LGA.

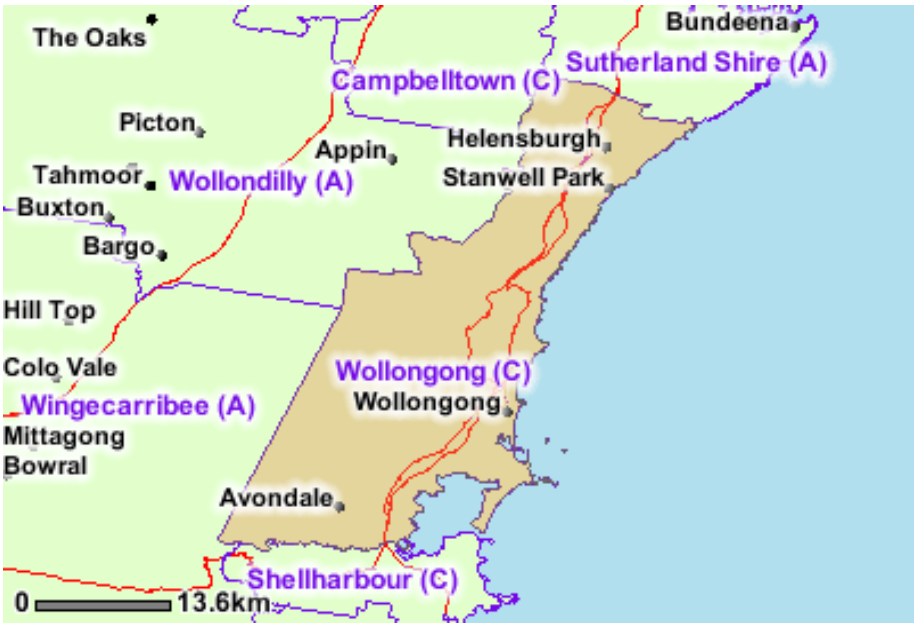

Figure 27.2 Wollongong Local Government Area (Source: ABS 2006a)

Finally, the largest geographical scale for comparison is the Illawarra Statistical Division (Illawarra SD) that encompasses Wollongong, Wingecarribee, Shoalhaven, Shellharbour and Kiama LGAs as indicated in *Figure 27.3*.

Figure 27.3 Illawarra Statistical Division (Source: ABS 2006a)

27.2 SOCIO-ECONOMIC DEMOGRAPHIC PROFILE

This profile has been prepared using publicly available information from the Australian Bureau of Statistics (ABS). Data has been sourced for the Wollongong LGA, as this wider area captures both direct and indirect impacts of the proposal. Data from the Illawarra SD has also been used to provide a comparative context for the areas directly or indirectly impacted.

In the instances where CCD is unavailable, Wollongong LGA and Illawarra SD have been compared to NSW statistics. It should be noted that the total figures for all age cohort tables are calculated on the basis of individual cohort figures. This means that in some instances totals will differ slightly due to the ABS policy of randomisation.

27.2.1 *Population Profile*

In 2006, the population of the Local Community was 8, 425, Wollongong LGA 184, 213 and Illawarra SD 394, 213. As shown in *Table 27.1*, the distribution between males and females was proportionally similar across the areas.

Table 27.1 Population by Sex, 2006

	Male		Female		Total
Local Community	4,183	49.65%	4,242	50.35%	8,425
Wollongong LGA	91,104	49.50%	93,109	50.50%	184,213
Illawarra SD	193,777	49.20%	200,436	50.80%	394,213

Source: ABS 2006a

As shown in *Table 27.2* and *Figure 27.4* the key demographic differences between the Local Community, Wollongong LGA and Illawarra SD were:

- the Local Community had a higher proportion of the population aged 0-4 years (6.9%) and 35-44 years (14.5%), than Wollongong LGA and Illawarra SD, which indicates a higher proportion of young families;
- the Local Community (15.8%) and Wollongong LGA (15.6%) had a slightly smaller proportion of people aged 65 years and over, in comparison to the Illawarra SD (16.8%); and
- Wollongong LGA had a higher proportion of people aged 15-24 years (14.0%) compared to the Local Community (11.5%) and Illawarra (12.8%).

Table 27.2 Age Demographic (%), 2006

Age	Local Community	Wollongong LGA	Illawarra SD
0-4 years	6.9%	6.1%	6.0%
5-14 years	13.4%	13.1%	13.9%
15-24 years	11.5%	14.0%	12.8%
25-34 years	13.3%	12.8%	11.1%
35-44 years	14.5%	14.0%	13.7%
45-54 years	13.3%	13.5%	13.9%
55-64 years	11.3%	10.7%	11.9%
65-74 years	7.6%	8.1%	9.0%
75 years and over	8.2%	7.5%	7.8%
Total	**8,427**	**184,213**	**394,213**

Source: ABS 2006a

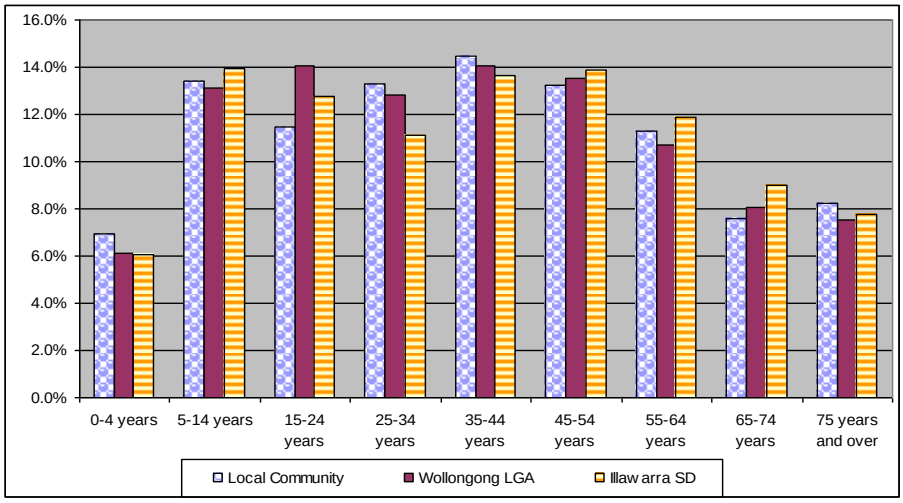

Figure 27.4 Age Demographic, 2006 (Source: ABS 2006a)

27.2.2 *Household Composition*

Table 27.3 and *Table 27.4* list statistics of household characteristics. Both the Local Community and Wollongong LGA had slightly lower proportions of family households than the Illawarra SD. In 2006, 71.5% of the Local Community's households were family households, which is slightly higher than Wollongong LGA (70.65%) but lower than the Illawarra SD (72.65%). The Local Community also had a slightly higher proportion of lone person households in 2006 (26.2%), compared to 25.56% in the Wollongong LGA and 24.45% in the Illawarra SD. Wollongong LGA also had a significantly higher proportion of group households. This could be indicative of the younger population and university students.

Table 27.3 Type of Household, 2006

	Local Community		Wollongong LGA		Illawarra SD	
	Number	**%**	**Number**	**%**	**Number**	**%**
Family household	2,301	71.50%	48,272	70.65%	105,702	72.65%
Lone person household	843	26.20%	17,465	25.56%	35,569	24.45%
Group household	74	2.30%	2589	3.79%	4,223	2.90%
Total Households	**3,218**		**68,326**		**145,494**	
Source: ABS 2006a						

Of family households in the Local Community, the majority (45.08%) were couples with children, which was similar to Wollongong LGA (45.13%), and slightly higher than Illawarra SD (43.14%). There was a higher proportion of couples with no children living in the Illawarra SD (39.25%) than Wollongong LGA and the Local Community.

Table 27.4 Family Household Characteristics, 2006

	Local Community		Wollongong LGA		Illawarra SD	
Family Characteristics	**Number**	**%**	**Number**	**%**	**Number**	**%**
Couple families with children	1,054	45.08%	22,207	45.13%	46,383	43.14%
Couple families without children	867	37.08%	17,946	36.47%	42,200	39.25%
One parent families	377	16.12%	8,342	16.95%	17,656	16.42%
Other families	40	1.71%	710	1.44%	1,278	1.19%
Total families	**2,338**		**49,205**		**107,517**	

Source: ABS 2006a

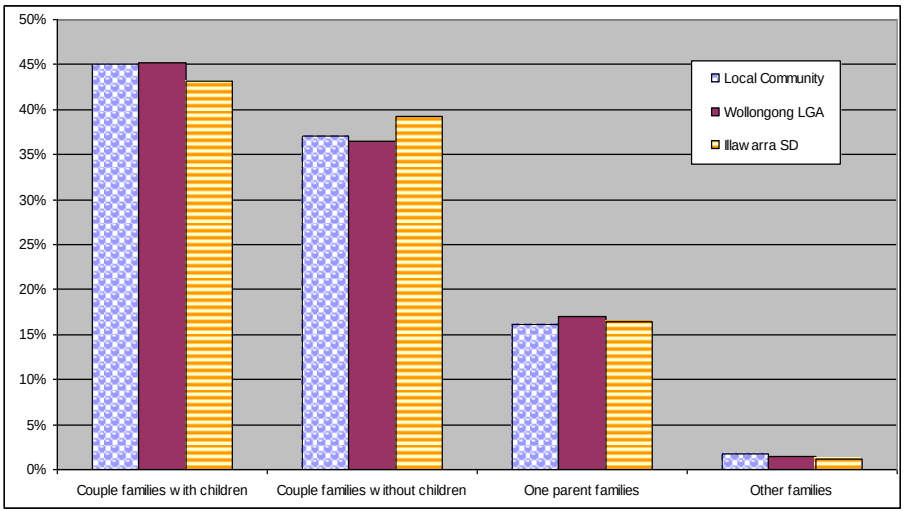

Figure 27.5 Family Composition, 2006 (Source: ABS 2006a)

27.2.3 *Population Growth*

Population growth figures available for the Illawarra SD show population increases between 1996 and 2006 in line with the overall NSW State growth of 9.1%. In the same period, Wollongong LGA experienced an increase of 6,625 people, or 3.7%. This was significantly lower than the Illawarra SD which grew by 30, 318 people or 8.4% over the same period. The data was sourced from the ABS Census 2006, Time Series Profiles, hence the variation in total population figures from *Table 27.1*.

Table 27.5 Population Growth, 1996 – 2006

	Wollongong LGA			Illawarra SD			NSW		
Year	1996	2001	2006	1996	2001	2006	1996	2001	2006
Total Population	177,009	181,612	183,634	360,298	381,898	390,616	6,038,696	6,371,745	6,585,732

Source: ABS 2006b

27.2.4 *Population Mobility*

Figure 27.6 shows the proportion of people living in the same address five years ago, in Wollongong LGA, from the previous census (2001). The figure indicates that the CCD directly adjacent to the NRE No.1 Colliery (1190509, to the north east) had a relatively stable population with 72-83% of the population living in the same address as five years ago. The other CCD directly adjacent to the colliery (1190708, to the south east) had a significantly smaller proportion of people living in the same address, with 54-64 %. The remaining CCDs were relatively stable, ranging between 64-72% of people residing in the same address.

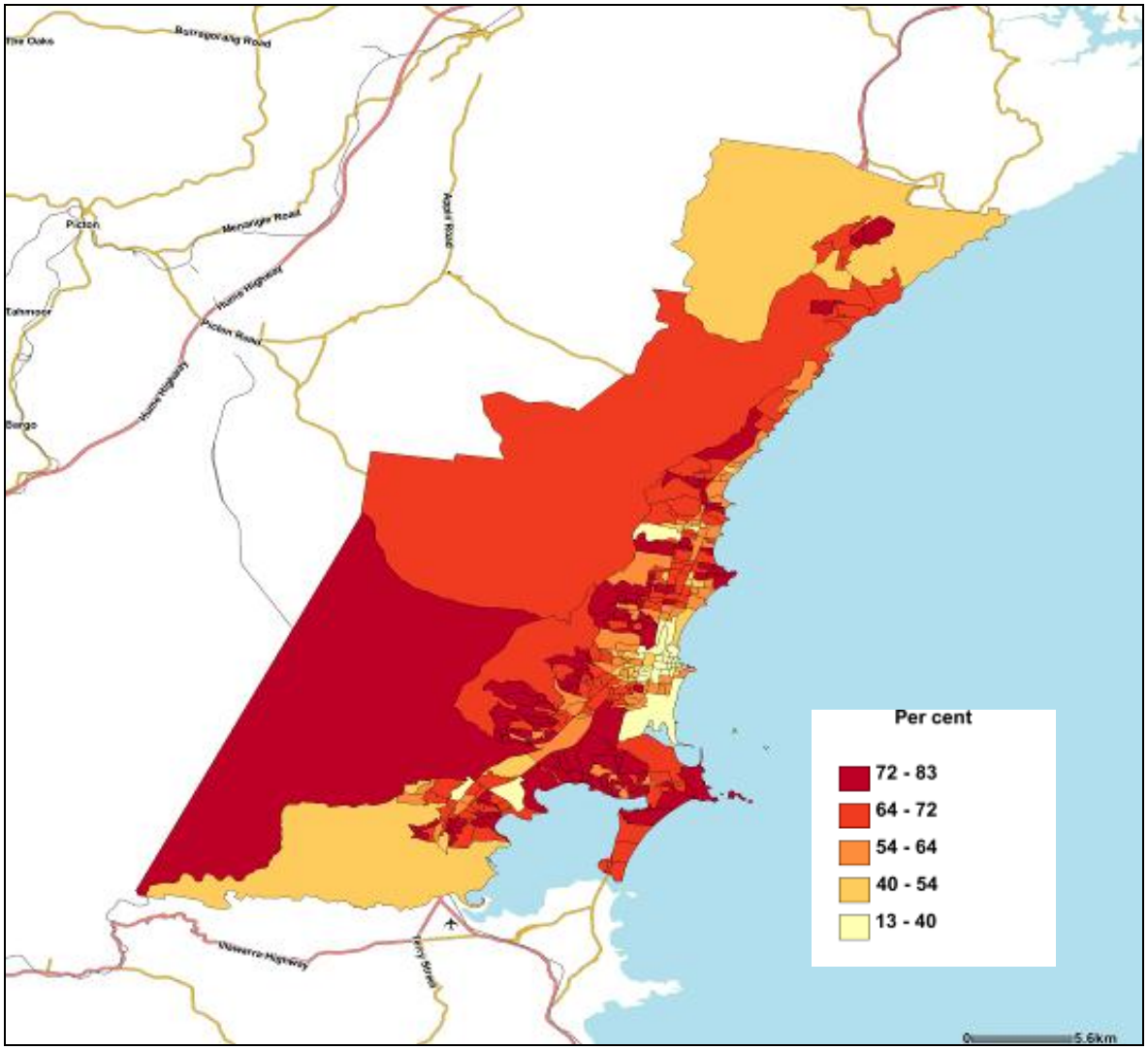

Figure 27.6 Household Mobility - People living at the same address as 5 years ago (2006) (Source: ABS 2006c)

27.2.5 *Employment Trends*

Occupations for employed persons in Wollongong LGA, Illawarra SD and NSW between 1996 and 2006 are shown in *Table 27.6.* In 2006, the most common occupation for employed persons in the Wollongong LGA were Professionals (21.0%), Technicians or Trades Workers (16.1%) and Clerical and Administrative Workers (14.6%). This is comparative to both the Illawarra SD and NSW trends for the same period.

Wollongong LGA also experienced a reduction in Clerical and Administrative workers, Machinery Operators and Drivers and Labourers between 1996 and 2006, although this is also consistent with the Illawarra SD and NSW trends.

Both Wollongong LGA (10.0%) and Illawarra SD (11.0%) have seen an increase in the Management area of employment between 1996 and 2006, however, the levels remain noticeably lower than the NSW average of 13.6% in 2006.

The changes in the labour force for Wollongong LGA are also demonstrated by the employment breakdown by industry shown in *Table 27.6.*

Table 27.6 Occupations 1996 – 2006

	Wollongong LGA			Illawarra SD			NSW		
	1996	**2001**	**2006**	**1996**	**2001**	**2006**	**1996**	**2001**	**2006**
Managers	9.1%	9.3%	10.0%	11.0%	10.6%	11.0%	13.5%	13.5%	13.6%
Professionals	18.5%	19.5%	21.0%	16.7%	17.3%	18.8%	18.2%	19.8%	21.2%
Technicians & trades workers	17.6%	16.6%	16.1%	17.9%	17.1%	16.7%	14.9%	14.1%	13.6%
Community & personal service workers	7.9%	9.1%	10.0%	8.1%	9.2%	10.2%	7.4%	7.8%	8.6%
Clerical & administrative workers	15.2%	15.1%	14.6%	14.4%	14.4%	13.8%	16.7%	16.3%	15.4%
Sales workers	9.0%	10.1%	9.6%	9.3%	10.5%	10.1%	9.3%	9.9%	9.7%
Machinery operators & drivers	10.2%	8.5%	7.8%	9.7%	8.4%	7.6%	7.8%	7.2%	6.4%
Labourers	9.7%	9.7%	9.2%	10.2%	10.4%	10.2%	9.6%	9.4%	9.5%
Inadequately described/Not stated	2.7%	2.0%	1.7%	2.7%	2.1%	1.6%	2.6%	2.0%	1.9%
Total	**69,581**	**73,153**	**76,509**	**135,966**	**148,402**	**158,028**	**2,558,875**	**2,748,396**	**2,901,482**
Source: ABS 2006b									

Occupations by sex for all three locations are shown in *Figure 27.7* and *Figure 27.8*. Key differences between areas include:

- most areas had approximately 20-25% of females and 15% of males employed as professionals;
- the Local Community had a higher proportion of people employed as technicians and trades workers and clerical and administrative workers than any other area;
- all locations had similar proportions of males and females working as labourers;
- the Local Community had a significantly lower proportion for both male and female workers in the managerial and professional occupations; and
- there was a larger gap between male and female sales workers in the Local Community (over 10% more females), than the average 7-8% in all other areas.

Figure 27.7 reveals that of males employed, over a quarter are employed as technicians and trades workers (25.95%) in the Local Community, which was marginally higher than Wollongong LGA and Illawarra SD. The lowest proportions of males working as professionals were found in the Local Community (below 15%). All three locations had similar proportions (around 11-12%) of males working as labourers. The Local Community had higher proportions of both males employed as community and administrative workers and clerical and administrative workers than Wollongong LGA and Illawarra SD.

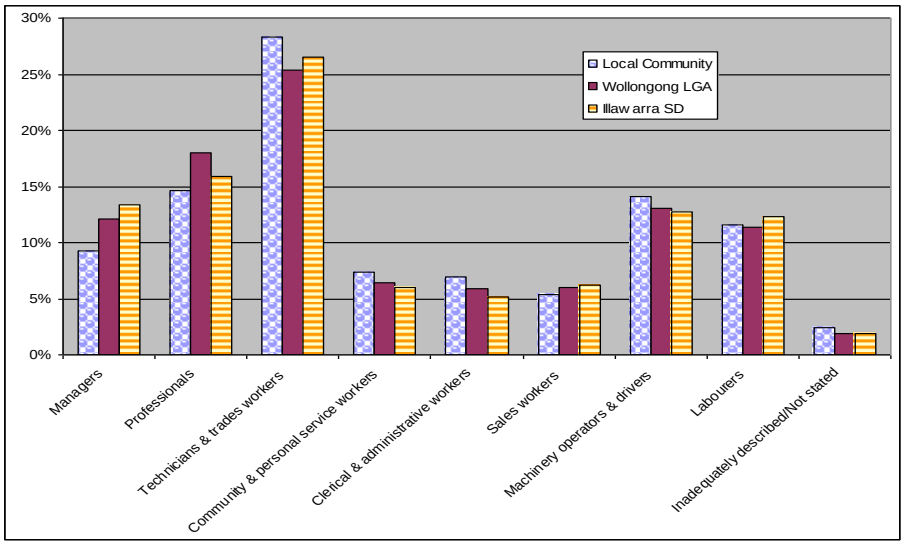

Figure 27.7 Occupation Type for Males, 2006 (Source: ABS 2006a)

Figure 27.8 reveals notable variations between occupation types for females across the three locations. A higher proportion of females in Wollongong LGA were employed as professionals (3-4% more), compared to females in the Local Community and Illawarra SD. Over 15% of females in the Local Community were employed as sales workers, which was marginally higher than Wollongong LGA and Illawarra SD. The Local Community had a higher than average proportion (over 27%) of females working as clerical and administrative workers, compared to the average 24-25% for the remaining areas.

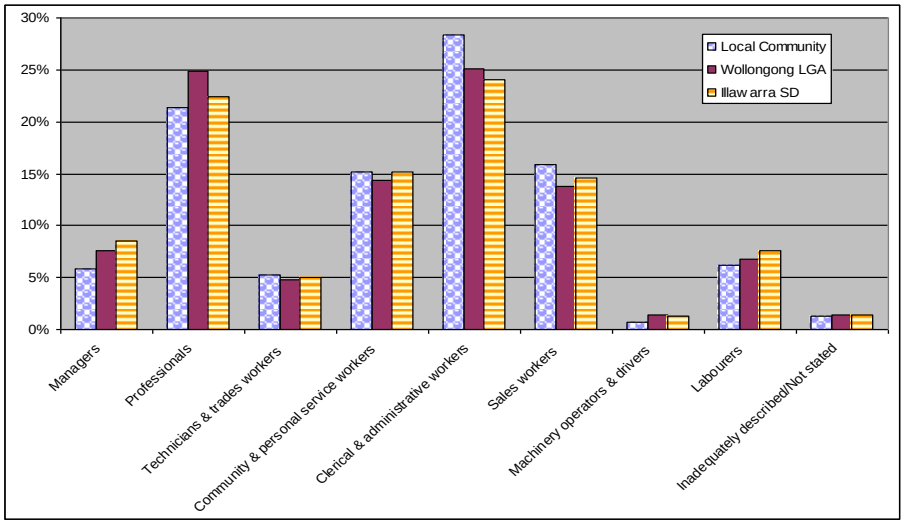

Figure 27.8 Occupation Type for Females, 2006 (Source: ABS 2006a)

27.2.6 *Industry of Employment*

The economy of the Wollongong LGA and the greater Illawarra SD is structured around manufacturing, tourism, retail, education and health care services. Historically, the manufacturing industry has played a vital role in the local economy of Wollongong LGA and Illawarra SD. However, WCC outlines in the 2007-2011 Social Plan, that key industry growth sectors now include tourism, retail, health, property, business services and education (Wollongong City Council 2007).

Although the manufacturing sector has fallen by over 4% between 1996 (16.2%) and 2006 (12.0%), manufacturing still remains the predominant industry of employment for Wollongong LGA, employing an above state average proportion of the workforce. The reduction in the manufacturing industry is also evident for both the Illawarra SD and NSW between 1996 and 2006 (refer to *Table 27.6*). Key growth industries of employment for both Illawarra SD and NSW also now include retail trade and health care and social assistance averaging at around 10-12% between 1996 and 2006.

The construction industry and public safety and administration are industries that have had significant increases in employment since 1996 for both Wollongong LGA and Illawarra SD, both above state averages. Manufacturing, mining, wholesale trade and agriculture industries have also experienced significant declines since 1996 for all three regions.

27.2.7 *Labour Force Status*

Unemployment levels in Wollongong have historically been higher than other areas of New South Wales. In October 2009 the unemployment rate for Wollongong LGA was 8.8%, compared with 5.7% for New South Wales at that time (DEWWR 2009). Illawarra SD also had a higher unemployment rate than NSW, at 7.3% in October 2009. As shown in *Table 27.7*, the increase in unemployment from October 2008 was greater for Wollongong and the Illawarra than NSW (DEWWR 2009).

Table 27.7 Unemployment Rates, October Quarter 2009

	Unemployment (000's)			Unemployment Rate	
	October 2008	October 2009	Change	October 2008	October 2009
NSW	173.5	205.6	32.1	4.9%	5.7%
Illawarra	9.5	13.7	4.2	4.7%	7.3%
Wollongong	7.9	11.2	3.3	5.6%	8.8%

Source: DEWWR 2009

27.2.8 *Household Income*

Figure 27.9 compares weekly household incomes across the Local Community, Wollongong LGA and Illawarra SD. The figure shows that:

- a lower proportion of Local Community households had incomes in the lower bracket, with 33.6% of Local Community households earning below $649 per week. This is in comparison to the Wollongong LGA (35.2%) and the Illawarra SD (36.2%);
- there was a slightly higher proportion of households earning $1,700 or more a week in the Wollongong LGA (21.4%) compared to the Local Community (19.2%) and the Illawarra SD (18.7%); and
- 42.8% of the households in the Local Community were earning more than $1,000 per week. This was marginally higher than 42.6% in the Wollongong LGA and 40.6% in the Illawarra SD.

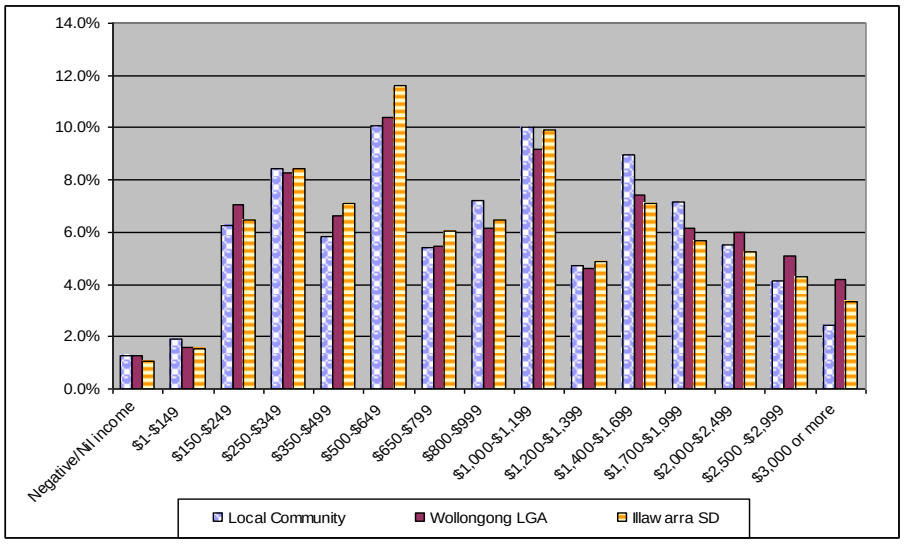

Figure 27.9 Weekly Household Income (Gross), 2006 (Source: ABS 2006a)

27.3 *COMMUNITY SERVICES, SOCIAL INFRASTRUCTURE AND RECREATION*

Major local services and social infrastructure are concentrated in the town centre of Corrimal, with limited services available in Russell Vale.

There is a small Community Hall located in Russell Vale, a pre-school and community parks.

Corrimal is a larger suburban area containing a moderate size shopping complex, a community centre, early childhood centre, library, community parks and reserves.

Major health services and facilities are located in the Wollongong town centre. Sporting facilities, clubs and entertainment venues are also provided in Corrimal, Bulli, Woonona and Wollongong.

27.4 *COMMUNITY DEVELOPMENT*

NRE contributes significant funds to the local community annually through specific community development programs and charities. Some of the programs and charities that are supported are listed in *Table 27.8*.

Table 27.8 Community development programs and charities

Greenacres Disability Services	Wollongong Hawks Basketball
St Francis Xavier's Catholic School	Avondale Rugby Club Inc.
Rett Syndrome Australian	Bellambi Surf Life Saving Club Inc.
St John Vianney's Catholic School	Dapto Swimming Club Inc.
Ovarian Cancer Australia	Woonona Soccer Club
Red Shield Appeal	Russell Vale Junior Football
Special Children's Christmas	Woonona Ockies Winter Swimming
Russel vale Public School	East West Orchestra
Light and Hope Clubhouse	Corrimal Rugby League Football
Sydney Utshab Inc.	Illawarra District Rugby
Bulli Football Club Limited	Russell Vale Golf Course
Woonona Netball Club	Corrimal Junior Cricket Club
Corrimal Rangers Football Club	Shamrocks Rugby Union Club

NRE provided community funding of $0.13m in 2009, and $0.67m in 2010.

27.5 *ANALYSIS OF IMPACTS*

27.5.1 *Methodology*

The potential for, and magnitude of, impacts resulting from the proposal have been addressed as part of other technical reports presented within this EAR.

This section identifies the potential social impacts of the Project, their significance, conclusions of technical reports and recommended mitigation measures where appropriate. The definitions of each level of significance are provided in *Table 27.9*.

Table 27.9 Impact Significance Definitions

Significance	Definition
Positive	An impact that inherently provides benefits to stakeholders or one that can produce positive effects with proactive management and action.
None to Low	An impact that can be easily addressed by a minor modification to construction or operational techniques (essentially an 'opportunity' to proceed at low cost and/or with minimal social impact).
Minor	An impact that can be addressed by modifications to construction or operational techniques, but at an additional cost; and/or likely to be raised as an issue by stakeholders.
Moderate	An impact that can, with some difficulty, be addressed by major (non-standard) modifications to either construction or operational techniques, at a large additional cost; and/or likely to require significant consultation to convince stakeholders that it can be addressed in an acceptable manner.
Major	An impact that has the potential to impose an unacceptably high risk (damage to corporate reputation, compromised social license to operate) unless managed or avoided in an appropriate way. It could involve an unacceptable additional cost or engineering risk; and/or lead to a significant delay to the Project timetable; and/or compromise international standards, country legislation, industry best practice; and/or cause an extreme NGO/ stakeholder reaction.

The significance of impacts has been assessed on the basis of their severity and the likelihood of occurrence, and the sensitivity of receptors to and degree of change caused by the impact. *Table 27.10* and *27.11* outline the impact methodology.

Table 27.10 Method for Identifying Significant Issues

Criteria Significance Assessment			
Severity	**Low likelihood**	**Moderate likelihood**	**High likelihood**
Low	None-Low	Minor	Minor
Medium	Minor	Moderate	Moderate
High	Moderate	Major	Major

Table 27.12 addresses the potential socio-economic impacts identified, their sources, significance ratings, and mitigation or enhancement measures if required.

Table 27.11 Significance Criteria for Negative Social Impacts

Severity Criteria				Significance Assessment Criteria			
Duration	**Extent**	**Degree of Change**	**Ability to adapt**	**Severity**	**Low likelihood** (Not heard of in mining sector)	**Moderate likelihood** (Has occurred in similar projects)	**High likelihood** (Has occurred in Australia)
Short-term	Individual/ Household	Inconvenience caused but with no consequence on long-term livelihoods or quality of life.	Those affected will be able to adapt to the changes with relative ease, and maintain pre-impact livelihood.	Minor	Minor	Minor	Minor
Medium-term	Small number of households	Primary and secondary impacts on livelihood and quality of life.	Those affected will be able to adapt to changes, with some difficulty, and maintain pre-impact livelihood, but only with a degree of support.	Moderate	Minor	Moderate	Moderate
Long-term/ irreversible	Large part of/full settlement	Widespread and diverse primary and secondary impacts likely to be impossible to reverse or compensate for.	Those affected will not be able to adapt to changes and continue to maintain pre-impact livelihood.	Major	Moderate	Major	Major

Table 27.12 Potential Impacts and Recommended Mitigation Measures

Impact	Source and Description of Impact	Impact Rating Prior to Mitigation/ Enhancement	Recommended Mitigation/Enhancement	Impact Rating after Mitigation
Increased population impacts on social infrastructure and services	Source: ▪ Increase in population (workforce) ▪ Increase in demand and usage of social infrastructure and services in local and regional area Vulnerability: ▪ Capacity of social infrastructure in local and regional area ▪ Capacity of health and community services in local and regional area Receptors: ▪ Local residents ▪ NRE employees and their families ▪ Local agencies ▪ Local service providers	Minor	▪ Majority of employees will likely be sourced/commute from major urban areas including greater Wollongong, and therefore it is predicted there will be sufficient capacity in the existing local services to accommodate the minor changes resulting from the proposal ▪ NRE continue to implement management programs that contribute to the social and economic aspects of the community – supporting suitable community development programs	Positive
Increased economic activity	Source: ▪ Direct employment with Project– total at peak operations 421 employees; ▪ Indirect and induced employment via increased demand for local services and infrastructure; and ▪ Direct Project expenditure in the local and regional area for goods and services Gain: ▪ Increased job opportunities in local and regional area; ▪ Increased skilled workforce; ▪ Increased opportunity for higher wages; and ▪ Increased demand for a diverse range of skills.	Moderate	▪ Procure local goods and services ▪ Employ local and regional workers	Positive

Impact	Source and Description of Impact	Impact Rating Prior to Mitigation/ Enhancement	Recommended Mitigation/Enhancement	Impact Rating after Mitigation
	Receptors: ▪ Local residents who become employees; ▪ Broader regional residents who become employees; and ▪ Local businesses that provide goods or services to the Project			
Impacts to property values	Source: ▪ Visual ▪ Noise ▪ Traffic Vulnerability: ▪ Impact and perceived impact on property values Receptors: ▪ Local residents in immediate vicinity of Colliery and haul route ▪ Property developers ▪ Property owners	Minor	▪ Colliery has been in place for over 100 years and the Project will result in improved environmental efficiency including: ▪ air quality – the highest predicted 24 hour incremental ground level concentrations of PM10 is 12.27 µg/m^3. This is an improvement of 47% from Stage 1. ▪ Predicted traffic and site noise will comply with relevant criteria with the exception of minor exceedances of less than 2 dB(A) which may occur at some receivers during the evening period ▪ There will be an increase in traffic on Bellambi Lane NRE will implement additional dust management at source	Minor
Increase in existing noise levels	Source: ▪ Operational infrastructure and surface facilities including coal load out facility, pit top infrastructure ▪ Road haulage. Vulnerability: ▪ Ongoing operational noise ▪ Ongoing haulage noise ▪ Sleep disturbance	Moderate	▪ Predicted traffic and site noise will comply with relevant criteria with the exception of minor exceedances of less than 2 dB(A) which may occur at some receivers during the evening period ▪ Noise barriers are proposed to better manage noise emanating from the site	Minor

Impact	Source and Description of Impact	Impact Rating Prior to Mitigation/ Enhancement	Recommended Mitigation/Enhancement	Impact Rating after Mitigation
	Receptors ▪ Local residents in immediate vicinity of Colliery and haul route ▪ Local businesses			
Increase in existing dust levels	Source: ▪ Operational infrastructure and surface facilities including coal load out facility, pit top infrastructure ▪ Road haulage Vulnerability: ▪ Ongoing dust ▪ Ongoing haulage dust Receptors ▪ Local residents (particularly those adjacent to Bellambi Lane) ▪ Local businesses	Moderate	▪ Modelling indicates that the proposed surface works including new truck load out and stockpile facilities will result in improved air quality ▪ New conveyors will be covered. ▪ Water sprays will continue to be used on the stockpile ▪ Trucks will be covered before leaving the site ▪ Trucks will be washed prior to leaving the site ▪ Investigating all opportunities to control dust and its related issues with truck movements	Minor
Increase in road haulage levels	Source: ▪ Traffic to and from the mine, (employees, visitors, suppliers, deliveries, contractors, maintenance) ▪ Road haulage Vulnerability: ▪ Increasing truck numbers on roads ▪ Ongoing traffic noise ▪ Road safety Receptors: ▪ Road users (Bellambi Lane and Northern Distributor) ▪ Local Business ▪ Local residents adjacent to Bellambi Lane	Moderate	▪ NRE will continue to enforce driver code of conduct in conjunction with Brindles ▪ Trucking fleet will be progressively upgraded ▪ Trucks will be covered before leaving the site	Moderate

Impact	Source and Description of Impact	Impact Rating Prior to Mitigation/ Enhancement	Recommended Mitigation/Enhancement	Impact Rating after Mitigation
Decrease in water quality and containment	Source: ▪ Potential for uncontrolled discharges to Bellambi Gully Creek Vulnerability: ▪ Capacity of creek to handle flooding events ▪ Water quality impacts down stream Receptors: ▪ Local residence (adjacent to Bellambi Gully) ▪ Local waterways	Moderate	▪ Construction Environmental Management Plan (CEMP) will be implemented ▪ Construction of the new Bellambi Gully Creek channel (Stage 1) will improve flood management	Minor

27.6 *CONCLUSION*

The Local Community is characterised as mostly family households with moderate income. Unemployment levels in Wollongong have historically been higher than other areas of NSW. In 2006 one of the most common occupations in the Wollongong work force was Technicians or Trades Workers, which would include the employees of the mines in the Illawarra. The Project is expected to have a positive impact on the Wollongong work force through continuing the current employment of 368 employees and increasing employment with an additional 53 individual employees to total 421 employees.

A number of perceived and actual negative social and economic impacts will occur as a result of the Project, and will be managed by a range of prevention and, mitigation processes. These impacts may include the following:

- potential noise associated with site operations and coal haulage which will be managed by construction of additional noise barriers and continuing noise monitoring;
- potential safety issues associated with increase traffic flows on the local road network associated coal haulage trucks which will be managed through enforcing a driver code of conduct; and
- potential dust impacts associated with coal haulage to be managed by truck washing, improved load out facilities and improved dust controls on conveyors and stockpile facilities.

The Project will have positive social impacts to the local area including:

- potential expansion of businesses with increased local spending on goods and services;
- ensuring ongoing employment in the mining sector across NRE operations in the Illawarra;
- significant flow-on effects into the local, regional, state and national economy;
- improved environmental efficiencies including improved air quality, noise and site management; and
- maintaining contribution to community development and ongoing opportunities for NRE to identify and support community development programs in the local and regional community.

28 *ECONOMIC ASSESSMENT*

This chapter provides an overview of the financial indicators for Wollongong and assesses the economic impacts of the Project.

28.1 *INTRODUCTION*

The Project will continue to generate economic benefits to the regional, state and national economies through the extraction, handling and sale of coal. The assessment compares the 'without Project' situation against the 'with Project' situation. As the Project would extend existing mining activities, the 'without Project' situation is defined as the case where the mining activities are not extended and thus the current operation would cease. This would lead to mine closure and job losses and to project-related investments not being realised. The 'with Project' situation assumes that all investments and operations will go ahead as currently planned over the extended lifespan of the Project (up to 18 years).

The Project is expected to reach full production capacity of 3 Mtpa by 2014 and extract a total of 46mt. Employment for the Project will increase to 421 full-time equivalent employees from 2012 onwards.

The 'upstream' economic benefits of the Project are accrued where the Project expenditure is incurred, at both the regional and national level. The upstream benefits accrue to the local workforce, contractors and suppliers that provide goods and services to the Project. The 'downstream' benefits are realised where the coal is used. In this case, the coal is sold to the export market and so downstream benefits that accrue to the Australian economy are limited to the foreign exchange revenues earned. In addition, royalties are paid to the New South Wales (NSW) government.

The economic assessment presented in this section provides an indication of the economic impact of the Project, including the direct benefits due to expenditure and employment and the broader flow-on benefits to the economy.

28.1.1 *Methodology*

The economic impacts of the proposed mining operations on the regional and national economies are estimated based on data from the financial analysis provided by NRE and the socio-economic data of the region discussed in *Chapter 19*. The assessment also makes use of regional and macro-economic information from the economic impact assessment of the Bulli seam Operations (Gillespie Economics, 2009), as this Project is carried out in the same area, and hence for some topics the same data and analysis applies.

Broadly, the net economic benefit of the Project can be assessed as the value of the extracted coal less the cost incurred in realising this value. The value of the coal can be measured as the revenue generated from coal sales[1]. The cost incurred, in economic terms, is the loss of the resources due to use by the Project.

[1] The market value of coal is taken as a valid proxy of the economic value of coal.

The economic value of these resources is their opportunity cost, or the value that would have been generated from using the resources in the next-best alternative (the opportunity for which is now lost). The opportunity cost of extracting the coal is the value of the coal if left in the ground for future use (the Project does not create the coal, only extracts it).

The economic indicators used to assess the economic impacts of the Project are:

- Net Present Value;
- direct and indirect economic benefits due to economic expenditure;
- direct and indirect employment creation; and
- government revenues.

28.1.2 *Net Present Value*

The Project is expected to generate additional revenue from coal sales of over $362 million (m) per year at full capacity[2]. Over the 18-year lifespan of the Project, total additional revenue will be $4,961m, equivalent to a total of $2,504m in present value terms[3].

The value of output is a gross term and does not account for the costs of producing the output. Net Present Value (NPV) is a measure of the net economic benefits to the economy or society and can be calculated by deducting the present value of the costs from the present value of output. Costs in this case are the costs of the coal, the costs of extracting the coal and the costs of bringing it to the market. This includes the costs of all the materials and services consumed by the Project. Royalty payments are used as a proxy for the value of the coal[4].

Levy payments, such as the Mine Subsidence Levy and the Rescue Station Levy, are used as proxies for the costs of mine subsidence and rescue services. Company and payroll tax has not been deducted. The NPV is thus estimated to be $609 million over the lifespan of the Project.

This is an estimation of *financial* NPV as it includes only *financial* costs and benefits rather than all the *economic* costs and benefits of the Project. A robust, detailed calculation of *economic* NPV (rather than *financial* NPV) requires assessment of the economic value of the coal output and the economic or opportunity costs of the resources used by the Project (particularly coal).

Value Added can be used as an indicator of what the Project contributes to the Gross Domestic Product. Value Added can be defined as the value of a product minus the costs

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[2] A $A/$US exchange rate of 0.85 is assumed.

[3] The New South Wales Treasury directs use of a 7% real discount rate in economic appraisal (NSW Treasury, 2007).

[4] Note that the project does not create the coal but merely extracts it and brings it to market.

of all materials and services consumed to make the product and bring it to market. In this case, Value Added in present value terms is the same as financial NPV estimated above.

28.1.3 *Direct Economic Benefits Due to Project Expenditure*

Expenditure by the Project

Another measure of the value of the Project to the Australian economy (upstream) is the sum of the net economic benefits of all the transactions that occurred in extracting the coal and bringing it to market (upstream transactions). Direct economic impacts arise from Project spending on salaries for employees and purchases of materials, equipment and services from suppliers. A measure of the upstream direct net economic benefit of the Project is the sum of the value of all the economic transactions generated by the Project. Analysing the expenditures of the Project also allows assessment of to whom and where in the economy the economic benefits accrue.

Expenditure of the Project includes:

- capital expenditure on materials, equipment, machinery and contractors;
- operational expenditure;
  - salaries to employees;
  - payments to suppliers of operational inputs and materials; and
  - payments to consultants and contractors, including transport providers and Port Kembla.

The Project will require some capital expenditure to extend the lifetime of the existing mining assets and to develop the new areas. These costs will be incurred between 2010 and 2013. No land purchases are proposed for the extension of the underground operations.

In addition, a small amount of ongoing capital expenditure would be required each year for maintenance. In total, capital expenditure accounts for 19% of total costs over the lifetime of the Project (excluding taxes, royalties and contributions).

The remaining 81% of costs are operating expenses, comprising mainly salaries and payments to suppliers (*Table 28.1*). The largest portion of payments to contractors is aligned with trucking services and coal management at the Port Kembla Coal Terminal (PKTC).

Table 28.1 Expenditure breakdown

Category	Percentage of total Costs[1]
Capital expenditure	19%
Operating costs	81%
Salaries	39%
Payments to suppliers	26%
Payments to contractors (incl. transport and port)	17%

1. Total costs excluding community contributions, taxes and royalties.

The Regional Economy

The impacts on the regional, State and national economies depends on the location of the employees, suppliers and contractors. The regional economy in this case is defined as the Wollongong, Shellharbour, Kiama, Wollondilly and Wingecarribee local government areas (LGAs) around the Project site where almost all employees reside (*Table 28.2*). Thus, the regional economy is mostly in the Illawarra Statistical Division (SD), but also partly in the Outer South Western Sydney (OSWS) Statistical Subdivision (SSD).

Table 28.2 Residential Location of Employees

Statistical Division/ Sub-division	LGA	%
Illawarra SD	Wollongong	67%
	Shellharbour	13%
	Kiama	5%
	Wingecarribee	5%
OSWS SSD	Wollondilly	9%

The discounted payments made by the Project over the 18-year lifespan of the Project and average annual payments by area have been estimated by NRE based on historical patterns and forecasts. Based on the location of suppliers and contractors, it is estimated that 66% of total Project expenditure will occur in the regional economy and a further 25% will occur in the broader NSW economy.

Of the projected 421 Project employees, 99% are expected to reside regionally (based on residence of current employees), therefore almost all salaries are expected to be paid into the regional economy. Salaries comprise 58% of payments into the regional economy (*Table 28.3*).

Over the lifespan of the Project, the total discounted direct economic impact is estimated to be $1,638m, of which $1,083m will be to the regional economy, equivalent to an average of $60m per year.

Table 28.3 Regional, State and National impacts (present values)[1]

Economy	Payment	% payment type	Annual average ($m)	Total lifetime ($m)	% of payment to economy
Regional	**Total**	**66%**	**60**	**1,083**	
	Capex	40%	7	126	12%
	Salaries	99%	35	627	58%
	Suppliers	20%	5	84	8%
	Contractors	91%	14	247	23%
NSW	**Total**	**91%**	**82**	**1,483**	
	Capex	65%	11	206	14%
	Salaries	100%	35	633	43%
	Suppliers	90%	21	377	25%
	Contractors	99%	15	268	18%
Australia	**Total**	**96%**	**87**	**1,565**	
	Capex	77%	14	243	16%
	Salaries	100%	35	633	40%
	Suppliers	100%	23	419	27%
	Contractors	100%	15	270	17%
Overseas	**Total**	**4%**	**4**	**73**	
	Capex	23%	4	73	100%

Economy	Payment	% payment type	Annual average ($m)	Total lifetime ($m)	% of payment to economy
Total	**Total**		**91**	**1,638**	
	Capex		18	316	19%
	Salaries		35	633	39%
	Suppliers		23	419	26%
	Contractors		15	270	16%

1. Excludes community contributions, royalties and taxes.

Impacts on Household Income

The Project will have a significant direct impact on household income because a large proportion of the above direct economic impact relates to salary payments (35%). The majority of impacts on household income will be in the regional economy, as almost all employees (99%) reside in the region. Approximately 67% of salaries will be paid into the Wollongong LGA (*Table 28.3*). In total, the Project will pay $633m in salaries (present value).

In addition, NRE will pay $419m to suppliers and $270m to contactors, a proportion of which will also be transferred as employee compensation. Much of these incomes will in turn be spent in the regional economy. (The indirect impacts on salaries and household income are assessed below).

The proposed Project will also have other direct impacts on the regional economy. These impacts will derive from expenditure on training for apprentices estimated at approximately $200,000 per year. Such training will help address skill shortages emerging in the mining sector and to improve the employment opportunities of local job-seekers. The expenditure on training has been included in salaries for the above assessment of economic impact but the economic value of the training is estimated to be far greater than the nominal expenditure.

In addition, the Project plans to continue their annual contributions to the community through direct funding of local initiatives. Over the lifetime of the Project, NRE is expected to contribute $3.5m to local communities (in discounted, present value terms). These contributions have not been included in the above assessment of economic impacts.

28.1.4 *Indirect Economic Benefits Due To Expenditure*

Multiplier Effects

In addition to the direct economic benefits of the Project estimated above, the Project will also generate indirect economic benefits. Multipliers are standard economic tools used to estimate the flow-on effects of income, expenditure and employment of a proposed increase in investment or production. Direct benefits to the economy are multiplied because the initial activity requires the purchase of goods, labour and other services and these purchases in turn generate further flow-on expenditure. The effect diminishes with each round of investment and expenditure until a final increase in the economic benefits can be calculated. The 'multiplier' is the ratio of the value of the final impact across the economy to the initial investment.

Several agencies and research organisations have estimated multipliers that apply for different industries. Multipliers can also be estimated for impacts on a local, regional or

national economy. The higher proportion of goods and services imported from outside a region will reduce a regional multiplier. A recent study concluded that mining is one of the industries in the Illawarra SD with the greatest income and employment economic multipliers (IRS, 2009).

This assessment uses multipliers estimated for the Bulli Seam Operations Economic Assessment (August, 2009) conducted by Gillespie Economics for Illawarra Coal. The Bulli Seam Study was conducted for a very similar (though larger) coal mining operation in the same region of NSW. The Bulli Seam Study used input-output analysis to estimate multipliers and assess the indirect impacts on the regional economy[5].

Both economic output multipliers and employment multipliers have been used in this assessment (Type IIA multipliers). Output multipliers are applied to estimate the flow-on, indirect economic benefits generated by the direct expenditure on the goods, services and labour needed for the Project. The output multiplier is disaggregated to show a separate 'value added' multiplier and a separate income multiplier that is used to estimate the flow-on effects due to increased wages and salaries as a result of expenditure by the Project. The employment multipliers use similar rationale to estimate the indirect generation of employment throughout the regional economy due to the Project.

Note: The estimation of indirect economic impacts using multipliers has several assumptions and limitations. In particular, the multipliers used in this assessment were transferred from another recent study and were developed specifically for a different, though very similar, project. Point estimates should be thought of as sitting within a range of possible values.

Impacts on the Regional Economy

Based on the above analysis of direct output and expenditure by the Project and the estimated economic multipliers, the Project is expected to increase regional output by $3,631m and regional incomes by $1,981m in present value terms over the 18-year lifespan (*Table 28.4*).

Table 28.4 Direct and Indirect Impact on the Regional Economy[1]

Multiplier ($m)	Direct effect	Indirect, Flow-on Effect	Total Effect
Output	$2,504	$1,127	$3,631
Multiplier	*1*	*0.45*	*1.45*
Income	$627	$1,354	$1,981
Multiplier	*1*	*2.16*	*3.16*
Employment	409	1,727	2,137
Multiplier	*1*	*4.22*	*5.22*

1. Note that the multipliers are based on the Gillespie Economics (2009) analysis which was specific for the expenditure patterns etc of that particular project. As such, the estimates in this assessment are considered approximations only but are considered valid due to the broad similarities between the Gillespie Economics (2009) and the proposed Project.

[5] Gillespie Economics (2009) developed an input-output table of the regional economy (Illawarra SD and OSWS SSD) using the Generation of Input-Output Tables (GRIT) procedure and a 2005-06 NSW input-output table (developed by Monash University) as the parent table.

Based on an average annual employment in the region of 409 full-time equivalent employees (FTEs), the Project is expected to increase regional employment by 2,137 FTEs. The multiplier effect on employment includes flow-on employment due to expenditure on suppliers and contractors, including trucking and coal terminal services. The impacts on employment are particularly valuable given the current relatively high and increasing unemployment rate in the region (IRIS, 2009).

Impacts on the NSW Economy

Impacts of the Project on the broader NSW economy will be even greater in absolute terms as a greater proportion of the mine expenditure and household expenditure is captured. It is estimated that the Project will increase output by $4,933m and value added by $1,054m in the NSW economy over the 18-year lifespan of the Project (*Table 28.5*).

Table 28.5 Direct and Indirect Impact on the NSW Economy

Multiplier ($m)	Direct effect	Indirect, Flow-on Effect	Total Effect
Output	$2,504	$2,429	$4,933
Multiplier	*1*	*0.97*	*1.97*
Value Added	$609	$445	$1,054
Multiplier	*1*	*0.73*	*1.73*
Income	$633	$2,830	$3,463
Multiplier	*1*	*4.47*	*5.47*
Employment	413	3,382	3,795
Multiplier	*1*	*8.18*	*9.18*

Sectors Impacted

Gillespie Economics (2009) found that the sectors most impacted by output, value-added and income flow-ons are likely to be the services to mining sector, other property services sector, legal, accounting, marketing and business sector, road transport sector, wholesale and retail trade sector, scientific research, technical and computer services sector, other business services sector and accommodation, cafes and restaurants sector.

Employment impacts are also likely to be felt across a number of sectors including the mining sectors, transport sectors, manufacturing sectors, wholesale and retail trade sectors, accommodation, cafes and restaurants sectors and services sectors (education, health, community services and personal services) (Gillespie Economics (2009).

28.1.5 *Downstream Impacts*

The above assessments have estimated the economic impact of the upstream impacts of the Project. In this case, the coal is destined for the export market and so will not be used in Australia. As such, the economic value of the downstream or forward linkages of the Project is limited to the generation of foreign exchange for Australia.

Over the 18-year lifespan of the Project, total additional undiscounted revenue will be $4,961m of which only $90m will be spent overseas on imports as part of capital expenditure (net foreign exchange revenue of $4,871m)[6].

28.1.6 *Impacts on Government Revenues*

Royalty payments were deducted from calculations of value added and NPV of the Project as they are considered a proxy for the value of the coal extracted. However, royalties and taxes are not included in the above assessment of economic impacts of the Project due to expenditure. Unlike expenditures paid to other industries, in return for the direct production of goods or delivery of a specific service, there is no clear product or service that is produced because of the royalties or taxes. However, taxes and royalty payments are an important contribution of the Project to government finances and will contribute to further direct and indirect economic impacts in the economy.

The Project will directly contribute a total of $576m (discounted) to Commonwealth and State government revenues over the lifespan between 2011 and 2029 (*Table 28.6*). These royalty and tax payments can be considered as a payment for the use of public resources (coal), infrastructure and government services. Due to multiplier effects, the total impact on government revenue due to the Project will be much greater than the direct impacts alone.

Table 28.6 Government Revenue[1]

Government	Tax	Total discounted payment ($m)
Commonwealth	Company Tax, Import Duties, Payroll Tax	$318
NSW	Royalties	$250
	Rescue Station, Mine Subsidence and ACARP Levies	$7
Total		$576

1. Approximately $3.3m in import duties is not included here but rather is included as part of overseas Capex.

28.2 *EXTERNAL COSTS*

The above assessment does not include an analysis of externalities, which are those economic costs and benefits that are external to the market and thus do not have a direct market value.

Externalities include the costs or benefits arising from any environmental and social impacts, which are discussed in the other sections of this report.

The evaluation of the economic impact due to externalities is beyond the scope of this assessment. However, it is noted that the economic costs of subsidence are potentially significant for mining operations of this type. In this case, the economic costs of subsidence of this Project are expected to be minimal.

[6] This does not deduct any other payments overseas such as interest on foreign loans or dividends to foreign shareholders or indirect payments, such as payments by suppliers for imports.

Subsidence is expected to be minimal as the mine is mostly located under the Sydney water catchment which has limited economic assets that could be damaged by subsidence. The Project will be paying a subsidence levy in accordance with government regulations to offset potential subsidence costs and these have been incorporated in the calculation of NPV above as a proxy for the economic cost of subsidence. Other significant external costs include the emission of greenhouse gases (GHGs) and rehabilitation of the site. GHG emissions of the Project are discussed in the *Chapter 11* and rehabilitation is discussed in *Chapter 16*.

28.3 *CONCLUSION*

The proposed Project is an extension of an existing coal mining operation that will extend the life of the current operations by 18 years. Without the Project, the current operations will cease and the output of the mine and jobs created by the mine will be lost.

Compared to the 'No Project scenario, the Project will have a significant positive economic impact on the economy. Over the 18-year lifespan, in present value terms, it is estimated that the Project will generate an additional:

- NPV of $609 million (m);
- expenditure of $1,638m, of which $1,083m will be to the regional economy, (equivalent to an average of $60m per year);
- total direct and indirect regional economic impact of $3,631m on total output, $1,981m on incomes;
- 409 regional jobs per year and indirect creation of a total of 2,137 regional jobs;
- $576m to Government revenues; and
- foreign exchange revenue of $4,961m (undiscounted).

29 *DRAFT STATEMENT OF COMMITMENTS*

This chapter provides a summary of the major commitments of NRE for the Project.

29.1 *INTRODUCTION*

The following Draft Statement of Commitments has been prepared in accordance with the DGRs and Part 3A of the EP&A Act. These commitments outline the management, mitigation and monitoring measures to be adhered to by NRE throughout the development and operation of the Project to manage potential adverse environmental impacts that may arise.

NRE have developed a suite of management and monitoring plans to address environmental impacts at the surface facilities and subsidence effects, impacts and consequences in Wonga East. These plans have been approved by the relevant agencies and include:

- NRE No.1 Colliery Longwall 4 and 5 Subsidence Monitoring Plan;
- NRE No.1 Colliery Longwall 4 and 5 Biodiversity Management Plan;
- NRE No.1 Colliery Longwall 4 and 5 Water Management Plan;
- NRE No.1 Colliery Longwall 4 and 5 Heritage Management Plan;
- NRE No.1 Colliery Longwall 4 and 5 Public Safety Management Plan;
- NRE No.1 Colliery Longwall 4 and 5 Built Features Management Plan;
- NRE No.1 Colliery Longwall 4 and 5 Electricity Transmission Lines Management Plan;
- NRE No.1 Colliery Heritage Management Plan;
- NRE No.1 Colliery Air Quality and Green House Gas Management Plan
- NRE No.1 Colliery Traffic Management Plan; and
- NRE No.1 Colliery Noise Management Plan.

NRE are committed to updating these plans in consultation with the appropriate regulatory authorities to address the effects, impacts and consequences of the Project. The Draft Statements of Commitments in *Table 29.1* identifies the proposed measures to be incorporated in the listed management plans.

Table 29.1 Draft Statement of Commitments

Outcome	Commitment	Timing
Statutory Requirements		
Compliance with all conditional requirements in all approvals, licences and leases.	• The development will be carried out as outlined in: • this Environmental Assessment Report (EA); • Project Approval; • Environment Protection Licence; • Subsidence Management Plans (SMPs); • Mining Lease(s) conditions; • Controlled Activity Approval; and • any other required approvals, licences or leases.	Continuous and as required.
All operations conducted in accordance with all relevant documentation.	• Undertake all activities in accordance with the accepted Mining Operations Plan; environmental procedures; safety management plan and/or site-specific documentation in force at that time.	Continuous and as required.
Stakeholder Consultation		
Effective communication/ consultation is undertaken throughout construction and operation of the Project.	• Conduct regular community liaison meetings and provide regular updates to the community both during construction and operation of the Project.	Prior to construction and at regular intervals of not less than twice a year during operation of the Project.
	• NRE will continue to provide support and funding to local community groups.	Ongoing.
Risk		
Bush fire risk will be managed by existing response procedures and on-site fire fighting water and equipment.	• Bush fire management measures will continue throughout the Project and include: • slashing/landscaping/vegetation management to minimise fuel build-up; • maintenance of fire breaks; • ongoing communication with the NSW Rural Fire Service; and • site fire fighting equipment and emergency response procedures.	Ongoing.
Public safety is a matter of regular consideration given the close proximity of the Russell Vale site to local residential areas.	Steps taken to ensure public safety will include: • signage around the site to inform the public of the dangers of entering the site. Signs are to be replaced if removed or damaged; • maintenance of boundary fences particularly adjacent to residential areas;	Ongoing.

Outcome	Commitment	Timing
	• random mobile patrols (by a private security company) of the site and some adjacent streets, covering after hours, weekend and public holiday periods; • locked access gates after hours; • installation of camera surveillance facilities at both the Russell Vale and No.4 shaft sites; • sealing or locking off entrances to portals where possible; • ensuring all truck drivers obey the road rules through implementation of a driver code of conduct; and • limiting the speed of trucks entering and leaving the site.	
Subsidence Potential adverse impacts from subsidence are managed, monitored and remediated where necessary.	• Implement a subsidence monitoring program and management plan that includes , but may not be limited to: • appropriate triggers and monitoring systems to demonstrate how management strategies have been achieved and where improvements can be made before, during and after mining; • a set of pre-determined triggers; • responses and actions that flow from each trigger. • adaptive management processes for continually detecting impacts and, validating predictions; • contingency planning for any unpredicted impacts; and • remediation of unpredicted impacts.	Prior to mining and ongoing.
	• Ground movements will be monitored as mining occurs, to measure the extent to which the actual movements may differ from those predicted. Any predicted impacts will be periodically reviewed in the light of additional data.	Prior to mining and ongoing.
	• An ongoing surface water monitoring and remediation program will be developed in consultation with the SCA, DRE and OEH.	Prior to mining and ongoing.
	• A Built Features Management Plan (BFMP) will be developed, in consultation with infrastructure owners such as RTA to manage impacts due to mining, if any, to the RTA infrastructure identified through a risk management assessment.	Prior to mining and ongoing.
	• For areas where the standing pillars in the Bulli seam are present under and within 100 m of Mount Ousley Road, subsidence will be monitored to assist in locating the finish line of the longwall panels.	Prior to mining and ongoing.
	• The specific longwall layout along with the start and end lines of applicable longwalls will be altered in the event that minimal subsidence impact cannot be demonstrated prior to secondary extraction under Cataract Creek.	Prior to mining and ongoing.

Outcome	Commitment	Timing
Soil and Water Construction and operations are managed such that adverse impacts to water quality and flows in Bellambi Gully Creek and the impact to surrounding residents is prevented or minimised.	• Dirty stormwater and mine water (up to the design standard) will be treated on site prior to discharge.	Continuous and as required.
	• Dirty stormwater from hard surfaces will be diverted into the SWCD. Water will be held in the SWCD to reduce solids prior to treatment and then discharging via LDP2.	Continuous and as required.
	• The stormwater control dam (SWCD) will be kept at a level that allows 30 ML of stormwater to be captured on site, reducing the flow and flood potential downstream.	Continuous and as required.
	• Chemicals will be properly stored and bunded. Dosing of flocculent will be metered and monitored on site. • Monitoring and dosing of flocculent will be audited.	Continuous and as required.

	• Preparation of a Construction Management Plan that includes the following:
	  • a dry and wet basin arrangement to minimise sediment transportation to the stormwater dam;
	  • works likely to contribute to erosion will not take place during heavy rainfall;
	  • stripping of topsoil, where available, immediately before starting bulk earthworks to be used for rehabilitation or revegetation works on site;
	  • suitable areas for any temporary stockpiling of excavated soil (on flat ground) will be clearly identified and delineated before the commencement of works;
	  • ensure stockpiles are:
	  • constructed on the contour at least 2 (preferably 5) metres from hazard areas, particularly areas of concentrated water flows or slopes steeper than 10 percent;
	  • stabilised if they are to be in place for more than 10 days. The stockpile of VENM excavated from the construction of the bypass channel will be grassed;
	  • protected from run-on water by installing water diversions upslope; and
	  • installed with sediment filters immediately downslope to protect other lands and waterways from pollution.
		Prior to construction.

	• Erosion, sediment control and runoff diversion measures will be established before any excavation begins. These will be left in place throughout works execution and beyond works completion until all surfaces have been fully restored and stabilised.	Prior to construction and for the duration of construction.
	• At Russell Vale site, solids will be mechanically dewatered and returned to the ROM coal product as appropriate or removed from site.	Continuous and as required.
	• A new 6 ML storage dam will be constructed at Russell Vale to collect run off from stockpile area.	Within 12 months of approval.

Outcome	Commitment	Timing
	• A water efficiency audit will be undertaken to identify ways to reduce water usage at the colliery.	Within 12 months of completion of surface works.

Surface Water
Operations are managed such that adverse impacts to catchment surface water are prevented or minimised.
	• Development and implementation of a monitoring program in liaison with SCA, OEH and NoW and to the approval of DP&I including:
	  • daily automated monitoring of selected pool water depths upstream, within and downstream of the 20mm subsidence zone. Monitoring will assess the inputs from catchment runoff and any flow variations within the Project Area before, during and after extraction;
	  • water quality monitoring in the Cataract River upstream of Cataract Reservoir, and Wallandoola, Lizard and Cataract Creeks upstream, within and downstream of the mining area, before, during and after mining;
	  • water quality field studies including regular visits to main channel sites to monitor for all key water quality parameter variations for the duration of mining and for an appropriate period following mining;
	  • visual monitoring of creek banks, stream gradients and vegetation in the stream and banks before and after any stream is undermined, particularly after significant stream flow events. If adverse impacts due to mining, such as subsidence/uplift, are identified a specific management and rehabilitation plan will be developed for the affected areas;
	  • monitoring of the integrity and overland flow of the waterfalls and rockbars will be undertaken, along with specific subsidence measurements to indicate any adverse effects to waterfalls and rockbars. Should monitoring identify any significant adverse impacts, appropriate adaptive management measures will be developed and implemented;
	  • monitoring of mine inflows through measurement of all water pumped, where practicable, into and out of the mine workings;
	  • rainfall monitored daily at the mine's weather station; and
	  • the quantity and variability of stream flow measured in Wallandoola, Lizard and Cataract Creeks by data loggers to assess the rainfall / runoff relationship, with photography used to monitor flow conditions in both the creeks and their unnamed tributaries.
		Prior to, during and after mining.

	• An end of panel report, will be prepared for each mined panel, to summarise all monitoring over the period and outline any changes in the surface water or groundwater system. • All monitoring and management will be reported in the Annual Environmental Management Report (AEMR), or its equivalent, in subsequent years. • All results will be reviewed one year after each panel has been completed and an updated ongoing monitoring and remediation program will be developed in consultation with the SCA, DRE, and NoW.	Post mining of each panel.

Outcome	Commitment	Timing
	• Precautionary and adaptive management procedures will be implemented to provide a systematic process for continually detecting impacts, validating predictions and improving mining operations to prevent adverse impacts on the streams systems overlying the proposed mining domains.	Prior to and during mining.

	• A Stream Management Contingency Plan will be prepared to:
	  • formulate intervention trigger levels for a range of physical and chemical parameters;
	  • provide further details on the adaptive management process;
	  • provide a range of applicable management measures;
	  • provide a range of applicable rehabilitation measures;
	  • clarify any further approvals that might be required for such management or rehabilitation; and
	  • set out the consultation, reporting and approval process.
		Prior to mining.

	• Contingency measures will be developed in consideration of the specific circumstances of the exceedance and the assessment of environmental consequence. Potential contingency measures for an exceedance of the water resource or watercourse performance measures could include, if appropriate;
	  • additional monitoring that increases the monitoring frequency or additional sampling to inform the proposed contingency measures;
	  • implementation of stream remediation measures to reduce the extent of fracturing;
	  • implementation of revegetation measures to remediate impacts of gas releases on riparian vegetation;
	  • provision of a suitable offset(s) to compensate for the reduction in the quantity of water resources reaching Cataract Reservoir or Cataract River; or
	  • implementation of adaptive management measures, such as reducing the thickness of the coal seam extracted, narrowing of the longwall panels and/or increasing the setback of the longwalls from the affected area.
		If required.

Groundwater
Operations are managed such that adverse impacts to local and regional groundwater resources are prevented or minimised.
	• Prepare and implement a monitoring program including:
	  • installation of a suite of shallow piezometers within upland swamps;
	  • automatic measurement of standing water levels, twice daily by pressure transducers and at least bi-monthly by manual dip meter;
	  • collection of at least one sample from each piezometer pre and post undermining to enable ongoing assessment of any subsidence related changes in groundwater quality; and
	  • daily monitoring of mine inflows through measurement of all water pumped into and out of the NRE No. 1 workings to enable the differential groundwater seepage into the workings to be assessed.
		Ongoing during mining and for 12 months after mining has ceased.

Outcome	Commitment	Timing
	• Groundwater samples to be collected at the start and finish of each panel from piezometers either adjacent to an active panel, or within an active mining area, and analysed at a NATA registered laboratory for major ions and selected metals. Piezometers not within an active mining area will be sampled and analysed once per year. • Results of the monitoring programs will be reviewed after each panel and one year after longwall extraction has been completed and an updated ongoing monitoring and remediation program will be developed in association with DRE, NOW and the SCA. This will also be reported in the AEMR. • Contingency procedures will be developed as required, with the measures to be developed being dependent on the issue to be addressed.	.
	• The procedures will be used to manage any impacts identified by monitoring that demonstrate the groundwater management strategies may not have adequately predicted or managed the groundwater system's anticipated response to mining. • Performance indicators will be identified prior to extraction of the proposed underground workings and a statistical assessment would be undertaken to detect when, or if, a significant change has occurred in the groundwater system which would benchmark the natural variation in groundwater quality and standing water levels. • A monitoring and management strategy along with an outline of a Trigger Action Response Plan (TARP) will be prepared to provide guidance on the procedures and actions required in regard to the surface water and groundwater systems in the proposed mining area. • An adaptive management plan will be developed to use the monitoring program to detect the need for adjustment to the mining operation so that the subsidence predictions are not exceeded and subsidence impacts creating a risk of negative environmental consequences do not occur.	As required and for 12 months after completion of mining.
	• The potential for surface water and groundwater system hydraulic connectivity will be assessed through monitoring of stream flows in and near actively mined areas as well as through monitoring and interpretation of the basement groundwater open standpipe and vibrating wire piezometers water levels / pressures and mine inflow changes.	As required and for 12 months after completion of mining.
	• The ground surface over the proposed underground workings will be surveyed in accordance with DRE subsidence monitoring requirements.	As required.
	• An end of panel extraction report will be prepared, which summarises all monitoring over the period. The report will outline any changes in the groundwater and include the following: • a statistical analysis (mean, range, variable, standard deviation) of the results for the parameters measured;	At the end of each panel extraction.

Outcome	Commitment	Timing
	• an interpretation of water quality and standing water level changes supported with graphs or contour plots; and • an interpretation and review of the results in relation to the impact assessment criteria.	
	• Daily rainfall data would be obtained from a local weather station for the duration of mining in the NRE No.1 catchment area.	For the duration of mining.
	• QA/QC would be attained by calibrating all measuring equipment, ensuring that sampling equipment is suitable for the intended purpose, using NATA registered laboratories for chemical analyses and ensuring that site inspections and reporting follow procedures outlined in the ANZECC 2000 Guidelines for Water Quality Monitoring and Reporting.	As required.
Air Quality Operations are managed to minimise potential adverse impacts to the environment, residences and the community.	• The decline conveyor and all new conveyors will be fully enclosed. Consideration will be given to the covering of the other conveyors where practical.	Continuous and as required.
	• Water sprays will continue to be used to minimise dust on an as needs basis.	Continuous and as required.
	• Trucks will be washed, as required.	Continuous and as required.
	• Trucks will be covered before leaving the site.	Continuous and as required.
	• Equipment will be maintained on a regular basis.	Continuous and as required.
	• Opportunities to control dust and dust related issues, regarding truck movements will be investigated.	Continuous and as required.
	• Alternate truck washing arrangements will be investigated to ensure trucks are clean and dry prior to leaving the site.	Continuous and as required.
	• NRE will continue to enforce the Driver's Code of Conduct, through continuing driver education (tool box talks) and regular audits.	Continuous and as required.
Greenhouse Gasses Manage operations such that greenhouse gas emissions on the environment are minimised.	• Energy audits will be held to ensure that the mine is using current practice techniques to minimise energy use and is operating at optimum energy levels.	Continuous.
	• Upgrades to internal surface haulage routes will be undertaken to improve efficiency of on-site operations.	As required.
	• The efficiency of all upgraded mobile and fixed equipment will be considered during procurement for fuel-powered equipment.	Prior to procurement of mobile and fixed equipment.
	• Site management will ensure that equipment is maintained to retain energy efficiency.	Continuous.

Outcome	Commitment	Timing
	• The inventory of emissions developed for this assessment will be updated and maintained.	Continuous and as required.
	• Emissions and abatement strategies will be reported annually as part of internal environmental reporting and National Greenhouse and Energy Reporting System obligations.	Annually.
	• NRE will investigate opportunities to capture and/or use methane.	2015 onwards.
Acoustics Operations are managed to minimise potential adverse impacts on the environment, residences and the community.	• The existing Bulli decline conveyor will be decommissioned and demolished by 31 December 2016 (under Stage 1 Preliminary Works Project).	On completion of the new driveage.
	• Attended noise monitoring will be undertaken upon the commencement of operations to confirm predictions.	Within 12 months of approval.
	• Site equipment to be selected to meet appropriate INP noise goals in accordance with the acoustic design parameters for acoustically significant plant and equipment presented in NRE No. 1 Colliery Preliminary Works Acoustic Assessment.	Prior to operation.

	• An operational Noise Management Plan (NMP) will be developed to specifically address potential noise impacts associated with the proposed operations at the nearest receivers, including road traffic noise. The NMP will outline methods and procedures to manage the following:
	  • results of the regular noise monitoring program on-site and within the surrounding area;
	  • response to any complaints or issues raised by the owner of the affected residence;
	  • noise mitigation measures and operating procedures to ensure compliance with noise goals; and
	  • noise monitoring data from the early stages of Project operations will be utilised to calibrate an operational specific noise model, to refine the potential predicted noise impacts.
		Within 12 months of approval.

	• An operational noise monitoring program will be developed to monitor noise emissions from the proposed operations, including road traffic noise to determine ongoing compliance with PSNLs and to identify any further feasible noise mitigation measures that can be implemented. The monitoring program will be implemented during periods of maximum production to confirm the acoustic performance of the proposed operations.	Following construction, during operational periods of maximum production.
	• The results of the noise monitoring program will be reviewed to assess compliance with the PSNLs and reported in accordance with any requirements of the approval or EPL.	Following each noise monitoring event.
	• Liaising directly with the affected community in respect of the timing and frequency of Peak periods of coal haulage.	Prior to peak coal haulage.

Outcome	Commitment	Timing

Construction activities are managed to minimise potential adverse impacts on the environment, residences and the community.	• A construction NMP will be developed to specifically address potential noise impacts associated with the proposed construction activities. The NMP will outline methods and procedures to manage the following:
	  • response to any complaints or issues raised by the owner of the affected residence; and
	  • noise mitigation measures and operating procedures to ensure compliance with noise goals.
		Prior to commencement of construction.

	• The results of the NMP will be reviewed by the operations manager to assess compliance with the goals and reported in accordance with any requirements of the approval or Environment Protection Licence required for the Project under the POEO Act.	Ongoing.
	• Construction will be limited to Monday to Friday 7:00am to 6:00pm and 8:00am to 1:00pm Saturday unless monitoring shows works to be inaudible at nearby residences.	During construction.
	• All works will be undertaken in accordance with the OEH's Interim Construction Noise Guideline (2009).	Prior to construction.
	• Where feasible, silenced site equipment will be used to minimise environmental noise emissions.	During construction.
	• All residents adjacent to the site will be notified of the start of works.	Prior to construction.
	• Any complaints regarding environmental noise emissions will be logged, investigated and responded to in an appropriate manner.	During construction.
Upland Swamps		
Operations are managed such that adverse impacts to upland swamps are prevented or minimised. Provide best practice environmental monitoring of upland swamps and allow analysis of the nature and extent of mine subsidence impacts, if any.	• The swamp monitoring plan developed for the extraction of A2 LW4 and 5 in Wonga East as part of the Biodiversity Management Plan (Biosis 2012b) and the Subsidence Management Plan Monitoring Program for A2 LW4 and A2 LW5 (Gujarat NRE 2012) will be revised and updated in liaison with SCA, OEH and to the approval of DP&I. • A risk assessment will be incorporated into the Biodiversity Management Plan to demonstrate predicted subsidence to ensure the size and functioning of the swamp, including potential changes in species composition or distribution within the swamp will not be adversely affected and to ensure that water drainage from the swamps will not be adversely affected due to subsidence or be re-distributed to an extent where such potential adverse changes could occur.	Prior to commencement of operations.

	• A monitoring program will be designed and implemented to:
	  • assess the swamp hydrology;
	  • provide advance warning of potential breaches of subsidence predictions;
	  • detection of adverse impacts on a swamp and underlying strata hydrology; and
	  • characterise the relationship between swamp/s and their role in recharging the regional groundwater systems.
		Ongoing during mining and for 12 months after mining has ceased.

Outcome	Commitment	Timing
	• Water levels will be measured automatically, twice daily by pressure transducers and regularly by manual dip meter from a network of shallow piezometers in potentially impacted swamps and reference sites, before and after mining. • Should the standing water level or groundwater quality be unacceptably affected due to subsidence, methods to ameliorate the situation until the water level or water quality recovers will be investigated. • Evaporation and rainfall data will be collected daily.	Prior to, during and for 12 months after mining has ceased.
	• At least one appropriately purged and collected, stored and transported groundwater sample will be collected from each swamp piezometer pre and post undermining to enable ongoing assessment of any subsidence related changes in groundwater quality.	Pre and post undermining.
	• Regular ground monitoring of the surface around swamps, and in swamps where visibility permits, will be undertaken at regular intervals and at least 18 months following mining. Inspection transects will be randomly selected varying at each survey to maximise detection. Inspections will record cracking in rock outcrops, slumping or erosion of soil, changes in flow patterns within the swamps evident as channelization or development of knick points.	Ongoing during mining and for 12 months after mining has ceased.
	• An end of panel (EoP) report, or its equivalent, will be prepared upon completion of each mined panel, to summarise all monitoring over the period. The report will outline any changes in the surface water or groundwater system over the mined out areas. • All monitoring and management activities will be reported in the AEMR, or its equivalent, in subsequent years. • All results will be reviewed one year after each panel has been completed and an updated ongoing monitoring and remediation program will be developed in consultation with the SCA, DRE and NoW.	At the end of each panel extraction.
	• An adaptive management plan will be developed to use the monitoring program to detect the need for adjustment to the mining operations so that the subsidence predictions are not exceeded and subsidence impacts creating a risk of negative environmental consequences do not occur in upland swamps.	As required and for 12 months after completion of mining.
Aquatic Ecology Operations are managed such that adverse impacts to native aquatic habitats are prevented or minimised. Provide best practice environmental monitoring of aquatic ecology	• Observations of aquatic habitats and surveys of aquatic macro invertebrates will be undertaken at impact and control locations in the headwater swamp regions during and after mining. • A survey of aquatic macro invertebrates (at impact and control locations) will be undertaken if the regular water quality monitoring program detects changes in the depth and quality of the water within Wallandoola Creek and Lizard Creek that are greater than anticipated on the basis of the subsidence predictions.	In accordance with a monitoring plan developed in liaison with relevant authorities.

Outcome	Commitment	Timing
and allow analysis of the nature and extent of mine subsidence impacts, if any.	• Ongoing monitoring of water quality, aquatic habitat, macro invertebrates and fish during the same seasons as used for the baseline study.	
To validate the predictions about the consequences of subsidence on aquatic habitats and biota and assess any unexpected impacts on these that may occur	• Additional surveys of aquatic habitats and biota will be undertaken as soon as possible if fractures of the stream bed and associated loss of water from pools or significant changes in pH, dissolved oxygen, turbidity or metal concentrations are detected during routine surface monitoring of the potential impact creeks. If fish or yabby kills are noted during routine surface monitoring, further studies will be undertaken to determine the extent of impact on aquatic ecology and whether there is a need for management/mitigation measures.	As required.
Terrestrial Ecology		
Monitoring to identify subsidence impacts as early as possible and identify any alterations required to the extraction plan.	• Ongoing monitoring of significant sensitive areas will be undertaken in accordance with an EMP. • Additional monitoring for threatened species identified as having a moderate to high likelihood of occurring in the Study Area, and as vulnerable to the impacts of subsidence, will be undertaken annually in seasons appropriate for the detection of each individual species. In particular, potential habitat in areas in which subsidence risk is greatest will be targeted, for example, Heath Frog habitat in WCVFS2, Giant Burrowing Frog in Wallandoola Creek, Large-eared Pied Bat, Eastern Bentwing-bat and Large-footed Myotis surveys in Lizard Creek gorge and associated tributaries. The design of ongoing ecological monitoring will be detailed in the EMP and will be flexible to account for seasonal and inter-annual variation in ecological conditions.	During and after mining.
Appropriate remediation measures are identified if required..	• All remediation works will be controlled and implemented in accordance with an Environmental Management Plan (EMP). • if significant cracking occurs in vegetated areas, then measures such as temporary fencing would be implemented to ensure that fauna are not injured or trapped; and • prior to any remediation works, advice would be sought from an ecologist regarding the potential impacts of such remediation works to plant and animal populations.	As required.
Aboriginal Cultural Heritage		
To provide sites officers with a teaching and learning experience regarding cultural heritage sites	• Additional monitoring and risk assessment will be undertaken in accordance with the Bulli PAC, for sites particularly within the predicted subsidence footprint prior to LW mining relevant Longwalls. • All monitoring and management to be undertaken in accordance with Table 21.10 of the EAR and the monitoring programme will include any Aboriginal objects that may be impacted by mining activities and that the mining footprint for these purposes includes the maximum extent of predicted subsidence.	As required.

Outcome	Commitment	Timing
To provide sites officers with a teaching and learning experience regarding cultural heritage sites	• Open Sites will be relocated where possible. Monitoring will involve visual inspection and update to the AHIMS sites. The women's site will be included in a monitoring program developed in consultation with female elders. • The following shelter sites will be monitored, 52-2-1183, 52-2-1187, 52-2-1198 and 52-2-1225 in the Wonga West Study Area; and 52-3-0311 Wonga East 1 and Wonga East 2 in the Wonga East Study Area. The monitoring program will include archival photographic recording of the three Wonga West sites with high significance (52-2-1183, 52-2-1187 and 52-2-1198) in conjunction with the initial pre-mining monitoring including archival recording including sketch plans of the art and shelter; • A report will be prepared, and a copy given to OEH. The AHIMS site cards will be updated with the information; • If any of the sites show changes during the course of monitoring, additional management and mitigation measures will be determined on a case by case basis by a qualified archaeologist in consultation with an Aboriginal representative; • The balance of the shelters will be relocated if possible and monitored pre and post mining. The AHIMS site cards will be updated as the sites are located; • All monitoring will be undertaken by a qualified archaeologist with the involvement of the Aboriginal community.	Pre mining; three and six months after mining beneath the shelter and post mining.

	• A chance finds protocol will be developed and will outline the need for :
	  • contacting the registered stakeholder groups who participated in fieldwork (Illawarra Local Aboriginal Land Council and D'harawal Knowledge Holders) and have a representative identify the object;
	  • the identification is positive, contacting a qualified archaeologist to record and provide management measures.;
	  • if human skeletal remains are suspected;
	  • surface works would stop in the immediate area of the remains;
	  • the local police and a physical anthropologist or archaeologist would be contacted;
	  • if the remains are determined to be of antiquity and of Indigenous origin; and management and mitigation measures would be drawn up in consultation with the registered stakeholder groups and the archaeologist.
		Pre and post mining.

Outcome	Commitment	Timing
Cliffs and Steep Slopes		
Monitoring to identify subsidence impacts as early as possible and identify any alterations required to the extraction plan.	• Monitoring and adaptive management strategies will be implemented to limit mining impacts on features of special significance; and • To avoid additional impacts to Lizard Creek waterfall and the Wallandoola Creek waterfall a trigger, action, and response plan will developed which limits horizontal movements to low levels in these areas.	During and after mining.
Non-Aboriginal Heritage		
Surface works at the Russell Vale site are managed such that adverse impacts to archaeology are minimised	• A Conservation Management Plan will be prepared for the Project. The plan will reflect the future need of the site as a continuing mine and include procedures to follow for the discovery of unanticipated 'Relics'.	Prior to commencement of construction.
	• No items identified as having heritage value or contributing to the heritage value of the site, will be demolished as part of this Project.	Prior to commencement of construction.
To provide a lasting record of the site	• A photographic recording of the 1887 portal and the site will be undertaken and copies will be lodged with the appropriate Local and State repositories.	Prior to construction.
	• A photographic recording of the site should be undertaken, to Heritage Archival Recording standards, prior to commencement of construction for the Project, to provide a lasting record of the site prior to the new development. Copies of the recording should be lodged with the appropriate Local and State repositories.	Prior to construction.
	• Items of moveable heritage, including historical photos, plans, maps, records and the like will be documented, collated and catalogued. Items of moveable heritage will be retained at their current location onsite and documented including historical photos, plans, maps and records to Heritage Archival Recording standards. A conservator will provide advice regarding the long term storage of the items to maximise their survival. When the item has been appropriately catalogued its will be donated to a suitable repository. Appropriate repositories will be identified prior to Project works commencing.	Prior to construction.
	• No secondary extraction will occur beneath or within a 1km of the Cataract Dam wall.	Ongoing.
Traffic and transport		

Operations are managed to ensure minimal impacts on the local road network	• NRE will implement a traffic/driver code of conduct which includes:
	  • trucking during PCKT approved hours;
	  • obeying legal speed limits including self-imposed 50km/hr speed limit along Bellambi Lane;
	  • ensuring drivers are vigilant regarding separation distances;
	  • avoiding compression braking. Compression brakes must not be used on the approach to Port Kembla Road/Springhill Road lights when entering or exiting PKCT;
	  • covering all loads;
		Ongoing.

Outcome	Commitment	Timing
	• washing all trucks prior to leaving the site; • reporting all vehicle faults to the owner; and • reporting all traffic incidents.	
	• Engage the transport company through regular toolbox talks.	Ongoing.
	• Design of truck bodies will be progressively upgraded to reduce noise and related impacts and increase operational efficiency.	Ongoing.
Visual Amenity		
Construction and design is managed to ensure minimal visual impacts on local residents.	• Colour treatments for surface facility components will be selected to match the surrounding environment.	Prior to construction.
	• Ensuring lighting is directed away from residences through the use of directional lighting and shielding in accordance with safety regulations, and which complies with Australian Standard AS4282 (INT) 1995 – Control of Obtrusive Effects of Outdoor Lighting.	During design and construction.
Operations are managed to ensure minimal visual impacts on local residents.	• Routine use of low beam on vehicle headlights by all operation and maintenance personnel.	Continuous.
	• Appropriate use of lighting to limit impacts on sensitive locations. This will be managed through inductions of all construction and operations employees.	Continuous.
Waste		
Avoidance of unnecessary resource consumption; reuse, reprocessing, recycling and energy recovery wherever possible and, where this is not possible, disposal of wastes in an environmentally responsible manner.	• On site storage and disposal of different categories of waste will be defined prior to construction. A sufficient number of covered storage bins will be provided for waste disposal on site, with separate bins for recyclable and non-recyclable waste. • Construction materials will be purchased with the aim of reducing waste products. • All waste material will be disposed of in accordance with the provisions of the Protection of the *Environment Operations Act 1997 and the Waste Classification Guidelines* (DECC, 2008). • Waste will be recycled where possible or disposed of at an appropriately licensed waste disposal facility. • All records will be retained as proof of correct disposal for environmental audit purposes.	***Ongoing.***
Rehabilitation		
	• Progressive short term rehabilitation of the site will be undertaken, particularly in respect to removal of surplus mining equipment, sealing of redundant mine entries and shafts and stabilisation of slopes and embankments. This will be carried out in accordance with the schedule in *Section 16.4.2* of the EA.	In accordance with the approved Mine Operations Plan and operational requirements in liaison with the Department of Resources and Energy.

Outcome	Commitment	Timing

	• Progressive medium term rehabilitation will include:
	  • decommissioning and removal of the steel core belt and transfer house;
	  • decommissioning and removal of the existing Bulli and Balgownie decline belts;
	  • decommissioning and rehabilitation of No.1 and no.2 shafts; and
	  • decommissioning and rehabilitation of the current Balgownie seam entries.
		In accordance with the approved Mine Operations Plan and operational requirements in liaison with the Department of Resources and Energy.

	• Rehabilitation and mine closure will be developed with consideration for previous land uses, existing zoning and the potential to reuse existing structures and materials in the future. A final mine closure plan will be developed having regards to 'Rehabilitation and Mine Closure' guidelines and 'ANZMEC Strategic Framework for Mine Closure' objectives and principles to ensure that all relevant aspects of closure have been addressed.	Prior to mining ceasing.
	• Areas no longer required for operation will be rehabilitated progressively.	Ongoing.

30 *CONCLUSION AND JUSTIFICATION*

This chapter provides a conclusion justifying the Project taking into account the predicted environmental and socio-economic considerations. It also assesses the Project against the principles of ecologically sustainable development.

30.1 *INTRODUCTION*

This EAR presents findings of an environmental impact assessment for the continuation of mining, establishment of new mining domains and where necessary, the upgrade of associated surface facilities and ancillary operations at NRE No. 1 Colliery.

30.2 *ECOLOGICALLY SUSTAINABLE DEVELOPMENT*

Ecologically sustainable development (ESD) embraces the multiple objectives of social wellbeing, environmental sustainability, and economic prosperity. The National Strategy for Ecologically Sustainable Development is endorsed by the Commonwealth government and provides broad strategic directions and a framework for governments at all levels to direct policy and undertake decision-making. The strategy defines ESD as, "*using, conserving and enhancing the community's resources so that ecological processes, on which life depends, are maintained, and the total quality of life, now and in the future, can be increased*".

The main theme behind ESD is that future generations should have a natural environment as good as, or better, than the one inherited by this generation. The aim of applying ESD to large resource developments is to ensure long term sustainable outcomes by the integration of profitable business with environmental responsibility, in partnership with the community.

In summary, the four principles of ESD are:

- the precautionary principle;
- social equity, including intergenerational equity;
- conservation of biological diversity and ecological integrity; and
- improved valuation and pricing of environmental resources, including incentive mechanisms.

An analysis of these principles as they relate to the Project follows.

30.2.1 *The Precautionary Principle*

Interpretation

The precautionary principle states that if there are threats of serious or irreversible damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation. This principle was developed in response to the great difficulties sometimes experienced when interpreting scientific data. Scientific method produces results based on confidence limits.

These are controlled by the scope of data acquisition, interpretation methods and general understanding of a particular phenomenon within a particular scientific discipline. This has been used as a way of validating a lack of response to a potential threat of serious or irreversible environmental degradation.

In the application of this principle:

- careful application should always be undertaken to avoid serious or irreversible environmental damage; and

- an assessment of consequences of various options should be undertaken in formulating a proposal.

ESD requires that uncertainty and the associated risk level be considered in decision making.

Justification

The environmental consequences of the Project have been assessed as accurately as possible using appropriate specialists in relevant disciplines. Assessments were undertaken in accordance with the relevant State Government Technical and Policy Guidelines listed in the Project DGRs. The assessment process involved computer modelling, field validation, scientific analysis and interpretation of the individual and cumulative environmental impacts of the Project. This process has enabled the potential impacts of the Project to be predicted with a reasonable degree of certainty.

All predictions, however, contain a degree of uncertainty, which reflects the variable nature of the environment. To minimise uncertainty a conservative approach was adopted in regards to both mine planning and use of reasonable worst case scenarios in the assessment of impacts.

The focus of mine planning was to eliminate subsidence risks where possible, by avoiding significant natural and built features. In developing the preferred mine plan, NRE adopted an iterative approach involving ongoing examination of longwall options in light of constraints imposed by significant features including the Illawarra Escarpment and other cliffs of special significance, ecologically significant sites, significant Aboriginal sites, named 3rd order and above creeks, significant swamps and Cataract Dam.

Where significant natural and built features could not be avoided, all potential threats have been identified and appropriate mitigation measures have been developed to reduce predicted consequences. All management procedures form part of the statement of commitments as outlined in *Chapter 29,* and will form part of the approval conditions for this Project. The proponent has also committed to adaptive management measures based on ongoing monitoring of features of special significance or features that warrant special protection so that greater than predicted and unacceptable impacts can be avoided.

The Project therefore meets the objective of the precautionary principle of ESD.

30.2.2 *Social Equity and Intergenerational Equity*

Interpretation

Social equity involves concepts of justice and fairness, so that the basic needs of all sectors of society are met and that there is a fair distribution of costs and benefits to improve the wellbeing and welfare of the community, population or society. Social equity does not imply equality, but that there should be equal access to opportunities for improved welfare, with a bias towards advantaging the least well-off sectors of society.

Intergenerational Equity refers to the present generation ensuring that the health, diversity and productivity of the environment are maintained or enhanced for the benefit of future generations.

Justification

It is acknowledged that coal is a finite resource, however the proposal will ensure that the reserve is mined in an efficient manner and that the existing benefits afforded to the community are maintained or enhanced over the Project's life. More than 300Mt of coking coal resources remain within the PAA. The Project will provide access to approximately 33 Mt of ROM coal over an 18 year period to supply the international coking coal markets.

Social and economic benefits are expected through the continuation of local employment, the transfer of technical and commercial skills to local industry, positive multiplier effects in the region and ongoing sponsorship and funding for community programs (see *Chapter 27* and *28*).

There are numerous Aboriginal archaeological sites recorded within the PAA and the avoidance strategy has ensured that most of these sites are not within the potential subsidence footprint. A commitment to monitoring and management of sites within the footprint has also been made.

NRE will ensure that, post-mining, the landform is compatible with those of surrounding lands, and remediation (if required) is planned in advance and undertaken in consultation with relevant stakeholders at the time. This is in accordance with the concept of intergenerational equity.

30.2.3 *Conservation of Biological Diversity and Ecological Integrity*

Interpretation

Biological diversity refers to the variety of all life forms, including plants, animals and micro-organisms, the genes they contain, and the linkages between them. Biological resources provide food, medicines, fibres and industrial products for current and future generations. They also provide for vital ecological services such as maintaining soil fertility and the supply of clean and fresh water. Maintaining biological diversity safeguards life support functions and can be considered a minimal requirement for intergenerational equity.

Justification

A comprehensive assessment of the predicted impacts of the Project on biodiversity including upland swamps, aquatic and terrestrial ecology, is detailed in *Chapter 22, 23* and *24*.

Ecological risk management zones were identified, including upland swamp communities, creek lines and riparian zones, significant fauna habitats and endangered ecological communities. Throughout the iterative planning process, the mine plan was refined based upon this information.

NRE has taken an elimination approach to mining impact on features of special significance status where possible while still maintaining economically viable coal extraction. In order to avoid impacts to surface features, the design of longwall panel layouts has been such that the potential for impacts to significant built and natural features is reduced. Specifically, longwall mining has been eliminated under the following features of special significance:

- the main channel of Lizard and Wallandoola Creeks;
- special significant cliff features including Lizard Creek and Wallandoola Creek Waterfalls, a 300m long cliff line on the northern side of Lizard Creek and the Illawarra Escarpment;
- upland swamps of special significance CRUS1, CRUS2 and CRUS3 in Wonga East and LCUS1, LCUS27, LCUS6 and WCUS1 in Wonga West; and
- Cataract River and all but a small section within the high water mark of Cataract Reservoir.

In addition, longwall panel width has been adjusted in order to minimise impacts to those features which cannot feasibly be avoided. The substitution of narrow longwall panels in Wonga East and Area 4 in Wonga West minimises subsidence impacts on other significant features including Cataract Reservoir and Cataract Creek.

30.2.4 *Improved Valuation and Pricing of Environmental Resources*

Interpretation

The principle relates to the need to determine proper values for services provided by the natural environment, such as cultural values or the atmosphere's ability to receive gaseous emissions. This would result in intergenerational equity, as improved valuation and pricing of resources is paramount in conserving the natural environment for future generations. This principle's aim is that the environment be considered in the planning and costing of projects, so it is no longer considered a free resource.

Applying standard methods of valuation and pricing to environmental resources is a difficult process. This is largely due to the intangible nature of much of the natural environment. Pollution and future exploitation can be controlled under the polluter pays principle, whereby polluters who degrade the natural environment are responsible and accountable for returning it to its previous condition.

Justification

This EAR has examined the environmental consequences of the Project and has identified a number of management measures to mitigate potential adverse impacts associated with the Project. These management measures have been included in the statement of commitments. NRE has committed to comprehensive management and monitoring measures to negate or mitigate identified potential adverse impacts arising from the Project. Improved valuation and pricing of resources may include the comprehensive noise, air quality, water quality, groundwater and archaeological monitoring networks that are or will be established at the Colliery.

The management measures identified in this EAR have been developed concurrently with the environmental assessment and have been incorporated directly into the Project design. As such, components of the proposal have been identified to minimise adverse impacts including construction of new truck loading facilities to improve air quality and acoustic attenuation and construction of a new stormwater management structures. The proposal therefore involves a higher initial capital expenditure to ensure a sustainable outcome. The cost of these measures can be used as an indirect indication of the value of environmental resources.

The provision of social and environmental inputs at all levels of assessment ensures that due consideration of any impacts and their associated costs are taken into account in the assessment of viability and the design of the Project. For example, economic considerations in the mine planning included the possibility of reducing the width of longwall panels. This approach has been adopted in Wonga East to reduce the potential for subsidence related consequences. In Wonga West this approach was examined to assess feasibility of reduction in magnitude of subsidence above the longwall panels. However, the technical options for location of longwall gateroads under Lizard Creek meant that the longwall layouts in Wonga West became uneconomic under these circumstances.

NRE will also be taxed based on the Project's greenhouse gas emissions as part of the Federal government's greenhouse gas cap and trade system.

The Project will ultimately be assessed on its merits and the environmental, social and economic costs and benefits of the Project will be considered in reaching a determination. The community and State government as well as the proponent have the opportunity to provide a valuation of the environmental resources within the Study Area. The Project therefore meets the objectives of the principle of improved valuation and pricing of environmental resources.

30.3 *CONSIDERATION OF THE CONSISTENCY OF THE PROJECT WITH THE OBJECTIVES OF THE ENVIRONMENTAL PLANNING AND ASSESSMENT ACT 1979*

The DGRs require consideration of the consistency of the Project with the objects of the EP&A Act.

Section 5 of the EP&A Act describes the objects of the EP&A Act as follows:

(a) to encourage:

(i) the proper management, development and conservation of natural and artificial resources, including agricultural land, natural areas, forests, minerals, water, cities, towns and villages for the purpose of promoting the social and economic welfare of the community and a better environment,

(ii) the promotion and co-ordination of the orderly and economic use and development of land,

(iii) the protection, provision and co-ordination of communication and utility services,

(iv) the provision of land for public purposes,

(v) the provision and co-ordination of community services and facilities, and

(vi) the protection of the environment, including the protection and conservation of native animals and plants, including threatened species, populations and ecological communities, and their habitats, and

(vii) ecologically sustainable development, and

(viii) the provision and maintenance of affordable housing, and

(b) to promote the sharing of the responsibility for environmental planning between the different levels of government in the State, and

(c) to provide increased opportunity for public involvement and participation in environmental planning and assessment.

The Project is generally consistent with the objects of the EP&A Act, as it:

- has balanced resource extraction with environmental management by adopting principles of avoidance in the first instance. Where avoidance could not be achieved, measures for the management and conservation of natural resources are proposed for the purpose of promoting the social and economic welfare of the community and a better environment (*Chapters 7-27*);

- promotes the economic use of land through development of the State's mineral resources while maintaining existing land uses;

- incorporates measures to manage potential adverse impacts on the existing communication and utility services in the region that may be affected by subsidence (*Chapter 18*);

- includes measures to minimise potential amenity impacts, such as visual, air quality and noise emissions, on public land and in the community in the vicinity of the Russell Vale site (*Chapter 9, 10 and 13*);

- supports community services through the ongoing provision of sponsorship and funding to local community programs (*Chapter 28*);

- adopts a mine plan which has regard for avoidance of significant environmental features and incorporates a range of monitoring measures for the protection of the environment, including the protection of native plants and animals, threatened species, and their habitats (*Chapters 22, 23 and 24*);

- incorporates the principles of ESD (*Section 30.2*);

- included consultation with relevant State agencies and local government (*Chapter 5*); and

- has reached out to the local community through a consultation program (*Chapter 5*) involving the establishment of a Community Consultation Committee as well as the distribution of newsletters and hosting information sessions, where feedback and concerns raised were noted and considered during finalisation of key aspects of this Project.

30.4 *CONCLUSIONS*

This EAR has been prepared to meet the requirements provided by the Director-General of the Department of Planning and Infrastructure and issues raised by the relevant government authorities and other stakeholders. The assessment has focussed on issues with the potential to impact the environment as identified through the environmental risk assessment undertaken for the Project and through subsequent consideration of Planning Assessment Commission Findings.

Identification of environmental risk was a key preliminary step in the mine planning and assessment process. Assessments and management measures presented throughout this EAR have, where appropriate, been tailored according to the level of risk.

The principal risks associated with the Project are the subsidence consequences from mining on natural and built features within the Project Application Area and potential amenity impacts to residents in the vicinity of the Russell Vale surface facilities. Assessments of subsidence, surface and groundwater, noise and vibration, air quality, greenhouse gas emissions, ecology, heritage, traffic and transport, waste and socio-economic impacts were undertaken. An overview of key assessment outcomes is provided in the following pages.

30.4.1 *Subsidence*

The proposed mine plan has been developed to avoid significant features as far as possible. NRE does not propose to undertake longwall mining directly under the main channel of Wallandoola or Lizard Creek, therefore minimising impact to any swamps located within their riparian zones.

Mining in Wonga East under Cataract Creek and in the DSC Notification Area has been designed with narrow longwalls and wide chain pillars, which are predicted and have been demonstrated to result in reduced subsidence effects in comparison to wider panels.

No longwall mining is proposed under and within 100m of Mount Ousley Road. No longwall mining is proposed within 1 km of the Cataract Dam wall.

Maximum subsidence in Wonga East is predicted to range up to 1.2 m as predicted by Seedsman 2012.. In Wonga East up to 1 m of subsidence is thought to have occurred as a result of previous mining and an additional 2.55 m of subsidence is predicted (Seedsman 2012) in Wonga West associated with currently proposed extraction from the Wongawilli Seam.

Subsidence monitoring data will be used to validate predictions prior to mining under features of special significance and engineering controls such as alternate layouts and altered start and end lines will be implemented where it cannot be demonstrated more than minimal impacts are identified as likely to occur during secondary extraction. Subsidence consequences on natural features such as streams, upland swamps, cliffs and threatened species and archaeology has been considered in relevant chapters.

30.4.2 *Catchment Surface Water*

All of the creeks, swamps, Cataract River and the Cataract Reservoir are contained within the Sydney Catchment Authority controlled Metropolitan Special Area. The potential effects, impacts and consequences of the proposed mining on surface water features are summarised as follows:

Cataract Creek and Cataract River

Due to the proposed mine plan which incorporates narrow longwalls with wide pillars and commitment to adaptive management, the proposed mining at Wonga East is not anticipated to be a significant risk to either Cataract Creek or Cataract River (upstream of Cataract Reservoir) in regard to stream flow, stream pools, water quality or aquatic ecosystems.

Wallandoola Creek

Due to the designed set back from the main channel of Wallandoola Creek (and the associated lack of subsidence and uplift), the proposed Wongawilli seam mine layout is anticipated to avoid potential adverse effects on the main channel of Wallandoola Creek. However, a localised potential risk to the integrity of stream flow and connectivity in Wallandoola Creek may be present in the area that may potentially undergo up to 6 mm/m of tensile strain and up to 0.5 m of subsidence to the south of Longwalls A3 LW3 and A3 LW4. It should be noted however that the stream flow in this reach has already been observed to be altered by previous subsidence associated with the extraction of Bulli seam in this area.

The pool water holding capacity in Wallandoola Creek or its tributaries is not anticipated to be adversely affected due to the low predicted tilts. The valley infill swamps along Wallandoola Creek are also not anticipated to be adversely affected due to the predicted subsidence tilts and strains.

A detailed swamp significance and risk assessment of the Wallandoola Creek valley infill and headwater swamps is contained in (GeoTerra, 2010a) and (Biosis, 2012).

Lizard Creek

Due to the designed set back from the main channel of Lizard Creek (and the associated lack of subsidence and uplift), the proposed Wongawilli seam mine layout is anticipated to avoid potential adverse effects on the main channel of Lizard Creek, including the deemed 'significant' section at Waterfall L1.

However, a localised low potential risk to the integrity of stream flow and connectivity in Lizard Creek may be present in the area that may potentially undergo 6 - 7mm/m of tensile strain to the north of Longwall A3 LW2 and south of the northern end of Longwall A4 LW5. It should be noted however that the stream flow in this reach has already been significantly altered by previous subsidence associated with the extraction of Bulli seam in this area.

The third order tributary stream bed and banks from the LCT1 / LCT2 junction to Lizard Creek is anticipated to have a low to minor potential risk of adverse effects due to extraction of Longwall A3 LW5.

The third order tributary stream bed and banks from C11 to Lizard Creek is anticipated to have a potential risk of adverse effects due to extraction of Longwall A3 LW5. It should be noted however that the stream flow and pool holding capacity in this stream reach has been observed to be significantly altered, possibly by previous subsidence associated with the extraction of the Bulli seam in this area.

The pool water holding capacity in Lizard Creek or its tributaries is not anticipated to be adversely affected due to the low predicted tilts and steep gradients in the incised sections of the creek catchment.

The valley infill swamps in the flatter gradient section along Lizard Creek are also not anticipated to be adversely affected due to the lack of predicted subsidence in those areas.

Cataract Dam

No reduction in the water quality of Cataract Reservoir is anticipated from the Cataract Creek, Cataract River or Bellambi Creek catchment outflows.

A 0.06 – 0.07ML/day (or 5 - 6%) reduction in flow from the Cataract Creek catchment to Cataract Reservoir is predicted at the end of mining Wonga East Area 2. However, it should be noted that this quantum is insignificant when compared to the average daily evaporation from the reservoir, and taking into account the limitations in using the surface water and groundwater models to estimate creek flows, groundwater seepage and inflow to the workings.

It has been assessed that there is a low risk of reduced water yield to Cataract Reservoir, and surface water and groundwater modelling indicates a low risk of potential change to the water holding capacity of, or loss of water from Cataract Reservoir.

The structural integrity of the dam wall and Cataract Reservoir will not be affected by the proposed mining. Further, the proposed workings have been positioned at sufficient distance from the Cataract Reservoir and there are no known geological structures which

could cause a mining induced hydraulic connection bewteen the workings and the base of the reservoir.

Broughtons Pass Weir

As the potential adverse subsidence impacts on stream flow, pool holding capacity and stream water quality in Lizard Creek and Wallandoola Creek are anticipated to be localised, if they occur at all, then the discharge out of the two creeks into the Cataract River is not anticipated to cause any adverse impacts on the water quality in Broughtons Pass Weir. The Cataract dam wall is located approximately 5km upstream of the Lizard Creek junction and 10.5km of the Wallandoola Creek junction, whilst Broughtons Pass Weir is located approximately 1.2km downstream of Wallandoola Creek.

30.4.3 *Groundwater*

The existing hydrogeological environment has been described and investigations have been commenced to provide an environmental baseline.

A groundwater model has been developed to represent the aquifers and to predict potential impacts. Within the limitations and constraints of the model, it is predicted that the proposed mining could depressurise the overburden up to the upper Bulgo Sandstone. However, it is predicted that the Bald Hill Claystone will remain intact and retain its semi-confining properties, maintaining hydraulic separation between the Hawkesbury Sandstone and Quaternary alluvial aquifers from the Bulgo Sandstone and deeper systems.

Mine water seepage is predicted to rise from the current 1.1 ML/day (402 ML/year) to 3.1 ML/day (1131 ML/year) at the end of mining (for total inflow at Wonga East and West). However, if unidentified fracture related storages are intercepted, short terms increases in the modelled seepage rates of up to 0.1 - 0.5 ML/day into the workings may occur, which should dissipate over a period of weeks to months.

Changes to inflow into Cataract Reservoir and to stream baseflow within the Lizard, Wallandoola and Cataract Creeks have been predicted, however these are anticipated to be minor.

A monitoring regime, as well as adaptive management and the development of contingency measures has been developed to monitor changes to the groundwater system and implement management measures should unexpected impacts occur, or are likely to occur based on ongoing monitoring and updated predictions due to mining.

30.4.4 *Russell Vale Water*

Expansion of mining operations to include the Wongawilli seam will cause fluctuations in mine water flows. At end of the Project the water production from mining operations is expected to increase to 3.1mL/day.

At the start of mining in the Wongawilli seam, water produced from mining operations will not be enough to meet demand and additional water will need to be provided to supplement the site's water requirements.

It is anticipated that discharge into Bellambi Gully will be in line with current practice, and as such the existing licence will still be applicable for the increased mining operations.

It is proposed that the sludge from the existing thickener tank be diverted from Dam 1. Instead, the sludge will be dewatered. This will improve the efficiency and economy of the treatment processes and the solids output.

30.4.5 *Air Quality*

The results of modelling indicate:

- the Project is predicted to comply with the long term OEH air quality impact criteria for PM_{10}, TSP and dust at all receptors for all scenarios;
- the Project is predicted to exceed maximum 24 hour average PM_{10} criterion on one day at one sensitive receptor, which is within the allowable five day exceedance limit; and
- the highest predicted incremental concentration of PM10 (24 hour average) at modelled sensitive receptors was 13.70 µg/m3 representing 27.4% of the nominated criteria (50 µg/m3).

The Project would therefore have no significant impact on the long term air quality parameters of dust deposition, annual average PM_{10} and TSP.

While a maximum of one exceedance of the OEH short term air quality criteria (maximum PM_{10} 24 hour average concentration) of 50 $\mu g/m^3$ is predicted, it is unlikely that the Project would have a significant impact on local air quality due to the following reasons:

- the Project was not the primary contributor for the exceedance. This predicted cumulative exceedance would largely result from windblown salt, agricultural dust, and other operations in and around the area; and
- the modelling considers that a range of activities occur concurrently during the one 24 hour period, which can be considered a 'worst case' approximation of emissions from site activities. The maximum 24 hour increments are predicted when this worst case activity level coincides with worst case meteorological conditions.

Concentration contours show that the highest impacts are centred around the Russell Vale site, with the predicted concentrations decreasing rapidly beyond the site boundary, with minimal impacts predicted beyond one kilometre.

A number of management measures, many of which are already in use, are proposed to ensure that emissions to the local air-shed are minimised.

30.4.6 *Greenhouse Gas*

In this assessment, total emissions over the lifetime of the Project (direct and indirect) have been calculated as being 165,971,970t CO_2–e. Annual emissions are anticipated to peak in 2015, contributing 9,220,665t CO_2–e to the atmosphere.

Peak year direct greenhouse gases emissions (Scope 1 and 2) are estimated to be approximately 2,548,453 tonnes $CO_{2\text{-}e}$/annum in 2015, meaning that the greenhouse intensity of the Project will equate to approximately 0.85 t $CO_{2\text{-}e}$ for each tonne of ROM coal material extracted. Total direct emissions over the operational lifetime of the Project are estimated at 45,872,154t$CO_{2\text{-}e}$.

30.4.7 ***Noise***

Minor exceedances of less than 2 dB (A) may occur at two receivers during the evening period. Noise levels of this magnitude would typically be indiscernible to the human ear, and further noise reduction may be achievable. These predicted noise levels would be confirmed upon the commencement of operations.

Traffic noise along Bellambi Lane has been assessed and the Project would result in an increase in $L_{Aeq,\,1hr}$ noise levels of less than 2 dB(A) compared to existing road traffic noise levels. Therefore, the predicted traffic noise generation would comply with the ECRTN (OEH).

30.4.8 ***Aquatic Ecology***

The potential impacts of mining on the aquatic ecology of the Study Area have largely been mitigated through the design of the proposed longwall layout and will be further managed through ongoing monitoring of water quality, aquatic habitat, macro invertebrates and fish during the same seasons as used for the baseline study. This will provide best practice environmental monitoring of aquatic ecology and allow statistically valid analysis of the nature and extent of mine subsidence impacts, if any.

The threatened Macquarie Perch (*Macquaria australasica*) and a hybrid of the freshwater cod species Murray Cod (*Maccullochella peelii peelii*) and Trout Cod (*Maccullochella macquariensis*) are known from the waters of Cataract Dam and have been recorded periodically in the waters of Cataract Creek. Due to barriers downstream, none of these species are expected to occur in Lizard Creek and Wallandoola Creek. The worst case subsidence predictions identify that extraction of the longwall panels in this reach of Cataract Creek may have an adverse impact on stream flow, pool holding capacity of the rock bars and potential iron hydroxide seepage (GeoTerra 2012a). The proposed action may affect habitat values required for spawning, should spawning occur in this reach of Cataract Creek. The proposed action will not impact the main habitat for all of these species in Cataract Dam.

The avoidance of longwall mining under Wallandoola Creek, Lizard Creek and Cataract River as well as adaptive management measures proposed to restrict subsidence effects to below 250mm in Cataract Creek will also protect nationally listed endangered fish species identified as occurring in these watercourses.

30.4.9 ***Terrestrial Ecology***

Elimination of many potential impacts on terrestrial ecology has been achieved by;

- realigning the longwall panel layouts to avoid sensitive areas;

- abandoning plans for longwall panels underneath the main channels of Lizard Creek and Wallandoola Creek;

- abandoning plans for longwall panels underneath Lizard Creek valley infill swamps and much of the Wallandoola Creek valley infill swamps;

- locating the fully supported driveage underneath Lizard Creek; and

- realigning and reducing the width of longwall panels in Wonga East.

Despite this approach, there remains a risk to a number of the ecological values of the Study Area.

The Project Application Area (PAA) supports habitat for a number of threatened species and two endangered ecological community (EEC) listed under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* and/or the *Threatened Species Conservation Act*. All threatened species and ecological communities with the potential to occur in the Study Area were considered for their vulnerability to subsidence.

Those species which were identified to have a moderate to high likelihood of occurrence, and which are also susceptible to subsidence, were assessed.

The assessments found that impacts could be significant for the Large-eared Pied Bat (*Chalinolobus dwyeri*) and for the Giant Burrowing Frog (*Heleioporous australiacus*), and that disruption to the breeding cycle of the Heath Frog could occur. No other species or EECs were considered to have the potential to be significantly impacted by the Project.

The significant impact assessment for the Giant Burrowing Frog concluded that the Project was likely to: lead to a long-term decrease in the size of an important population of a species; reduce the area of occupancy of an important population; fragment an existing important population into two or more populations; disrupt the breeding cycle of an important population; and modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline. The assessment also found that although the local population may be impacted, the Project is not predicted to interfere substantially with the recovery of the species as a whole.

The significant impact assessment for the Large-eared Pied Bat concluded that the Project has the potential to disrupt the breeding cycle of an important population, and that there is a negligible to low risk that the action could modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline. The assessment found that although the local population may be impacted, the Project is not predicted to interfere substantially with the recovery of the species as a whole.

Heath Frog is considered likely to occur within the Wallandoola Creek drainage, and suitable habitat for breeding occurs within the valley infill swamp WCUS7. This swamp is likely to be subject to subsidence impacts and cracking of substrate may occur (GeoTerra 2012b). If cracking of pond bars or substrate were to occur, habitat condition may become degraded to a point such that Heath Frog could no longer successfully breed

there. The assessment found that if that were the case, the Project may disrupt the breeding cycle of an important population.

It is generally recognised that the impacts of subsidence due to longwall mining on terrestrial ecosystems (including Shale Sandstone Transition Forest EEC) are likely to be less significant than those experienced by aquatic-dependent ecosystems (DECC 2008). Subsidence prediction values for the areas of Shale/Sandstone Transition Forest EEC indicate a maximum predicted subsidence of 2.3m and maximum permanent predicted tilt of 15mm/m under the EEC in the Study Area. This subsidence is considered unlikely to result in significant impacts on the EEC.

NRE are currently preparing a referral to the Commonwealth Department of Sustainability, Environment, Water, Population and Communities (DSEWPC) for the Project.

30.4.10 ***Swamps***

There are 84 upland swamps in the Study Area including 79 headwater swamps, one valley infill swamp, and 4 swamps that contain both headwater and valley infill swamp types. Elimination of many potential impacts on upland swamps has been achieved by realigning the longwall panel layouts to avoid sensitive areas including swamps. Impacts to swamps of special significance status CRUS1, CRUS2 and CRUS3 in Wonga East and LCUS1, LCUS27, LCUS6 and WCUS1 in Wonga West have been avoided.

There is potential impacts to swamps of special significance CCUS1, CCUS4, CCUS5 and CCUS10 in Wonga East and LCUS8, WCUS4, WCUS7 and WCUS11 in Wonga West and commitments to ongoing monitoring and the preparation and implementation of adaptive management measures for these swamps have been made to reduce as far as economically viable the impacts on these swamps.

30.4.11 ***Heritage***

The approach to mine planning has enabled the majority of significant Aboriginal sites to be avoided, particularly those sites located adjacent to Cataract Dam.

There are 56 Aboriginal archaeological sites recorded within Study Area comprising 12 sites of high scientific significance, 20 sites of moderate scientific significance and 24 sites of low significance. The avoidance strategy has ensured that 35 of these sites are not within the potential subsidence footprint. Eight high significance sites, 15 moderate significance sites and 12 of the low significance sites have been avoided. A suite of monitoring measures for the affected sites has been included in NRE's commitments.

No items of historic heritage items are predicted to be impacted by the Project.

30.4.12 ***Traffic and Transport***

The average number of coal trucks operating in 2019 (modelled peak year) is projected to generate between 512 and 682 vehicle trips per day, which is an increase of 126% to 202% over current rates. A detailed traffic assessment including consideration of peak flows and intersection functioning has determined that the Project is not predicted to impact on the safety and performance of the road network along the transport corridor. Potential

safety issues associated with increase traffic flows on the local road network interacting with coal haulage trucks will be managed through enforcing a driver code of conduct in conjunction with the trucking contractor.

30.4.13 *Visual Amenity*

Changes to the existing viewscape, resulting from the Project, from publicly accessible viewpoints outside the Colliery are minor.

30.4.14 *Waste*

Continued implementation of current waste management practices, as amended to reflect improved technology or practice, will minimise potential adverse impacts resulting from waste generation.

30.4.15 *Socio-Economic*

A number of perceived and actual negative and positive social and economic impacts will occur as a result of the Project, and will be managed by a range of prevention and mitigation processes. These impacts may include the following:

- noise associated with site operations and coal haulage which will be managed by construction of new haulage facilities and enforcing the driver code of conduct;
- potential safety issues associated with increased coal truck flows on the local road network, which will be managed through enforcing a driver code of conduct;
- potential dust impacts associated with coal handling to be managed by truck washing, improved load out facilities and improved dust controls on conveyors and stockpiles;
- continued full time employment for approximately 297 people increasing to 381 over the life of the Project. In addition, the engagement of varying numbers of contractors and casual employees will generate employment opportunities throughout the construction stage of the Project;
- direct positive impact on the local and regional economy through the payment of salaries and wages to the staff over the life of the Project and continued contribution and support of local community programs; and
- continued payment of government taxes and royalties.

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