Chapter 26

Social and health

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Chapter 26 Social and health

The Secretary's environmental assessment requirements for the Narrabri Gas Project include a requirement to assess the likely social impacts of the development. A social impact assessment (refer to Appendix T1) was prepared in response to this requirement. A screening level health impact assessment was also undertaken to consider the potential impacts of the project on human health (refer to Appendix T2). This chapter draws on those assessments to provide an overall assessment of the potential social and health impacts of the project.

The key findings of the impact assessment in relation to social and health were:

- The project has the potential to generate a range of socio-economic benefits in the Narrabri LGA, the wider region and NSW.
- The involvement of local business and contractors in the project would be supported through a procurement and logistics policy.
- Benefits associated with job creation including job diversity and potential gradual increases in the resident population.
- There may be increased demand on housing and accommodation during the construction period.
- There may be some minor changes to land use, lifestyle and amenity for landholders in the project area.
- Potential health and wellbeing impacts that were raised during stakeholder and community consultation for the project aligned broadly with those identified and investigated in the *Independent review of coal seam gas activities in NSW* (NSW Chief Scientist and Engineer 2013 and 2014). The residual risk from potential health and wellbeing was assessed as low.
- Field development would only occur on private property if there is a Land Access Agreement with the landholder and a Farm Management Plan is in place regarding appropriate siting of infrastructure.

About 1,300 workers would be directly employed during the peak construction phase of the project, which would occur over a period of three to four years. About 200 workers would be directly employed for the ongoing operation of the project, being a combination of existing and new jobs mostly based in Narrabri.

The key potential social impacts would be housing and accommodation demands associated with the increase in resident population during the operation of the project. These demands would be met in part by the use of existing camp facilities in the Narrabri region and the expansion of Westport workers' accommodation. The project also has the potential to cause some impact on land use, lifestyle and amenity for landholders in the project area as a result of construction activities and placement of infrastructure. These potential impacts would be avoided, mitigated or managed through consultation with affected landholders, formalised in Land Access Agreements and Farm Management Plans. No gas field infrastructure would be placed on a property without written agreement from the landholder.

In all cases it was concluded that potential impacts to human health would be low risk given the engineering controls and avoidance, mitigation and management measures that would be in place.

The implementation of mitigation and management measures, and the design of the project, would be satisfactory to control and minimise potential social impacts. As such, the residual social and health risks presented by the project would be low to very low.

26.1 Methodology

This chapter summarises the findings of the social and health impact assessments undertaken for the EIS (refer to Appendices T1 and T2 respectively). The following tasks were undertaken to assess the social and health impacts of the Narrabri Gas Project:

- identification of communities potentially impacted by the project
- description of characteristics of communities potentially impacted by the project
- consultation with targeted stakeholders
- identification and classification of the potential benefits and impacts of the project
- preparation of a screening level health impact assessment (Appendix T2)
- identification of mitigation and management measures to control impacts.

Communities potentially impacted by the project were identified and described with reference to data from the Australian Bureau of Statistics, regional plans and other local government publications, and previous social impact assessments. Communities with potential to be directly impacted were considered to be the residents of the project area and the township of Narrabri, as well as communities in the broader region.

Consultation undertaken for the project was supplemented with targeted stakeholder consultation undertaken specifically for the social impact assessment. This included consultation with Narrabri Shire Council, NSW Farmers Association, Narrabri Local Aboriginal Land Council, the Community Consultative Committee and various public service providers.

The health impact assessment was undertaken in accordance with relevant guidelines including *Health Impact Assessment: A Practical Guide, Centre for Health Equity Training* (Harris *et al.* 2007) and the *Health Impact Assessment Guidelines* (enHealth 2001).

Potential impacts were classified in accordance with the risk assessment methodology outlined in Chapter 10. Potential impacts were therefore classified based on a combination of the likelihood of the potential impact occurring and the severity of the consequences if the impact were to occur.

Detailed methodologies for the social impact assessment and environmental health impact assessment are provided in Appendix T1 and Appendix T2 respectively.

26.2 Existing environment

26.2.1 Overview

Potential social impacts from the project would be experienced at both the local and regional level.

At the local level, the area of influence would include the project area, which is characterised by State forest and agriculture. The project area crosses 255 private land titles, and contains about 114 identified sensitive receivers. A further 103 sensitive receivers were identified within about three kilometres of the project area. Other land use in the project area includes recreation at Yarrie Lake.

Potential pathways for health impacts in the project area include:

- groundwater (particularly shallow aquifers utilised for groundwater supply)
- surface water (particularly where used for recreational purposes)
- the air and noise environment.

At the regional level, the area of influence would include the Narrabri local government area (LGA), particularly the township of Narrabri. Other population centres within the Narrabri LGA include the towns of Wee Waa, Boggabri and the villages of Baan Baa, Bellata, Edgeroi, Gwabegar and Pilliga. Consultation and research identified community values and aspirations for Narrabri LGA. It was found that the community wants a local area that:

- protects past and existing industry, but promotes future and emerging industries
- is well governed and financially sustainable
- promotes and preserves culture and history
- is proud of its identity and its people
- grows and develops, however not at the cost of community diversity or by displacing people who already live in the area
- is proactive, healthy and encourages participation in physical activity
- is accessible by all and promotes inclusivity
- has access to government services and opportunities
- is vibrant, safe and inviting.

To a lesser degree, the project's area of influence would extend beyond the Narrabri LGA include the LGAs of Gunnedah, Liverpool Plains, Tamworth, Uralla, Armidale Dumaresq, Glen Innes Severn, Inverell, Gwydir, Moree Plains, Walgett, Coonamble, Gilgandra, Warrumbungle and Dubbo.

26.2.2 Population

The population of the Narrabri LGA over the last three census periods (2001, 2006 and 2011) is presented in Table 26-1. The population trended downward over that period. This downward trend has been evident elsewhere in the wider region, particularly in LGAs west of Narrabri.

According to more recent Australian Bureau of Statistics estimates, the population of Narrabri grew by six per cent between the 2011 Census and April 2014, reaching an estimated 13,685 people. This increase in population can be attributed to economic growth through development in the resources sector.

Table 26-1 Population in Narrabri and wider region

Local government area	2001 Census	2006 Census	2011 Census
Narrabri	13,800	13,119	12,925
Narrabri township	-	7,419	7,392
Gunnedah	11,976	11,525	12,066
Tamworth	n/a	53,590	56,292
Uralla	5,728	5,734	6,034
Armidale Dumaresq	23,920	23,368	24,105
Glen Innes Severn	n/a	8,780	8,656
Inverell	15,020	15,510	16,075
Gwydir	n/a	5,311	4,965
Moree Plains	15,680	13,976	13,429
Walgett	8,279	6,944	6,454
Coonamble	4,567	4,208	4,030
Gilgandra	4,712	4,522	4,368
Dubbo	37,565	37,843	38,805
Warrumbungle	n/a	9,808	9,588
Liverpool Plains	n/a	7,540	7,480

26.2.3 Age and gender

Age and gender distribution in the Narrabri LGA and across NSW at the 2011 Census are compared in Figure 26-1. The median age in the Narrabri LGA is 39 years.

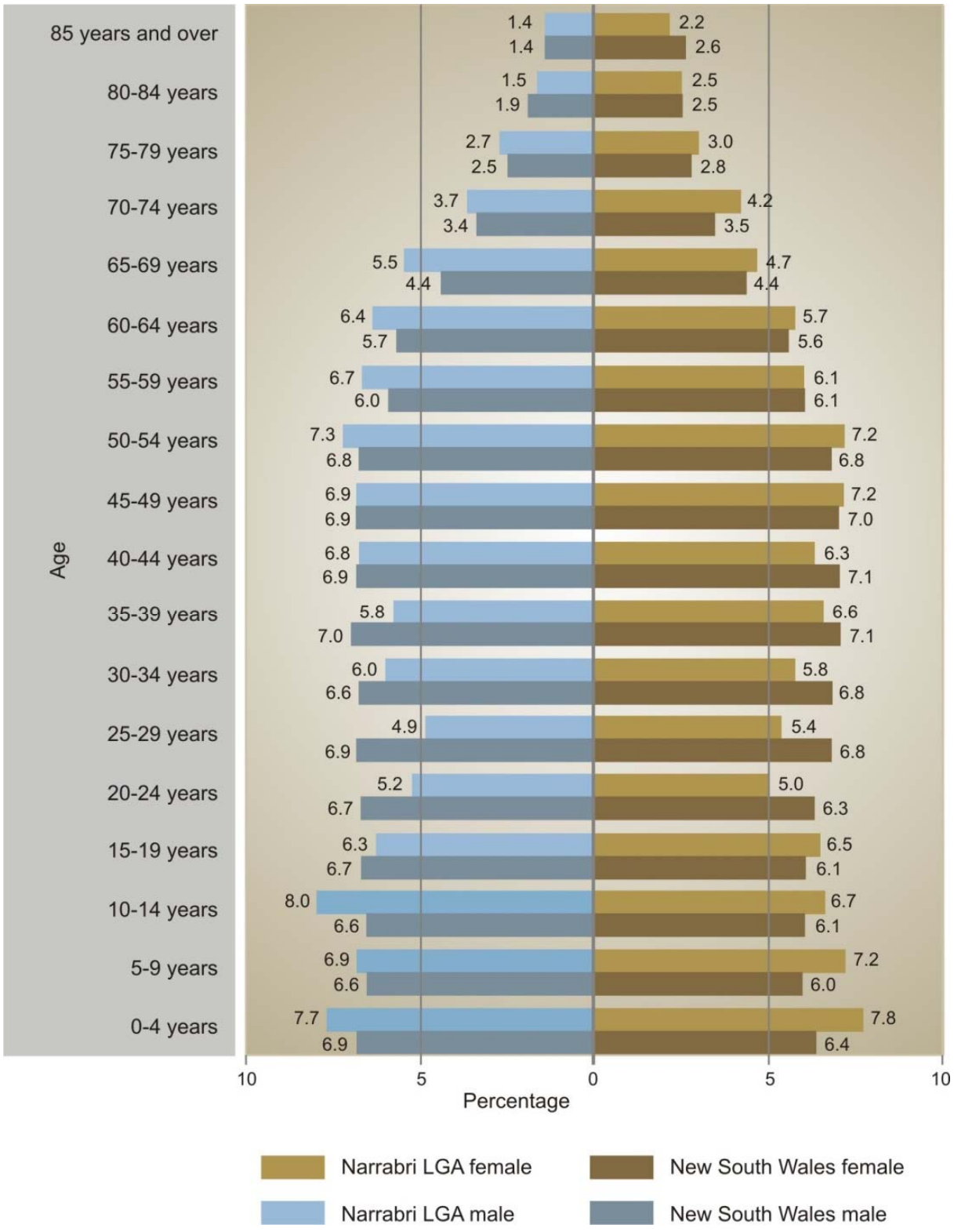

Figure 26-1 Age and gender distribution in Narrabri LGA

26.2.4 Family composition

Family composition in the Narrabri township, Narrabri LGA and across NSW at the 2011 Census is compared in Table 26-2. The average family size in the Narrabri LGA at the 2011 Census was consistent with the Australian average of about 2.5 persons.

Table 26-2 Family composition

	Couple	Two-parent family	Single-parent family
Narrabri township	41.3 %	41.1 %	16.0 %
Narrabri LGA	41.6 %	41.7 %	15.3 %
New South Wales	36.6 %	45.5 %	16.3 %

26.2.5 Cultural and ethnic composition

The proportion of the population born in Australia and overseas in the Narrabri LGA and across NSW at the 2011 Census is compared in Table 26-3. The data show that a majority of the population in Narrabri LGA is born in Australia, with a small proportion born overseas. About 11 per cent of the population in Narrabri LGA are Aboriginal or Torres Strait Islander persons, which is substantially higher than the NSW average of 2.5 per cent.

Table 26-3 Cultural and ethnic composition

	Australia	Overseas
Narrabri LGA	89.6 %	4.0 %
New South Wales	68.6 %	25.7 %

Note: Percentages exclude non-respondents

26.2.6 Employment and income

Planning and policy documents indicate that Narrabri has a skilled, stable and qualified workforce. The Narrabri LGA has a workforce of approximately 7,700 people with an unemployment rate of 5.1 per cent. The wider region has a workforce of approximately 123,750 with an unemployment rate of 6.5 per cent. By comparison, the unemployment rate in NSW is approximately 5.8 per cent (Department of Employment 2013). The unemployment rate among Aboriginal or Torres Strait Islander persons in the Narrabri LGA was significantly higher at 26.3 per cent.

The major employment industries in the Narrabri LGA are agriculture, forestry and fishing (21.4 per cent); retail trade (9.8 per cent); and health care and social assistance (9.6 per cent). Agriculture, forestry and fishing are also major employment industries in the wider region including Gunnedah, Uralla, Glen Innes Severn, Gwydir, Moree Plains, Walgett, Coonamble, Gilgandra, Warrumbungle and Liverpool Plains.

Narrabri is also home to emerging coal and gas resource industries. The Gunnedah Basin, in which Narrabri is situated, has been labelled as the ‘new coal frontier in New South Wales’ (Narrabri Shire Council 2007). A range of benefits from these emerging industries are recognised by Narrabri Shire Council, including attraction of ancillary business, demand for housing and accommodation, and increased employment opportunities. Narrabri Shire Council (2013) has developed an extractive

industries policy to balance the outcomes of these emerging industries with community sentiment, public amenity, human health, heritage and environmental values. With regard to natural gas development, key aspects of the policy include supporting the establishment of ancillary business to deal with the emerging extractive industries, demanding a 'nil' net effect on surface water and aquifers used by the community, and to support individual property rights with regard to field development.

The median household income in the Narrabri LGA was $982 per week, substantially lower than the NSW median of $1,237. Employment and income are discussed further in Chapter 27.

26.2.7 Housing and accommodation

Housing by ownership status in the Narrabri LGA and across NSW is compared in Table 26-4. The data show that a majority of houses in Narrabri are owned or being purchased, while about 30 per cent of houses are rented.

Median house prices in Narrabri have increased steadily since 1999, reaching $325,000 in 2013. The number of house sales has been roughly constant during the same period, with sales ranging between 107 and 163 per annum since, with the exception of 2008 and 2013 the numbers temporarily dropped to 95 sales and 79 sales respectively (Pricefinder 2014).

Rental vacancies have been historically low, fluctuating between zero per cent and two per cent between 2009 and 2012, before slightly increasing between two to four per cent through 2013. The number of properties available to rent in Narrabri was 12 in January 2014 and 32 in September 2014 (Realestate.com.au 2014; 2014a).

Narrabri also hosts a range of short-term accommodation facilities. As at 2011 there were 11 listed motels and four listed hotels with an average of 20 rooms. Smaller bed and breakfast accommodation, farm stay accommodation, serviced apartments, camping grounds and caravan parks with over 300 beds are also available (Narrabri Shire Council 2011).

Narrabri Shire Council predicts that up to 1,000 new dwellings will be required in the Narrabri LGA by 2031 (Narrabri Shire Council 2011). In addition, tourism and emerging resource industries have led to increased demand for short-term accommodation.

Several areas surrounding the township of Narrabri have been nominated for future residential development. Consultation with Narrabri Shire Council and real estate agents identified three proposed housing developments in the township of Narrabri.

The townships of Narrabri and Boggabri already host large accommodation camps operated by private entities. Both camps have capacity for 500 persons, with an existing approval to expand the Narrabri camp to 900 persons. The two camps alleviate some demand on short-term accommodation by providing accommodation for fly-in fly-out and other non-resident workers.

Table 26-4 Housing by ownership status

	Fully owned	Being purchased	Rented
Narrabri LGA	36.7 %	28.1 %	30.0 %
New South Wales	33.2 %	33.4 %	30.1 %

Note: Percentages exclude non-respondents

26.2.8 Social infrastructure and services

Social infrastructure in the Narrabri LGA includes a range of education, community, cultural, recreational, emergency and health facilities and services. The township of Narrabri is also recognised as a transport hub with a range of rail, road and airport facilities. Facilities identified in the Narrabri LGA, along with major facilities in the wider region, are listed in Table 26-5. Generally, the existing social infrastructure and services adequately service the current population of Narrabri. However, research and consultation found the following challenges in the region:

- the provision of social infrastructure and support services including housing, are issues for the development of the mining and resource industry
- health infrastructure, including emergency services, could accommodate growth, but the procurement of suitably skilled and qualified staff remains a challenge
- there are limited education and training programs to train local people for employment in emerging industries
- population growth may lead to shortages in childcare services and may require upgrades to community infrastructure (Narrabri Shire Council 2011). There may also be a need for facilities and services catering for non-resident populations associated with mining and resources industry, as well as seasonal agriculture and tourism
- emergency services have the capacity to meet the existing needs of the region but in rare cases where incidents occur in parallel there can be shortfalls. Access within the Pilliga forest is a challenge for all emergency services.

Table 26-5 Social infrastructure and services

Type	Facility	Quantity	Note
Education	Playgroup, childcare and pre-school	17	-
	Primary school	12	-
	Secondary schools	2	Narrabri and Wee Waa
	TAFE campuses	5	TAFE campuses in townships of Narrabri, Tamworth, Gunnedah, Inverell and Moree
	Tertiary education	7	Narrabri Community College, University of New England access centres in townships of Tamworth, Gunnedah, Inverell, Moree, Narrabri, Guyra
	Research institution	3	CSIRO Australian Cotton Research Institution; CSIRO Australia Telescope Compact Array (Paul Wild Observatory); I.A. Watson Wheat Research Centre (University of Sydney)
Culture and recreation	Libraries	3	Wee Waa, Narrabri and Boggabri
	Sporting fields	27	There are also several recreation reserves, playgrounds and barbecue facilities
	Equestrian facilities	1	Narrabri hosts the largest pony club in the southern hemisphere

Type	Facility	Quantity	Note
	Public pools	3	Boggabri, Narrabri and Wee Waa swimming pools and the Narrabri Aquatic Centre Indoor Pool
	School farm	1	Federation Farm, owned by Narrabri Shire Council and share-farmed by local schools
	Theatre / conference venue	1	The Crossing Theatre, a cultural centre and conference venue featuring two cinemas, auditorium, commercial kitchen and function rooms
	Caravan parks and camp grounds	Several	Three located in Narrabri
Health	Medical services	Several	Doctors' surgeries, community health centres, pharmacies, dental surgeries, optometrists, physiotherapy, chiropractor, therapists, speech pathology, rehabilitation.
	Hospitals	4	Narrabri, Wee Waa, Boggabri and Tamworth. The Narrabri hospital is a new, well equipped 38-bed facility with a number of supporting facilities including a theatre, pathology services, X-ray, physiotherapist, ultrasounds and sufficient equipment to stabilise patients. Tamworth Health Service provides higher order health services and is the key health facility servicing the area
	Aged care services	7	-
	Other community services	Several	Large number of community services including disability services
Other	Emergency services	Several	Police, ambulance, air ambulance, fire and rescue, rural fire service, State Emergency Service
	Aviation facilities	3	Narrabri airport, Wee Waa airport, Boggabri grass air strip (used occasionally)
	Passenger and freight rail	Several	-
	Bus, coach and taxi services	Several	-
	Local and State government offices	Several	-

26.2.9 Health and wellbeing

The health of the community is influenced by a complex range of interacting factors including age, socio-economic status, social capital, behaviours, beliefs and lifestyle, life experiences, country of origin, genetic predisposition and access to health and social care.

There are limited data available that specifically deal with health and wellbeing in the Narrabri region. The available health statistics provided by NSW Health for the Narrabri LGA were reviewed and compared with statistics for the whole of NSW.

The data indicate that the population in the Narrabri LGA has a higher rate of hospitalisation attributable to alcohol, body mass and diabetes. Cardiovascular disease deaths and the overall death rate are also relatively high when compared with the NSW population as a whole.

26.2.10 Recreational values

Narrabri is known as the gateway to 'the Pilliga', an agglomeration of forested areas covering over 500,000 hectares, around Coonabarabran, Baradine and Narrabri. The Pilliga is known for its recreational features and land uses, including:

- bird watching
- wildflower appreciation
- bushwalking
- hunting
- bike riding
- camping
- picnicking.

In relation to the project area, recreational features and land uses are most common west of the Newell Highway and south of the project area in Pilliga East State Forest. Yarrie Lake is a key visitor attraction within the project area, and is highly valued by the local community.

Other key recreational values occur within the Narrabri region, outside of the project area. The Narrabri region also offers historical and heritage sites such as the CSIRO Australia Telescope, museums, galleries and sport and recreational facilities. A number of recreational uses are also associated with the social infrastructure and services in the Narrabri LGA identified in Section 26.2.8.

The Siding Spring Observatory is a research facility and tourist attraction located approximately 78 kilometres from the southern end of the project area in the Warrumbungle LGA. The observatory is an active research facility that also attracts day time tourists and visitors.

26.3 Potential impacts

26.3.1 Project workforce

About 1,300 workers would be employed during the peak construction phase of the project, which would occur over of the initial three to four years of the project. Of those, about 1,050 would be responsible for the general construction of the project while the remaining 250 would be responsible for drilling gas wells.

The estimated workforce sourcing and accommodation arrangements in this period are summarised in Table 26-6. It is expected that 25 per cent of the general construction workforce would be rostered off at a given time, meaning the associated accommodation requirements at a given time would likely be less than the estimated peak workforce.

Table 26-6 Workforce during the initial three to four years

Workforce	Estimate	Estimated proportion (%)	Source	Accommodation within Narrabri
General construction	1,050	10	Narrabri and immediate region[a]	Existing dwellings
		20	Wider region[b]	Workers' accommodation facilities in Narrabri[c]
		65	NSW	
		5	Interstate	
Drilling	250	100	NSW and interstate	Westport workers' accommodation and existing workers accommodation in Narrabri

[a] Within Narrabri or a one-hour drive from the project

[b] LGAs of Gunnedah, Liverpool Plains, Tamworth, Uralla, Armidale Dumaresq, Glen Innes Severn, Inverell, Gwydir, Moree Plains, Walgett, Coonamble, Gilgandra, Warrumbungle and Dubbo

[c] Purpose-built facilities such as the privately operated camp in Narrabri

After the initial three to four years, the project workforce would reduce to about 345 workers to support the operation of the project and ongoing construction.

Of those, about 200 would be responsible for the general operation of the project, 100 would be responsible for the ongoing drilling of gas wells, while the remaining 45 would be responsible for the ongoing construction of well pad infrastructure, gas and water gathering lines. The anticipated sourcing and accommodation arrangements in this period are summarised in Table 26-7.

Table 26-7 Workforce after the initial three to four years

Workforce	Total	Proportion (%)	Source	Accommodation
General operations	200	25	Existing roles already in Narrabri[a]	Existing dwellings
		20	Narrabri and immediate region[b]	Existing residents
		25	Relocated from wider region[c], NSW or interstate	Housing in Narrabri
		25	Administration support in existing Santos offices in major capital cities	Adelaide, Brisbane and / or Sydney
		5	Wider region[c], NSW or interstate	Short-term accommodation in Narrabri
General construction	45	10	Narrabri and immediate region[b]	Existing dwellings[a]
		90	Wider region[c], NSW or interstate	Workers' accommodation facilities in Narrabri
Drilling	100	100	NSW and interstate	Westport workers' accommodation and existing workers accommodation facilities in Narrabri

[a] Existing Narrabri operations team

[b] Within Narrabri or within a one-hour drive from the project; includes existing Narrabri operations team

[c] LGAs of Gunnedah, Liverpool Plains, Tamworth, Uralla, Armidale Dumaresq, Glen Innes Severn, Inverell, Gwydir, Moree Plains, Walgett, Coonamble, Gilgandra, Warrumbungle and Dubbo

26.3.2 Community characteristics

A proportion of the construction workforce with specialised skills would be non-resident workers from outside the Narrabri LGA (refer to Table 26-6). As such, the project would generate an increase in the non-resident population during the initial three to four years. The non-resident workforce during operation is anticipated to include relatively low proportions of workers sourced outside the local area, fly-in fly-out workers, and the specialised drilling workforce (refer to Table 26-7).

The presence of a non-resident workforce would not be unusual or unprecedented in the Narrabri community. The Narrabri region has a history of short-term increases in workforce and population to support major projects. More recently this has included the construction of Narrabri North Mine, construction of Narrabri Hospital, expansion of Boggabri Mine and construction of Maules Creek Mine.

The increase in non-resident, typically single male population has the potential to impact on community values through potential anti-social behaviour and / or impacts on community cohesion. Consultation with Narrabri Police and members of the community indicated that while such impacts had occurred on occasion, non-resident workforces are generally well behaved. It is recognised that workforce management by mining and resource companies effectively mitigate these potential impacts.

The 200 general operations workers required for the project would include a mix of existing roles already based in Narrabri, support roles based in Sydney, Brisbane and Adelaide and new roles that would be created over the life of the project. Generally, employees would be sought from the local area with training programs instigated where skills are not currently available. It is anticipated that about 50 workers would relocate to Narrabri for employment during the operation of the project, effectively becoming permanent residents and members of the local population. Assuming an average Australian family of 2.6 persons, the permanent population of Narrabri is anticipated to increase by about 130 persons. This represents a 1.7 per cent equivalent increase in population within the township of Narrabri. It is expected that this increase in population would be accommodated within existing infrastructure and services currently available.

Consultation with Narrabri Shire Council, Narrabri Chamber of Commerce and representatives of community groups indicated that the increase in the resident population would benefit the community. In particular, jobs created by the project were seen as an incentive for young people in the region to move, or return, to Narrabri in pursuit of professional employment.

Studies undertaken on natural gas development in Condamine indicated that while farmers had concerns about the potential impacts of the development, there was a level of tolerance and resilience within the community and no clear evidence that stressors were dividing existing communities (Coote 2013). Nonetheless, mitigation and management measures would be implemented by the project to mitigate and manage potential social and health impacts and safeguard against impacts on community cohesion (refer to Section 26.4).

26.3.3 Housing and accommodation

A proportion of the construction workforce with specialised skills would be non-resident workers that would be accommodated at camp facilities in the township of Narrabri, or Westport workers' accommodation. As such, the project is not anticipated to significantly impact the demand for housing and accommodation during construction. The township of Narrabri already hosts a large, privately operated accommodation camp with capacity for 500 people (and approval to expand to 900 people), to help manage the impacts of a non-resident workforce.

During operations, employees relocating with their families would find accommodation within existing housing stock in Narrabri. It is expected that employees would relocate progressively over the project. Based on the record of house sales in Narrabri (refer to Section 26.2.7), it is anticipated that the housing market would have sufficient capacity to absorb the new residents.

The project would source a relatively small proportion of non-resident workers during the operational phase. These non-resident workers would continue to occupy workers' accommodation facilities and the Westport workers' accommodation in the project area.

Real estate agencies in the township of Narrabri identified three future housing developments that would further increase accommodation availability for the project workforce.

26.3.4 Social infrastructure and services

Significant population increases may place additional demand on health and emergency social infrastructure. However, it is anticipated that the non-resident workforce would generally address their regular health needs at their place of permanent residence. Therefore, it is anticipated that the workforce during construction would not place significant additional demands on existing health infrastructure and services in the Narrabri LGA.

The estimated 50 workers who permanently relocate to the township of Narrabri for the operation of the project would require health infrastructure and services. Consultation with Narrabri District Health Service and other medical service providers indicated that an increase in the population of this order would be unlikely to adversely impact their ability to serve the wider community.

It is not anticipated that the project would regularly require emergency services. Consultation with NSW Fire and Rescue Services and the NSW Rural Fire Service in Narrabri indicated that the project would not impede their capability to service the wider community. The local ambulance and police services also indicated that they anticipate minimal calls from the project sites or workforce and would be able to respond in the unlikely event of additional demand from the project.

As the project is not expected to directly impact on the health of the existing population or project workforce (refer to Section 26.3.6), associated increases in demand on health infrastructure and services are not expected.

26.3.5 Recreational values

Potential impacts on the recreational values of Yarrie Lake would be avoided through detailed design of the project and by implementing the Field Development Protocol (refer to Appendix C). A surface development exclusion zone of 200 metres would be established around Yarrie Lake and its reserve area.

Due to the diffuse nature of the gas field, potential impacts on recreational values would be characterised by a limited and temporary restriction of access during construction, as opposed to a wholesale change of land use. The potential for impacts to occur would be limited as the identified values (such as bird watching, bushwalking or camping) would occur over a wide area. Potential impacts on access would be transient, as construction activities progress through the gas field.

The project is not anticipated to have social impacts on the Siding Spring Observatory due to its distance from the project area.

26.3.6 Health and wellbeing

Concerns about a range of potential health and wellbeing impacts were raised during stakeholder and community consultation for the Narrabri Gas Project. These issues encompassed those identified in the *Independent review of coal seam gas activities in NSW* (NSW Chief Scientist and Engineer 2013 and 2014) and broadly included potential impacts relating to air quality, water quality, land contamination, noise, hazards (including bushfire) and the community (namely stress and anxiety). These issues and their potential pathways of exposure to humans are presented in Figure 26-2. The potential impacts on health and wellbeing were assessed in the Health Impact Assessment for the project (refer to Appendix T2).

Air quality

As shown in Figure 26-2, the potential health impact of the project with regard to air quality would be the inhalation of air emissions during construction and operation. An air quality assessment was undertaken (refer to Appendix L) that assessed predicted concentrations of air emissions at sensitive receivers (occupied residences) against relevant air quality criteria, primarily for the protection of human health. The assessment found that the residual risk of the project with regard to air quality would be low.

The main air emission during construction was assessed to be fugitive dust from construction sites, while the main air emission during operation was assessed to be oxides of nitrogen from generators at well pads, safety flares, the power generation facility and boilers in the central gas processing facility. These air emissions were assessed to be the most likely to approach the relevant air quality criteria, and therefore defined the distance at which the relevant air quality criteria for all other emissions would be met.

The assessment found that during construction the distance between sensitive receivers and construction sites would be sufficient to achieve compliance with the relevant air quality criteria in most cases. Where necessary, the risk of exceedance could be reduced through the implementation of mitigation measures in the Air Quality Management Plan, such as increased water or chemical coating of disturbed soil surfaces. Air emissions during operation of the project are expected to meet the relevant air quality criteria at all identified sensitive receivers.

The potential air impacts of the project are discussed further in Chapter 18.

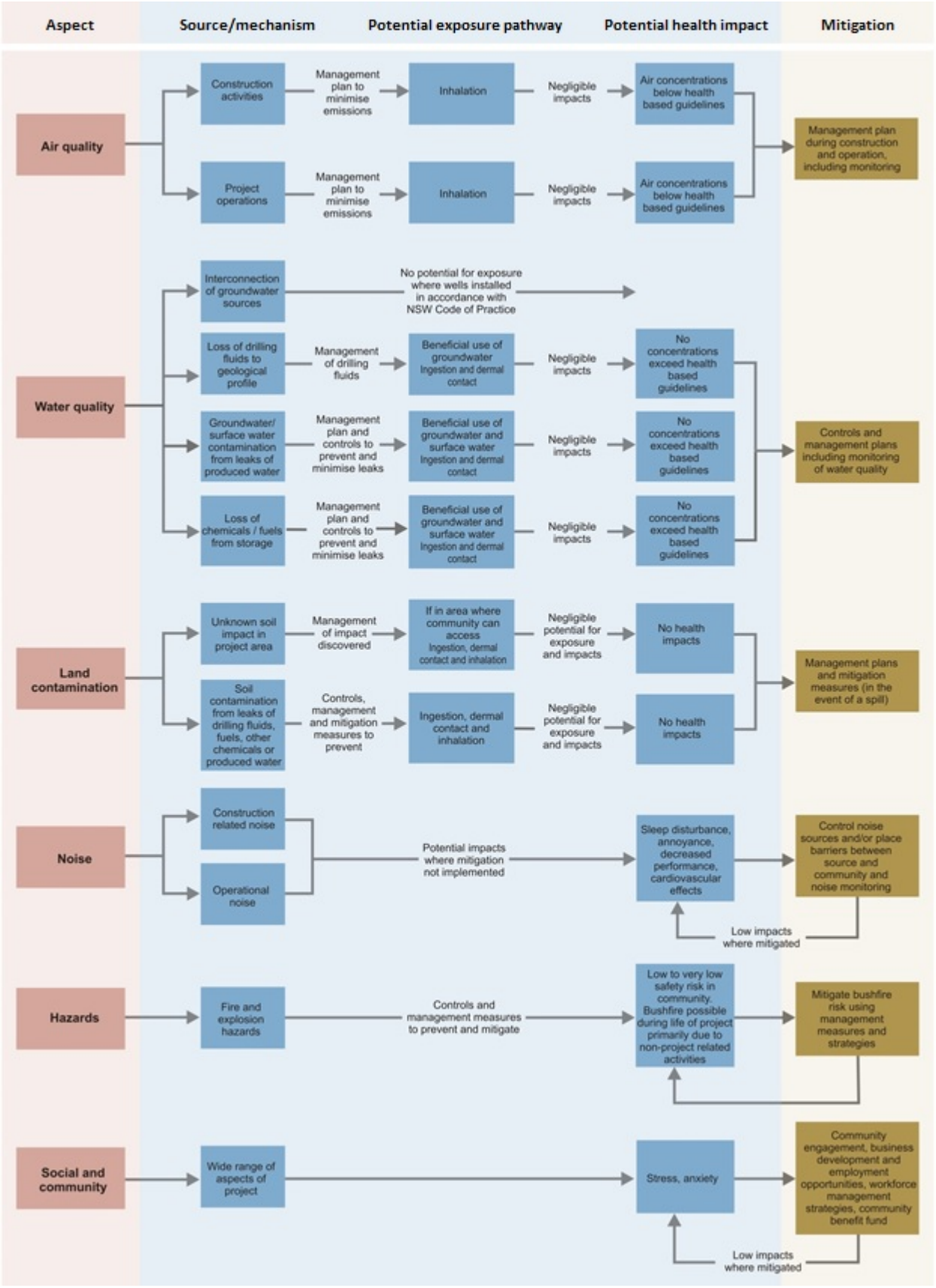

Figure 26-2 Potential health impacts and exposure pathways

Water quality

Interconnection of groundwater sources

A groundwater impact assessment was undertaken that assessed the potential for the construction and operation of gas wells to impact groundwater (refer to Chapter 11 and Appendix F). The assessment concluded that the potential for interconnection of groundwater sources and subsequent flow would be low. All lines of evidence indicate that registered groundwater extraction bores in the project area target the Pilliga Sandstone or overlying aquifers, which are separated from the target groundwater units by numerous, relatively impermeable geological layers (refer to Chapter 11 and Appendix F).

The potential interconnection of groundwater sources would occur during drilling and completion of gas wells. Depressurisation of target groundwater units would have the potential to cause imperceptible quantities of groundwater to flow from relatively shallow groundwater aquifers (where water quality is relatively good) to the deep target groundwater units (where water quality is relatively poor). Degradation of groundwater quality in the relatively shallow groundwater aquifers would not be anticipated given this predicted direction of flow.

In addition to the geological barriers, gas wells would be drilled in accordance with the *Code of Practice for Coal Seam Gas: Well Integrity* (DTIRIS 2012), which sets a number of engineering requirements to establish zonal isolation, further preventing flow between groundwater units.

Overall, the risk impacts to human health due to groundwater flow between target groundwater units and shallow groundwater aquifers would be low.

Loss of chemicals including drilling fluids

A chemical risk assessment report was undertaken (refer to Appendix T3) which assessed the potential for loss of chemicals including drilling fluids and subsequent potential impacts on human health. The assessment concluded that the proposed use of chemicals including drilling fluids posed a low risk to human health due to the engineering controls and monitoring that would be in place, the limited possibility for human contact with leaks or spills, and the dilution or degradation that would typically occur in the unlikely event of a loss.

The potential for loss of drilling fluids occurs during drilling of gas wells. During drilling and prior to well casing, drilling fluids would have the potential to come into contact with the surrounding geological profile and groundwater. Loss of drilling fluid to shallow groundwater in particular would have the potential to impact human health where the affected groundwater is used for domestic uses or human consumption. Such losses would be prevented by standard engineering controls and drilling practices. Gas wells would be lined with steel casing and cement, while drilling fluids at the surface would be stored in impervious tanks or lined pits. The balance of drilling fluids would be monitored during drilling in order to detect losses and corrective action would be performed if a loss were registered. Therefore, it is very unlikely that drilling fluids would be released to groundwater or surface water in significant volumes.

In the unlikely event of a more than negligible loss of drilling fluids, its viscosity would limit its movement through the geological profile or groundwater. Exposure pathways relevant to human health would only be possible where groundwater bores or surface water bodies are located in close proximity to the drilling locations. These exposure pathways would be limited, particularly within the Pilliga State Forest where bores are limited and watercourses are ephemeral in nature. Regardless, the fluids would be subject to dilution or chemical reactions that would further reduce the risk of human health impacts. The drilling fluids used in the project would comprise low toxicity, generally inert substances that are broadly utilised by the petroleum and gas industry and drilling for other industries. In NSW, the proponent currently uses water-based drilling fluids, rather than oils or other synthetic fluids. Water typically comprises 70 to 80 per cent of the drilling fluids with the remainder made up of weighting agents (bentonite clay, or

starch and cellulose), common additives (primarily salts) and a small amount of other chemicals (refer to Chapter 6).

None of the chemicals contained in typical drilling fluids exhibit the combination of persistence, bioaccumulation and toxicity that would make them major concerns for human health. As such, all of the chemical compounds are expected to:

- degrade in the subsurface to non-toxic compounds
- react with other materials to yield non-toxic compounds
- exist in non-toxic forms (such as salt).

Overall, no human health impacts are expected due to the generally benign chemical characteristics of the drilling fluids and the low likelihood of a significant loss and migration of drilling fluids occurring.

Loss of produced water

Impacts to human health as a result of loss of produced water (groundwater extracted from target coal seams) would be very unlikely due to:

- the chemical properties of the extracted groundwater
- the design and operational controls that would be in place to minimise the likelihood of spills or leaks (refer to Chapter 14 for mitigation and management controls)
- the chance of a leak or spill occurring in an area that provides a pathway to human contact
- the chance of a leak or spill being sufficiently large or long in duration prior to detection
- the dilution that would occur in the unlikely event of a leak or spill
- the type of contact that would occur in the very unlikely event of human contact.

A screening level review of data from existing operations in the project area (refer to Appendix T2), assessed produced water in its undiluted form against the recreational water guidelines. The recreational water guidelines are typically quantified as 10 times the Australian Drinking Water Guidelines to adjust for an incidental ingestion rate of 0.2 litres per day. The adoption of these guidelines is conservative as the guidelines assume that this incidental ingestion occurs every day for a lifetime, whereas in the very unlikely event of human exposure to produced water, the exposure would be an isolated occurrence. The screening level review found the produced water complied with the adopted guidelines for all parameters even before dilution occurs, excluding salinity and alkalinity (which are related). The guidelines for salinity and alkalinity are an aesthetic guideline that relates to palatability and maintenance of infrastructure like water pipelines, rather than health effects. For context, the salinity of produced water is above that normally found in fresh water but is not as high as the salinity of the ocean.

Leaks or spills of produced water are considered unlikely given design and operational level controls and monitoring, in accordance with relevant guidelines and standards, which would form part of the project. For example, produced water / brine ponds would be double-lined, with seepage collection pumps installed between liners and beneath the secondary liner. Water gathering lines would be designed and situated with consideration to their proximity to watercourses, where practicable. Produced water infrastructure would be tested prior to operations and leak detection / pressure monitoring systems would be in place to detect losses of produced water and trigger corrective action and remediation. Furthermore, produced water pressure at the well head and within underground water gathering lines is low. Leewood and Bibblewindi produced water and brine pond design would meet or exceed the requirements in the *Exploration Code of Practice: Produced Water Management, Storage and Transfer* (NSW Department of Industry, Skills and Regional Development 2015c).

The potential pathways for human contact with produced water include watercourses and groundwater resources. Water management infrastructure in proximity to a watercourse would be limited to the relatively small sections of water gathering lines at watercourse crossings. The likelihood of a substantial loss of produced water in these areas would be accordingly low, and would require flow to be occurring in the watercourse at the time of the loss to provide a pathway to human contact. Losses of produced water to a groundwater resource could occur in the event of a sustained loss from a pond or water gathering line. In these cases, it is unlikely that such a spill would occur and continue undetected given the management and monitoring practices that are put in place. If a leak is detected it would be isolated and repaired.

The produced water could be encountered either through recreational contact (such as swimming) or extraction for potable or domestic use. Both scenarios would require the produced water to enter a watercourse of groundwater resource. The likely distance between the point of loss and the point of potential human contact would mean that substantial dilution would occur prior to contact.

Overall, no human health impacts are expected due to the low likelihood of a loss of produced water occurring under the circumstances that would lead to human contact and the generally benign chemical characteristics of produced water, especially given the likely dilution that would occur prior to contact.

Loss of fuels or other chemicals from storage

This risk of accidental spills of fuels or other chemicals would be managed by standard operating procedures, protocols and inductions. Bunding in accordance with Australian Standards would be installed at hydrocarbon and chemical storage facilities to contain potential spills. Refuelling would not occur within 40 metres of a watercourse, and with suitable containment when volumes greater than 50 litres are involved. The distance between major infrastructure and watercourses would also reduce the health risk of spills, with Bibblewindi approximately two kilometres distant and Leewood approximately 400 metres distant from their nearest watercourse respectively. As such, the human health risk associated with spills of fuels or other chemicals is low.

Refer to Chapter 25 and Appendix S for additional information.

Land contamination

As shown in Figure 26-2, the potential health impact of the project with regard to land contamination would be interaction with pre-existing land. The risk of spills of hydrocarbons and chemicals is assessed in Chapter 14, Chapter 25 and Appendix S.

A contaminated land assessment was undertaken (refer to Chapter 14 and Appendix I3) which assessed the risks of interaction with pre-existing land contamination. The assessment concluded that the risk of impacts with regard to land contamination would be generally low because potential land contamination would occur sparsely in the project area and would be readily avoided, mitigated and managed.

Noise

As shown in Figure 26-2, the potential health impact of the project with regard to noise would be generation of noise during construction and operation with the potential to exceed the relevant noise criteria at a sensitive receiver. A noise assessment was undertaken (refer to Chapter 19 and Appendix M) that assessed predicted noise levels at sensitive receivers against relevant noise criteria, primarily for the protection of human comfort and health (including sleep).

Noise would be managed during construction and operation so that it complies with the noise limits identified in Chapter 19, unless subject to a private negotiated agreement with a landholder. The noise

limits would be achieved through the siting of field infrastructure and / or the implementation of all reasonable and feasible measures. Given this commitment to meet the relevant noise limits during construction and operation, the residual risk to human health with regard to noise would be low. The potential noise impacts of the project are discussed further in Chapter 19.

Hazards

The risk of hazardous events is assessed in detail in Chapter 25 and Appendix S. Key findings are that:

- The chance of an uncontrolled loss of containment of gas leading to a fire or explosion causing exposure to heat or explosion overpressure at sensitive receptors would not exceed 50 chances in a million per year. This would meet the risk criteria defined in Hazardous Industry Planning Advisory Papers under *State Environmental Planning Policy No 33—Hazardous and Offensive Development.*
- The chance of an uncontrolled loss of containment of liquid chemicals or dangerous goods leading to injury at sensitive receptors would not exceeding 10 chances in a million per year (or 50 chances in a million per year for irritation). This would meet the risk criteria defined in Hazardous Industry Planning Advisory Papers under *State Environmental Planning Policy No 33—Hazardous and Offensive Development.*
- The risk of sudden loss of containment of significant quantities of water resulting from catastrophic failure of a pond wall is very low as they would be designed in accordance with Australian Standards, guidelines set by the Australian Committee on Large Dams (ANCOLD) and the procedures and guidelines of the NSW Dam Safety Committee.
- A large scale bushfire, whether from project activities or other sources, would present threats including loss of life or injury, loss of property and community infrastructure, and impacts on commercial livelihoods including agriculture. As such, the overall risk associated with a bushfire is considered medium due to the inherent potential consequences, and despite the remote likelihood the project causing a bushfire. Bushfire risk would be made as low as reasonably practicable through the implementation of a Bushfire Management Plan prepared in conjunction with landholders, the Forestry Corporation of NSW and the NSW Rural Fire Service. The Plan would formalise and build on measures informed by the proponent's participation in the Resource Industry Fire Management Group.

Community

As shown in Figure 26-2, potential health impacts with regard to the community would relate to increased stress or anxiety that could stem from a range of project aspects. A review of prior studies into stress and anxiety within communities near natural gas developments was undertaken as part of the health impact assessment (refer to Appendix T2).

Coote (2013) undertook a survey of farmers in the Condamine area in Queensland. The study specifically looked at levels of stress from a range of sources, including common stressors in rural areas such as droughts, floods, and financial fluctuations. The study indicated that while farmers have concerns about the impacts of natural gas developments there is a level of tolerance and resilience in the community and no clear evidence that the levels of stress are dividing existing communities.

Queensland Health (2013) conducted a review of health complaints among residents in the Tara region to determine whether the health complaints were attributable to natural gas activities in surrounding areas. The assessment evaluated health complaints reported to the Darling Downs Public Health Unit and environmental monitoring data (air, water, soil and noise) for the area. The predominant symptoms reported in the community were headaches, eye irritations, nosebleeds and skin rashes. The outcome of the assessment was that there was no clear link between the health complaints in the Tara region and the impacts of the natural gas industry on air, water or soil.

Community health impacts would be avoided, mitigated and managed through consultation with affected landholders (formalised in Land Access Agreements and Farm Management Plans). A range of policies, strategies and initiatives would also be implemented to maximise potential benefits and opportunities of the project at a broader level, while minimising negative social and health impacts. As such, the overall risk associated with community health impacts is low.

26.3.7 Socio-economic impacts

It is anticipated that the project would generate economic benefits at the local, regional and State levels. The project would increase the real economic output of the Narrabri LGA by $11.9 billion (refer to Chapter 27). In particular, the project would

- create employment opportunities
- create opportunities for local business, as suppliers of goods and services to the project
- introduce a Gas Community Benefit Fund to stimulate local and regional businesses and support major projects and physical and community infrastructure in the local area (refer to Section 26.4).

Adequate and relevant training opportunities are available in the region of the project. Appropriate training for technical skills in particular is available at Tamworth TAFE. State and Commonwealth programs are in place that assist with fees and other expenses associated with training. In addition, training, scholarship and apprenticeship programs would be implemented in consultation with local institutions to provide career pathways for Narrabri locals.

The project may compete with employment sectors such as agriculture and forestry, mining and manufacturing, and construction (refer to Section 26.2.6). The mining industry in particular may face competition for labour from the project. The source of labour for the project is expected to be dispersed, while peak labour demand would be restricted to the peak construction phase, lasting around three years.

The potential competition impacts during the operation of the project would be relatively minor, considering the reduced workforce requirement compared to construction and the existing labour pool involved in Narrabri and surrounding areas. The economic impacts of the project are discussed in detail in Chapter 27.

26.3.8 Landholder impacts

Private land would be accessed as per the *Agreed Principles of Land Access* (NSW Government 2014b), to which the proponent is a signatory, along with AGL, NSW Farmers Association, Cotton Australia, Dairy Connect, the Country Women's Association of NSW and the NSW Irrigators Council. The *Agreed Principles of Land Access* would avoid impacts on landholders and sensitive receivers as follows.

- Any landholder must be allowed to freely express their views on the type of drilling operations that should or should not take place on their land without criticism, pressure, harassment or intimidation. A landholder is at liberty to say "yes" or "no" to the conduct of operation on their land.
- Gas companies will respect a landholder's wishes and not enter onto a landholder's property to conduct drilling operations where that landholder has clearly expressed the view that operations on their property would be unwelcome.
- The parties will uphold a landholder's decision to allow access for drilling operations and do not support attempts by third-party groups to interfere with any agreed operations. The parties condemn bullying, harassment and intimidation in relation to agreed drilling operations.

Potential impacts on landholders in the project area would include:

- Land use, land access and management, land productivity and economic viability (including heightened cost of labour). These impacts would be particularly relevant to agricultural properties in the project area. Actual loss of income would be offset through the implementation of compensation provisions contained in Land Access Agreements made with landholders. A case study of landholder compensation indicated that compensation would clearly recompense landholders for loss of agricultural productivity. Impacts on agricultural properties have been assessed in an agricultural impact statement (refer to Appendix K).
- Additional demand on time for project related matters, loss of privacy due to presence of project workforce and uncertainty related to project timing. These would be effectively managed as no field infrastructure would be placed on a property without written agreement from the landholder, effective ongoing consultation with the affected landholders and payment for legal advice.
- The potential to disrupt certain values that contribute to the existing lifestyle of landholders, particularly during construction and to a lesser extent during operation. Values that contribute to lifestyle in the project area that may be degraded by the project include:
  - the distance between sensitive receivers and construction sites would be sufficient to achieve compliance with the relevant air quality criteria in most cases. Where necessary, the risk of not complying with the criteria would be reduced through the implementation of mitigation measures in the Air Quality Management Plan. Air emissions during operation of the project are expected to meet the relevant air quality criteria at the boundary of all operational sites, hence all identified sensitive receivers. The potential air impacts of the project are assessed in Chapter 18
  - noise would be managed to an acceptable level with the implementation of mitigation and management measures, or otherwise through private negotiated agreements with potentially affected landholders. The potential noise impacts of the project are assessed in Chapter 19
  - visual amenity impacts would be readily avoided, managed and mitigated through the placement of infrastructure in consultation with landholders and the adoption of appropriate lighting standards. Potential impacts on visual amenity are assessed in detail in Chapter 23.

26.3.9 Post-closure

The eventual closure of the project would represent the removal of a source of economic value-add and income. This has the potential to affect employees and business that would benefit from the operation of the project and could subsequently lead to demographic changes if individuals and their families leave the region seeking other opportunities.

The significance of the changes would depend on the socio-economic state of the region at the time. The Gas Community Benefit Fund would make a significant contribution to the region that could provide lasting benefits well beyond the life of the project.

26.4 Mitigation and management

A range of policies, strategies and initiatives would be implemented to maximise potential benefits and opportunities of the project, while minimising negative social and health impacts. The mitigation and management measures are described further below and Table 26-8 sets out the anticipated effectiveness of each measure at reducing the level of environmental risk posed by the project.

The mitigation and management measures may be read in conjunction with the measures to safeguard public health and amenity with regard to water quality (refer to Chapter 11 and Chapter 12), soils and land

contamination impacts (refer to Chapter 14), air quality (refer to Chapter 18), noise (refer to Chapter 19), traffic and road safety (refer to Chapter 22) and visual amenity (refer to Chapter 23).

The project would support local businesses and local employment during the construction and operation stages. The involvement of local business and contractors in the project would be supported through a procurement and logistics policy. A procurement and contracts officer would work with local businesses to help local business and contractors comply with environment, health and safety standards necessary for participation in the project. It is envisaged that forums currently held annually to support local business and contractor involvement would continue to occur.

The proponent would provide timely and accessible information regarding the project to the community and stakeholders as well as mechanisms for feedback.

Throughout the life of the project, consultation with landholders or leaseholders would continue to occur regarding activities on their land. All activities would be undertaken in accordance with Land Access Agreements and Farm Management Plans in place. Compensation would be provided to landholders for work undertaken on their properties. A public fact sheet that further describes the project landholder engagement is reproduced in Appendix T1.

Workforce management strategies would also be implemented to promote the health, safety and wellbeing of the project workforce, and their integration with the Narrabri community. Key measures would include:

- a code of conduct applying to all workers during the construction and operation of the project
- programs that promote community integration for workers and their families relocating to Narrabri through increased support and partnership with local community organisations
- scholarship, training and apprenticeship programs in consultation with local institutions to provide career pathways for Narrabri locals through training and up-skilling.

Although the impacts of the project on housing and accommodation are not expected to be significant, workforce housing and accommodation strategies would be implemented and be adapted as needed throughout future project planning phases.

A Gas Community Benefit Fund would be established which would receive an estimated $120 million through the life of the project. The proponent will continue to work in partnership with local communities and invest in social infrastructure and economic development opportunities that address impacts created by the project and / or leave a positive legacy for the local communities. The proponent will continue to engage with Narrabri Council and the State Government to finalise the Gas Community Benefit Fund arrangements including administration and governance and the process for identifying projects. The Gas Community Benefit Fund could provide lasting benefits well beyond the life of the project.

Social impacts would be monitored throughout the construction and operation of the project. The mitigation and management measures described above and summarised in Table 26-8 would be implemented adaptively to changing conditions or emergent social impacts.

Table 26-8 Environmental risk assessment

Potential impact	Phase	Pre-mitigated risk			Mitigation and management measures	Residual risk		
		Likelihood	Consequence	Risk		Likelihood	Consequence	Risk
Impact of workforce on community values	Construction	Possible	Minor	Low	A procurement and logistics strategy will be implemented. An Aboriginal engagement strategy will be implemented to maximise Aboriginal employment including for contractors. A complaints and dispute resolution process will be implemented. Land Access Agreements and Farm Management Plans will be developed in consultation with affected landholders. Construction workforce housing and accommodation strategies will be implemented. The proponent will contribute to a Gas Community Benefit Fund in accordance with the NSW Gas Plan. Surface infrastructure will be excluded from Yarrie Lake and a buffer of at least 200 m around Yarrie Lake. See also measures to safeguard public health and amenity with regard to water quality, soils and land contamination, air quality, noise, road safety, visual amenity and bushfire in	Unlikely	Negligible	Very low
	Operation	Unlikely	Minor	Low		Remote	Negligible	Very low
	Decommissioning	Remote	Negligible	Very low		Remote	Negligible	Very low
Impact on housing and accommodation availability and affordability	Construction	Possible	Minor	Low		Possible	Minor	Low
	Operation	Almost certain	Minor	Medium		Almost certain	Minor	Medium
	Decommissioning	Unlikely	Negligible	Very low		Unlikely	Negligible	Very low
Impact on social infrastructure and services	Construction	Remote	Negligible	Very low		Remote	Negligible	Very low
	Operation	Remote	Negligible	Very low		Remote	Negligible	Very low
	Decommissioning	Remote	Negligible	Very low		Remote	Negligible	Very low
Impact on recreational activities	Construction	Possible	Minor	Low		Possible	Negligible	Very low
	Operation	Unlikely	Negligible	Very low		Unlikely	Negligible	Very low
	Decommissioning	Unlikely	Negligible	Very low		Unlikely	Negligible	Very low
Impact on health and wellbeing	Construction	Unlikely	Minor	Low		Unlikely	Minor	Low

Potential impact	Phase	Pre-mitigated risk			Mitigation and management measures	Residual risk		
		Likelihood	Consequence	Risk		Likelihood	Consequence	Risk
	Operation	Unlikely	Minor	Low	Chapters 12, 14, 18, 19, 22, 23 and 25 respectively.	Unlikely	Minor	Low
	Decommissioning	Unlikely	Minor	Low		Unlikely	Minor	Low
Management of amenity on land hosting infrastructure through compensation and adherence to noise management criteria	Construction	Possible[a]	Minor	Low		Almost[b] certain	Minor (positive)	Medium (positive)
	Operation	Remote	Negligible	Very Low		Almost certain	Moderate (positive)	High (positive)
	Decommissioning	Unlikely	Negligible	Very Low		Almost certain	Moderate (positive)	High (positive)
Changes to lifestyle and amenity of neighbouring landholders	Construction	Possible	Minor	Low		Possible	Negligible	Low
	Operations	Unlikely	Negligible	Very Low		Unlikely	Negligible	Low
	Decommissioning	Unlikely	Negligible	Very Low		Unlikely	Negligible	Very Low
Potential additional demand on time of landholders hosting project infrastructure, loss of privacy due to presence of workforce on property and uncertainty about the project.	Pre-construction	Likely	Minor	Medium		Possible	Minor	Low

Potential impact	Phase	Pre-mitigated risk			Mitigation and management measures	Residual risk		
		Likelihood	Consequence	Risk		Likelihood	Consequence	Risk
Socio-economic benefits of the project including job creation, job diversity and increased local spending, funds for community infrastructure through the Gas Community Benefit Fund.	Construction	–	–	–		Almost certain	Major (positive)	Very high (positive)
	Operation	–	–	–		Almost certain	Major (positive)	Very high (positive)
	Decommissioning	–	–	–		Almost certain	Major (positive)	Very high (positive)

[a] Pre-mitigation assessment indicates that it is possible that amenity and lifestyle may be impacted if considered in isolation of project commitments such as the principles of land access, project commitment on meeting noise criteria, and the implementation of noise mitigation strategies including negotiation and compensation

[b] Residual assessment indicates that lifestyle and amenity would be effectively managed through project Field Development Protocol and commitments which will provide net benefits

26.5 Conclusion

The project has the potential to generate a range of socio-economic benefits in the Narrabri LGA, the wider region and NSW. The key social benefits of the project would be job creation, including job diversity, and potential gradual increases in the resident population. Housing and accommodation demands associated with the peak construction phase of the project would largely be met by existing camp facilities in the Narrabri region.

Potential impacts on landholders would be readily avoided, mitigated or managed through consultation with affected landholders, formalised in Land Access Agreements and Farm Management Plans. No gas field infrastructure would be placed on a property without written agreement from the landholder. Social impacts would be monitored throughout the construction and operation of the project, while mitigation and management measures would be implemented in a manner that is adaptive to changed conditions or emergent social impacts.

The potential health and wellbeing impacts from the project were assessed through a Health Impact Assessment (refer to Appendix T2). The health impact assessment found that:

- the residual risk with regard to air quality would be low
- the risk impacts to human health due to groundwater flow between target groundwater units and shallow groundwater aquifers would be negligible
- no human health impacts are expected due to the generally benign chemical characteristics of the drilling fluids and the low likelihood of a significant loss and migration of drilling fluids occurring
- no human health impacts are expected due to the low likelihood of a loss of produced water occurring under the circumstances that would lead to human contact and the generally benign chemical characteristics of produced water, especially given the likely dilution that would occur prior to contact
- the human health risk associated with spills of fuels or other chemicals is low
- the risk of impacts with regard to land contamination would be generally low because potential land contamination would occur sparsely in the project area and would be readily avoided, mitigated and managed
- noise would be managed during construction and operation so that it complies with the noise limits identified in Chapter 19, unless subject to a private negotiated agreement with a landholder. The noise limits would be achieved through the siting of gas field infrastructure and / or the implementation of all reasonable and feasible measures. Given the commitment to meet the relevant noise limits during construction and operation, the residual risk to human health with regard to noise was assessed to be low.

Considering the above, the overall residual health and wellbeing risk was assessed as low.

Residual risks from the social and health impact assessment are shown in Table 26-9.

Table 26-9 Social and health residual risks

Potential impact	Construction	Operation	Decommissioning
Impact of workforce on community values	Very low	Very low	Very low
Impact on housing and accommodation	Low	Medium	Very low
Impact on social infrastructure and services	Very low	Very low	Very low
Impact on recreational activities	Very low	Very low	Very low
Impact on health and wellbeing	Low	Low	Low
Management of amenity on land hosting infrastructure through compensation and adherence to noise management criteria	Medium (positive)	High (positive)	High (positive)
Changes to lifestyle and amenity of neighbouring landholders	Low	Low	Very low
Socio-economic benefits	Very high (positive)	Very high (positive)	Very high (positive)