Chapter 19

Noise and vibration

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19. Noise and vibration

The Secretary's environmental assessment requirements for the Narrabri Gas Project include a requirement to assess potential noise and vibration impacts in accordance with the *Industrial Noise Policy, Interim Construction Noise Guideline* and *NSW Road Noise Policy*. A noise and vibration assessment was undertaken as presented in Appendix M. A predictive noise model was used to assess impacts during the construction and operation of major facilities and gas field infrastructure.

Construction work would generally be undertaken seven days per week during daytime hours, with the exception of drilling and completions activities which have an operational requirement to occur continuously 24 hours per day.

The key findings of the impact assessment in relation to noise were:

- With a small number of exceptions, construction activities for the major facilities of the project are predicted to comply with noise management levels at all sensitive receivers at all times.
- All operational activities of the project would also comply with the noise management level of 35 dB(A), unless otherwise resolved through private negotiated agreements.
- The implementation of noise constraints identified through this assessment have been included within the Field Development Protocol to ensure that noise management outcomes are considered during construction and operation of gas field infrastructure.
- Work can be programmed to manage the small number of potential exceedances through notification and agreements with potentially affected sensitive receivers.
- A surface infrastructure exclusion zone of 200 metres around Yarrie Lake will assist to protect recreational values at this location.
- In the rare occurrence of the safety flares at Leewood or Bibblewindi being required to operate at maximum capacity the intrusive noise criteria may be exceeded at sensitive receivers under adverse meteorological conditions.
- There are a suite of mitigation and management measures available to minimise potential impacts of noise from the construction and operation of the project and these will be considered through the implementation of a Noise Management Plan.
- Based on the nature of the proposed equipment associated with both construction and operation, the project is not expected to generate infrasound (low frequency noise).
- Based on the constraint of no infrastructure being located within 200 metres of a sensitive receiver unless otherwise agreed, the potential for exceedances to the vibration criteria as a result of the project is unlikely.

A predicted exceedance of the noise criteria does not necessarily mean the receiver would be adversely affected or impacted by the noise. Rather, the criteria are proposed to ensure that the potential for noise impacts from the project are identified and then minimised through the implementation of mitigation and management measures.

All feasible and reasonable mitigation measures would be applied to meet the noise management level of 40 dB(A) at occupied residences during standard construction hours (7 am to 6 pm Monday to Friday and 8 am to 1 pm Saturday). Outside of those hours, construction work will meet the noise management level of 35 dB(A) at occupied residences, unless otherwise resolved through private negotiated agreements with landholders. The final selection of noise mitigation measures would depend on the nature of the activities, noise emissions produced and the proximity of the activities to sensitive receivers.

In addition, potentially impacted occupied residences would be notified of the nature of the works, expected noise levels, duration of works and a method of contact to raise noise complaints. It is noted that no complaints were received in relation to construction activities at Leewood or Bibblewindi during the proponent's exploration activities in 2013 and 2014.

Vibration from construction or operation of the project is not predicted to exceed the criteria for human comfort at sensitive receptors given that field development would not occur within 200 metres of a residence, unless subject to a private negotiated agreement.

Based on the assessment undertaken and the project commitment regarding noise criteria at occupied sensitive receivers (unless otherwise agreed in a private negotiated agreement), the noise and vibration impacts from the construction and operation of the project are considered to be low.

19.1 Methodology

The following tasks were undertaken to assess noise generated by the project:

- description of existing environment, including meteorology and background noise
- identification of noise generating equipment and corresponding noise levels
- development of predictive noise models for calm and adverse meteorological conditions
- assessment of predicted noise and vibration levels at sensitive receivers against relevant criteria
- development of mitigation and management measures to control potential impacts.

Existing meteorology and background noise in the project area were described for the purpose of predictive noise modelling. Existing meteorology was described with reference to data from the Bureau of Meteorology. Background noise (including existing road traffic noise) was determined through background noise monitoring in the project area.

Noise generating equipment was identified in accordance with the description of the project (refer to Chapter 6), while traffic generated by the project was quantified with reference to the detailed traffic impact assessment (refer to Appendix P). Associated noise levels were identified with reference to various Australian and British standards, manufacturer data sheets and previous noise assessments. These noise levels were considered to be representative, although final selection of equipment used on the project would occur during detailed design.

Predictive noise models were used in the assessment along with and a number of road traffic noise algorithms. The noise models were used to predict noise levels at sensitive receivers (refer to Section 19.2.2). These noise levels were then compared with relevant criteria, primarily for the protection of human comfort and health (including sleep). The criteria were generally identified from the *Industrial Noise Policy* (NSW EPA 2000) and the *Interim Construction Noise Guideline* (DECC 2009), as appropriate. Additional, issue-specific criteria included road traffic noise criteria under the *Road Noise Policy* (DECCW 2011) and vibration criteria for human comfort *Assessing Vibration: A Technical Guideline* (DEC 2006) or structural damage under German Standard DIN 4150-3:1999 *Structural vibration – Part 3: Effects of vibration on structures*.

Noise from major facilities and infrastructure with predetermined locations was predicted at sensitive receivers and took into account the mitigating effects of structures, topography and vegetation on noise levels. This infrastructure includes Leewood, Bibblewindi, the Bibblewindi to Leewood infrastructure corridor, the Leewood to Wilga Park underground power line, Westport workers' accommodation and the sites of planned road intersection upgrades.

As the precise location of gas field infrastructure would be defined through the implementation of the Field Development Protocol, the noise assessment included a constraints-based approach to guide the siting of wells. Distances required to meet noise management levels at sensitive receivers were calculated for gas field infrastructure, without accounting for the mitigating effects of structures, topography and vegetation on noise levels.

Road traffic noise was modelled taking into account the predicted traffic generation, percentage of heavy vehicles, timing of vehicle movements and road surface types. An assessment of vibration equipment and blasting was undertaken to determine safe work distances.

A detailed methodology, including details on model calibration, is provided in Appendix M.

19.2 Existing environment

19.2.1 Land use

The majority of the project would be located in an area designated under the *Narrabri Local Environmental Plan 2012* as either RU1 (Primary Production) or RU3 (Forestry).

Land use in the Narrabri local government area is dominated by agriculture (54.7 per cent). Other land uses are rural residential development (18.7 per cent), native vegetation (14.6 per cent), irrigated plants consisting predominantly of cotton (11.1 per cent), intensive animal husbandry (0.2 per cent) and extractive industries (0.1 per cent) (refer to Chapter 17 Property and land use).

Brigalow Park Nature Reserve, which is surrounded by the project area though excluded from the project footprint, is designated E1 (National Parks and Nature Reserves).

19.2.2 Sensitive receivers

Noise and vibration sensitive receivers are defined based on the type of occupancy and the activities performed in the land use. In accordance with the *Interim Construction Noise Guideline* (DECC 2009), sensitive noise and vibration receivers within the project area include existing and proposed residences, educational institutes, hospitals and medical facilities, places of worship, commercial or industrial premises and recreational areas.

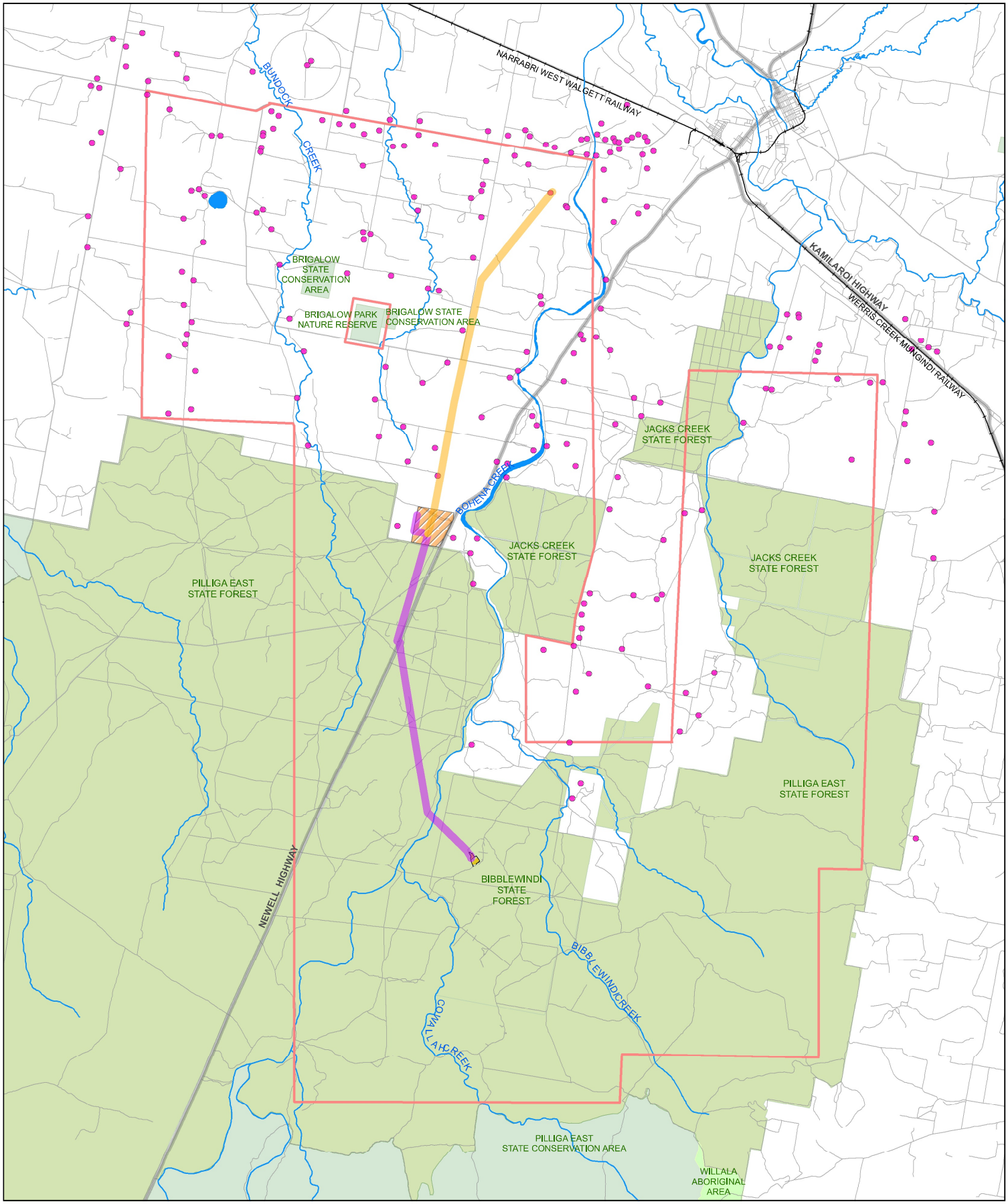
The assessment identified 114 sensitive receivers within the project area at relatively low density. A further 103 sensitive receivers were identified within three kilometres of the boundary of the project area. These sensitive receivers identified in and around the project area are shown in Figure 19-1.

Sensitive receivers surrounding Bibblewindi and Leewood are shown in Figure 19-2 and Figure 19-3 respectively. For the purposes of the assessment no distinction was made as to whether the sensitive receiver was occupied or not. The assessment was completed consistent with the infrastructure placement constraints detailed in the Field Development Protocol (refer to Appendix C), including that no gas wells would be located within 200 metres of an occupied residence.

Noise impacts on fauna are addressed in Chapter 15 Terrestrial ecology.

Yarrie Lake is the primary local visitor attraction in Narrabri local government area that lies within the project area. The landscape elements of the Yarrie Lake area are highly valued by the local community, and it has been considered a passive recreational area from a noise perspective for the project. Consequently, a surface infrastructure exclusion zone of 200 metres surrounding Yarrie Lake is proposed to protect the passive recreational values of the area.

Westport workers' accommodation is not considered to be a sensitive receiver as the occupants would be working on the project and thus higher external noise levels are acceptable. These facilities would be designed to comply with the internal noise criteria presented in *AS2107:2000, Acoustics – Recommended design sound levels and reverberation time for building interiors.*



LEGEND

- Project area
- Leewood
- Bibblewindi
- Parks and reserves
- State forest
- Aboriginal areas
- Lakes and dams
- Watercourses
- Roads
- Train line
- Sensitive receivers
- Leewood to Wilga Park infrastructure corridor
- Bibblewindi to Leewood infrastructure corridor

0 1.75 3.5 7
Kilometers

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 55

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Narrabri Gas Project
Environmental Impact Statement

Sensitive receivers within three kilometres of the project area

Job Number 21-22463
Revision A
Date 25 Jul 2016

Figure 19-1

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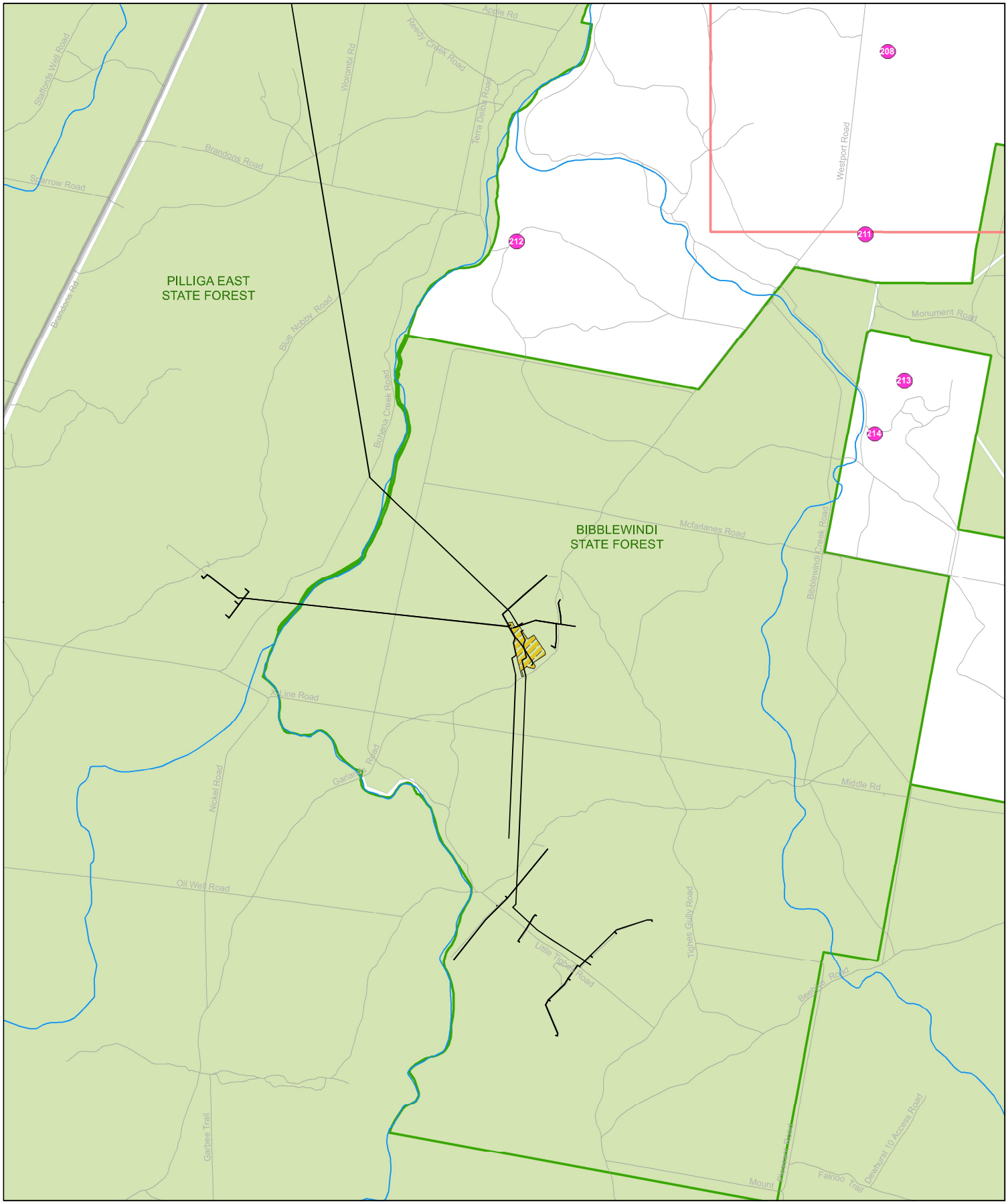
Level 15, 133 Castlereagh Street Sydney NSW 2000 T 61 2 9239 7100 F 61 2 9239 7199 E sydmail@ghd.com.au W www.ghd.com.au

Data source: NSW Department of Lands: DTDB and DCDB - 2012-13. Santos: Operational and Base Data - 2013. Created by: jrichardson



LEGEND

- Project area
- Bibblewindi
- State forest
- Watercourses
- Roads
- Existing pipelines
- Sensitive receivers

0 0.5 1 2
Kilometers

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 55

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Narrabri Gas Project
Environmental Impact Statement

Sensitive receivers surrounding Bibblewindi facility

Job Number 21-22463
Revision A
Date 18 Mar 2015

Figure 19-2

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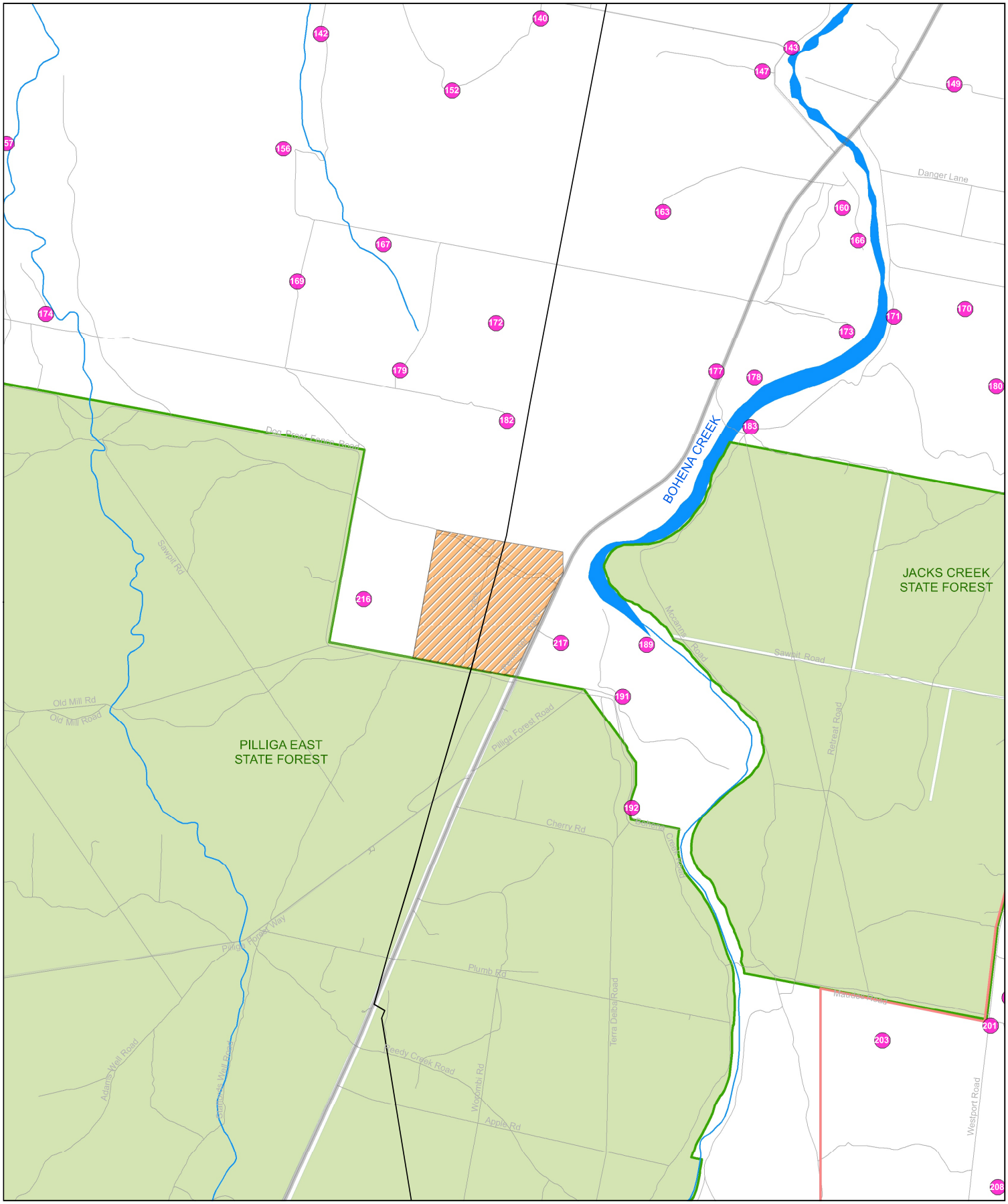
Level 15, 133 Castlereagh Street Sydney NSW 2000 T 61 2 9239 7100 F 61 2 9239 7199 E sydmail@ghd.com.au W www.ghd.com.au

Data source: NSW Department of Lands: DTDB and DCDB - 2012-13. Santos: Operational and Base Data - 2013. Created by: afoddy



LEGEND

- Project area
- Leewood
- State forest
- Lakes and dams
- Watercourses
- Roads
- Existing pipelines
- Sensitive receivers

0 0.5 1 2
Kilometers

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 55

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Narrabri Gas Project
Environmental Impact Statement

Sensitive receivers surrounding Leewood facility

Job Number 21-22463
Revision A
Date 18 Mar 2015

Figure 19-3

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Level 15, 133 Castlereagh Street Sydney NSW 2000 **T** 61 2 9239 7100 **F** 61 2 9239 7199 **E** sydmail@ghd.com.au **W** www.ghd.com.au

Data source: NSW Department of Lands: DTDB and DCDB - 2012-13. Santos: Operational and Base Data - 2013. Created by: afoddy

19.2.3 Existing noise environment

Background and ambient noise monitoring results

Noise monitoring locations are shown in Figure 19-4. Monitoring locations were distributed through the project area to collect data representative of the range of background noise environments. Monitoring locations A and B were positioned within the northern (predominantly agricultural) part of the project area, monitoring location C was positioned nearby Leewood and adjacent to the Newell Highway, while monitoring locations D and E were positioned in the southern (predominantly forested) part of the project area.

Daily noise level tables and charts of the monitoring results are presented in Appendix M. The *Industrial Noise Policy* (EPA 2000) requires that, 'where the rating background level is found to be less than 30 dB(A), then it is set to 30 dB(A)'.

The results of long-term noise monitoring show that the existing noise levels in the study area are consistently below 30 dB(A) except in proximity to the Newell Highway. These findings were consistent with previous noise surveys undertaken in the study area (refer to Figure 19-4). Existing noise sources are typical of the environment including those generated by commercial logging operations, agricultural activities, construction activities at Leewood, gas exploration activities and traffic along the Newell Highway and local roads.

Short-term (15 minute) attended measurements were taken at the long-term monitoring locations to supplement the logger data and identify noise sources. Attended measurement noise levels were also consistent with previous results that found background noise levels to be below 30 dB(A).

Existing road traffic noise

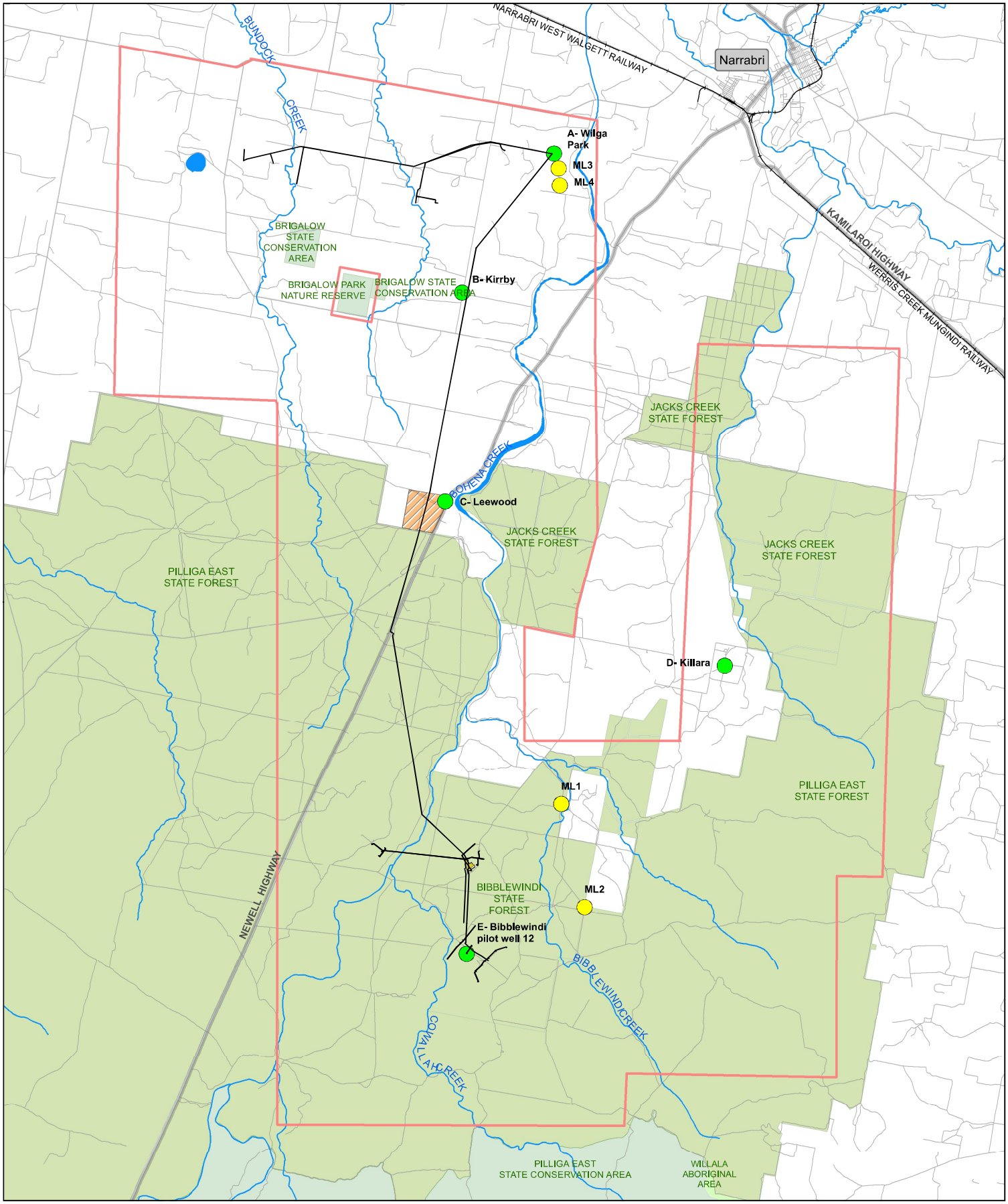
The project area has a mix of State, local and forestry roads. The major road is the Newell Highway, which is a major transport route between New South Wales and Queensland. The road network near the project area also includes the Kamilaroi Highway, McFarlane's Road, Rockdale Road, Westport Road, X- Line Road, Beehive Road and Old Mill Road.

Table 19–1 presents the road traffic noise descriptors for noise monitoring locations B and C. Monitoring location C was near the Newell Highway, while monitoring location B was near a rural local road.

Monitoring and attended observations at location C was dominated by road traffic noise primarily from heavy vehicle movements. The road traffic noise would decrease as the distance from the Newell Highway increases. Noise levels of this magnitude are typical of highways with substantial heavy vehicle movements. No significant road traffic noise was recorded at monitoring location B.

Table 19–1 Existing road traffic noise descriptors

Noise monitoring location	Road traffic noise descriptors	
	$L_{Aeq(15hr)}$ dB(A) 7am to 10pm weekdays	$L_{Aeq(9hr)}$ dB(A) 10pm to 7am weekdays
B – Kirby (local rural road)	42	40
C – Leewood (Newell Highway)	65	62



LEGEND

- Project area
- Leewood
- Bibblewindi
- Parks and reserves
- State forest
- Aboriginal areas
- Lakes and dams
- Watercourses
- Roads
- Train line
- Existing pipelines
- Noise monitoring locations
- Previous noise monitoring locations

0 1.75 3.5 7
Kilometers

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 55

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Narrabri Gas Project
Environmental Impact Statement

Job Number 21-22463
Revision A
Date 25 Jul 2016

Noise monitoring locations

Figure 19-4

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Level 15, 133 Castlereagh Street Sydney NSW 2000 T 61 2 9239 7100 F 61 2 9239 7199 E sydmail@ghd.com.au W www.ghd.com.au

Data source: NSW Department of Lands: DTDB and DCDB - 2012-13. Santos: Operational and Base Data - 2013. Created by: jrichardson

19.2.4 Local meteorology

To assist with predictive noise modelling, the following key aspects of local meteorology are noted:

- Monthly mean temperatures at Narrabri Airport show a typical seasonal variation in the temperature range. The warmest months are November to March, with mean maximum temperatures during these months ranging from 30 to 35 °C. The coolest month is July, with a mean minimum temperature below 5 °C.
- The average annual rainfall measured at the Narrabri Airport is 569 millimetres per year. The average annual rainfall measured at Rosewood Farm, six kilometres north of Leewood, is 505 millimetres per year.
- Relative humidity is highest in the mornings and during the wetter winter months and lowest in the summer afternoons.
- Seasonal wind roses for Narrabri Airport weather station show the prevailing winds are generally from the north in the warmer months and from the south-east in the cooler months.
- Temperature inversions are a feature of the local meteorology. Night-time temperature inversions occur approximately 62 per cent of the time during winter (June to August). Temperature inversions were therefore taken into consideration in modelling to represent adverse meteorological conditions.

19.3 Noise and vibration criteria

The *Interim Construction Noise Guideline* (DECC 2009) is aimed at managing noise from construction works regulated under the *Protection of the Environment Operations Act 1997* which includes scheduled development work that would enable scheduled activities to be carried out. Petroleum exploration, assessment and production is a scheduled activity under the *Protection of the Environment Operations Act 1997,* therefore, the *Interim Construction Noise Guideline* (DECC 2009) is considered relevant for assessment of construction activities associated with the development of the project. Further detail for the assessment of project construction activities under the *Interim Construction Noise Guideline* is provided in Appendix M.

The *Interim Construction Noise Guideline* construction noise management levels during standard recommended construction hours are 40 dB(A). The recommended standard construction hours for the purpose of this policy are 7 am to 6 pm Monday to Friday and 8 am to 1 pm Saturday. The *Interim Construction Noise Guideline* includes a highly noise affected construction noise management level of 75 dB(A), where there may be a strong community reaction to noise and timing restrictions or respite periods may be necessary for construction activities.

For this project, the construction noise management level would be 40 dB(A) (equivalent to the level of noise in a library) during recommended standard hours. For periods outside the standard recommended construction hours, the *Interim Construction Noise Guideline* construction noise management levels are 35 dB(A) (equivalent to the level of noise in a very quiet room).

Operational activities are assessed against the *Industrial Noise Policy*. The intrusive noise criteria under the *Industrial Noise Policy* (EPA 2000) is 35 dB(A). The project-specific operational noise criteria are shown in Table 19–2. The night time sleep disturbance criterion of 45 $_{LAeq}$ is also included in Table 19–2 as is the Yarrie Lake amenity (cumulative) criterion of 50 $_{LAeq}$. Refer to Appendix M for further information.

A predicted, exceedance of the noise criteria does not necessarily mean the receiver would be adversely affected or impacted by the noise. Rather, the criteria are proposed to ensure that the potential for noise

impacts from the project are identified and then minimised through the implementation of mitigation and management measures.

Table 19–2 Project-specific operational noise criteria dB(A)

Receiver area	Time of day	Project specific operational noise criteria	Sleep disturbance screening criteria
Occupied residential receivers	Day[a]	35 $L_{Aeq(15min)}$	-
	Evening[b]	35 $L_{Aeq(15min)}$	-
	Night[c]	35 $L_{Aeq(15min)}$	45 L_{Amax}
Yarrie Lake	When in use	50 $\mathbf{L_{Aeq(period)}}$[d]	-

[a] 7am to 6pm Monday to Saturday, or 8am to 6pm on Sundays and public holidays

[b] 6pm to 10pm

[c] 10pm to 7am

[d] This is the amenity (cumulative) criteria. Note that 50 dB(A) is equivalent to noise levels in an office or classroom.

19.4 Potential impacts – construction

19.4.1 Leewood

Construction noise sources

Construction at Leewood is expected to occur predominately during daylight hours, seven days per week.

Noise generating construction activities would include:

- clearing, levelling and excavation
- constructing bunds
- constructing concrete pads and building foundations
- assembling prefabricated units on site
- coating and painting
- testing and commissioning the equipment.

The facilities at Leewood would be designed to minimise on-site construction through the use of prefabricated equipment, demountable buildings and precast civil structures.

Typical equipment required for these activities includes a dozer, scraper, excavator, truck, compactor, concrete truck and pump, asphalt, roller, crane, generator, welding rig and hand tools. The highest L_{Aeq} sound power levels (that is noise measurements at the source) during the construction at Leewood would be produced by the dozer (115 dB(A)), scraper (113 dB(A)) and compactor (113 dB(A)).

For equipment operating continuously (generators), the LAmax noise level would be generally within 3 dB(A) of the LAeq noise level. For heavy machinery, LAmax noise level events would be typically 8 dB(A) greater than the LAeq noise level at maximum power. For reversing alarms, a sound power level of 112 dB(A) LAmax was assumed. The LAmax noise levels were used for the sleep disturbance assessment.

Assessment of construction noise impacts

Construction noise levels were predicted for the worst-case scenario where the power generation facility, central gas processing facility and water management facilities are being constructed simultaneously. However, in practice, the construction work is likely to be staged with not all construction equipment operating simultaneously.

Construction activities are predicted to comply with the noise management level of 40 dB(A) during recommended standard hours at all sensitive receivers with the one exception being receiver 217, where noise management levels are predicted to be exceeded by up to 3 dB(A) during calm meteorological conditions, and up to 8 dB(A) during adverse meteorological conditions (refer to Appendix M).

Noise levels at five sensitive receivers (receivers 182, 189, 191, 216 and 217) are predicted to be above the noise management levels of 40 dB(A) by up to 8 dB(A) if construction work was undertaken outside of recommended standard hours during calm meteorological conditions, or up to eight sensitive receivers (receivers 172, 179, 182, 189, 191, 192, 216 and 217) by up to 13 dB(A) for construction work outside of recommended standard hours during adverse meteorological conditions.

The predicted maximum construction noise levels exceed the sleep disturbance screening criteria of 45 dB(A) at one receiver (receiver 217) where an exceedance of 3 dB(A) is predicted during adverse weather conditions if construction work was to be undertaken at night (between 10 p.m. and 7 a.m.). It is noted that no complaints were received in relation to construction activities at Leewood as part of the proponent's exploration activities in 2013 and 2014.

19.4.2 Bibblewindi

Construction noise sources

Construction at the Bibblewindi facility is expected to generally occur predominately during daylight hours seven days per week. Construction would include the following activities:

- clearing and levelling the site
- constructing concrete pads
- assembling prefabricated units on site
- testing and commissioning equipment
- work over of one of the seven existing non-operational appraisal wells.

Similar to Leewood, the in-field compression facility would be a pre-fabricated design transported to the site for connection and commissioning. Typical noise-generating equipment required for these activities are the same as Leewood.

Assessment of construction noise impacts

Construction activities are predicted to comply with the noise management levels both during and outside of standard construction hours at all identified sensitive receivers. The predicted maximum noise level at the nearest sensitive receiver is 30 dB(A) during adverse meteorological conditions which is consistent with background noise levels and therefore unlikely to be discernible. The predicted maximum construction noise levels are also below the sleep disturbance criteria at all identified sensitive receivers.

Despite these findings, the general construction noise management measures provided in Section 19.6 would still be considered where feasible and reasonable. It is also noted that no complaints were received in relation to construction activities at the Bibblewindi facility as part of the proponent's exploration activities in 2013 and 2014.

19.4.3 Bibblewindi to Leewood infrastructure corridor

Construction noise sources

Widening of the existing corridor and installing infrastructure would generally occur during daylight hours seven days per week. This would involve the following activities:

- locating, marking and protecting existing underground and overhead services along the corridor
- felling and removing trees and vegetation
- stripping and grading topsoil
- building temporary bridging and right-of-way crossings
- stringing, welding, bending, lowering and laying pipes
- trenching
- padding and backfilling
- horizontal directional drilling (likely to be limited to the Newell Highway)
- installing high-voltage cable.

Typical noise-generating equipment required for these activities include a backhoe, capping tractor, crane, dozer, excavator, front-end loader, grader, hydraulic drill rig, padding machine, pipe layer, pipeline bender, rock saw, tack rig, trailer and truck. The highest L_{Aeq} sound power levels during the construction of the infrastructure corridor would be produced by the rock saw (117 dB(A)) and the dozer (115 dB(A)).

Construction noise levels at sensitive receiver were predicted for general construction activities across the length of the infrastructure corridor and horizontal directional drilling operations at crossings of the Newell Highway.

Once detailed design and site surveying requirements are undertaken for this work, the method of installation would be finalised. In areas where there is hard rock or otherwise unsuitable conditions for standard construction techniques, blasting may be required. Although it is considered that this is unlikely, a blasting impact assessment was undertaken and is summarised in Section 19.4.9.

Assessment of construction noise impacts

It is not expected that the noise management levels of 35 dB(A) and 40 dB(A) would be exceeded for sensitive receivers associated with construction activities along the Bibblewindi to Leewood infrastructure corridor during recommended standard hours and also outside recommended standard hours during calm meteorological conditions.

Five sensitive receivers (receivers 191, 192, 212, 216 and 217) are predicted to receive noise levels exceeding the noise management level of 35 dB(A) by up to by up to 4 dB(A) if construction work was undertaken outside of recommended standard hours during adverse meteorological conditions. However, noise impacts are expected to be short term and temporary as the construction work front progresses

along the corridor. Management and mitigation measures provided in Section 19.6 would be implemented where required.

19.4.4 Leewood to Wilga Park underground power line

A gas pipeline between Wilga Park Power Station and the Leewood property was constructed as part of a previous approval. If power is not supplied by the proposed power generation facility at Leewood, a new underground transmission line is proposed to reticulate power from Wilga Park Power Station to Leewood along the existing gas pipeline route. This construction work would occur generally during daylight hours, seven days a week.

Construction activities along the Wilga Park to Leewood transmission line construction corridor are predicted to exceed the construction noise management level of of 40 dB(A) at up to 19 sensitive receivers by up to 41 dB(A) during recommended standard hours in calm conditions and up to 38 sensitive receivers by up to 44 dB(A) when work is undertaken outside of recommended standard hours during adverse meteorological conditions (refer to Appendix M). The highly noise affected management level of 75 dB(A) has the potential to be exceeded at one receiver (receiver 75) by 9 dB(A).

All reasonable and feasible mitigation measures would be implemented if exceedances of the noise management levels were predicted at occupied sensitive receivers. The project is committed to meeting noise management levels at occupied sensitive receivers outside of standard construction hours, unless a written agreement is in place with the landholder. Noise associated with the construction of the transmission line would be very short term at each location, typically lasting less than five days (likely less than one day with regard to the highly noise affected receiver), as construction proceeds along the corridor.

19.4.5 Ancillary infrastructure

Road and intersection upgrades

Construction equipment expected to be used for intersection upgrades at X-Line Road and Old Mill Road on the Newell Highway includes a milling machine, haul truck, bobcat, asphalt paver, shuttle buggy, vibratory roller and line-marking truck. The highest L_{Aeq} sound power levels would be produced by the milling machine (111 dB(A)) and shuttle buggy (110 dB(A)). Road and intersection upgrade construction is expected to generally occur seven days a week during daylight hours, subject to the requirements of Roads and Maritime Services.

Noise levels were predicted from the noisiest construction stage (paving) during calm and adverse meteorological conditions (see Appendix M). Construction noise levels are predicted to comply with the construction noise management levels at all sensitive receivers during upgrade of the intersections.

Westport workers' accommodation

Expansion of the Westport workers' accommodation would involve clearing and grading additional land and installing prefabricated buildings.

For this work, typical noise-generating construction equipment includes a dozer, scraper, excavator, truck, compactor, crane and hand tools. The highest L_{Aeq} sound power levels would be produced by the dozer (115 dB(A)), scraper (113 dB(A)) and compactor (113 dB(A)).

Construction of the Westport workers' accommodation is predicted to comply with the noise management levels during recommended standard hours and when work is undertaken outside of recommended standard hours during calm meteorological conditions. Noise levels are predicted to exceed the noise management level at one sensitive receiver if work was to be undertaken outside of recommended standard hours during adverse meteorological conditions.

Treated water pipeline from Leewood to Bohena Creek

A water discharge pipeline would be constructed from the Leewood water treatment plant to Bohena Creek. Construction equipment is expected to remain similar to that discussed in Section 19.4.1 for gathering lines.

Based on modelling, the construction of the water pipeline is predicted to exceed the noise management levels during standard construction hours at three sensitive receivers based on a nominal construction route between Leewood and Bohena Creek. If work was to be undertaken outside of standard hours, noise would exceed the noise management level at up to eight sensitive receivers and up to 14 sensitive receivers during adverse meteorological conditions.

All reasonable and feasible mitigation measures would be implemented if exceedances of the noise management levels were predicted at occupied sensitive receivers during standard construction hours. The project is committed to meeting noise management levels at occupied sensitive receivers outside of standard construction hours unless a written agreement is in place with the landholder.

19.4.6 Gas field

Wells

Construction noise sources

The project would comprise up to 850 new wells on up to 425 well pads; with no gas wells located within 200 metres of an occupied residence. Well construction involves ground-clearing preparation, well pad construction and drilling and completion activities. Drilling activities have an operational requirement to occur continuously 24 hours per day.

Noise levels were predicted for well construction during calm and adverse meteorological conditions for the following construction scenarios:

- scenario one - ground-clearing preparation and well pad construction. These activities would be generally undertaken during daylight hours, seven days per week
- scenario two - 'base case' drilling and completion activities (well drilling, pipe removal, casing completions and cementing with no mitigation). These activities would be undertaken on a continuous basis, 24 hours a day, seven days per week
- scenario three - 'mitigation case' drilling and completion activities (well drilling, pipe removal, casing completions and cementing with all feasible and reasonable mitigation measures). These activities would be undertaken on a continuous basis, 24 hours a day, seven days per week.

Typical construction equipment assessed includes: chainsaws, an ultra-logger, dozer, grader, excavator, scraper, bobcat skid steer loader for ground clearing preparation and front end loader, and a truck and generator for well pad construction. Equipment for drilling and completion activities includes hand tools, a mobile crane, truck, winch, mud pump engine, mud shaker, generator, hydraulic power unit,

high- pressure cement unit and welding rig. The highest L_{Aeq} sound power levels during well construction would be produced by the high-pressure cement units 122 dB(A) (unmitigated) during well cementing.

In terms of the noise-generating equipment for well-construction activities listed above:

- There is potential for impulsive noise characteristics during pipe removal and casing operations from the placement of the drill pipe onto the pipe racks or bins. This banging noise can be minimised by careful operation. Therefore, no impulsive modifying factor adjustments were applied to drill rig pipe removal.
- There are no tonal or low frequency characteristics associated with the drill rig noise source. Therefore, no modifying factor adjustments were applied to the assessment.
- If unmitigated, the high-pressure cement truck has the potential to be the loudest noise source. To model the distances required to meet noise management levels as sensitive receivers two mitigation scenarios were considered to treat noise from the cement truck:
  - option one – select a high-pressure cement truck which produces lower noise emissions
  - option two – provide a temporary demountable shed enclosure or other barrier around the high-pressure concrete truck. The shed or barrier would be designed to provide a minimum of 15 to 20 dB(A) attenuation.
- The mud pump, generator and hydraulic power unit engines can be designed to reduce noise emissions. A mitigation scenario was considered which includes a treated engine compartment of the mud pump, generator and hydraulic power unit.

It is important to note that drilling activities are temporary, typically lasting several weeks (between around 10 and 30 days) at each location. Well cementing is the loudest source of noise during well construction but is short term, occurring over a number of hours. As such, potential exceedances of the construction noise management levels would be temporary and are not considered significant.

Assessment of construction impacts

A maximum distance of 1,875 metres is predicted to be required to meet noise management levels during the night-time period (adverse meteorological conditions) during cementing (which would be the highest noise source activity), with mitigation measures implemented.

Maximum noise level events (single or infrequent occurrences) associated with drilling are likely to be associated with the movement of drill casings and air releases. There is the potential for sleep disturbance criteria to be exceeded where sensitive receivers are within 1,300 metres of a drilling rig. However, well siting and the construction management approach will ensure relevant criteria are not exceeded unless there is an agreement in place with the landholder for the period of construction. This noise constraints approach is detailed in the Field Development Protocol. Additional management and mitigation measures (detailed in Section 19.6) could be implemented to further reduce the noise in order to meet the noise management levels.

If there is well construction activity in the vicinity of Yarrie Lake distances for construction activities of 290 metres and 430 metres are required to meet noise management levels under calm and adverse meteorological conditions respectively for the maximum noise source activity. It is also noted that the Field Development Protocol states a 200 metre surface development exclusion zone around Yarrie Lake.

Access tracks and water and gas gathering lines

Construction noise sources

Access to well pads would be via existing roads and access tracks wherever practicable. Where this is not possible, new tracks would be constructed. A construction corridor up to approximately 12 metres wide would be required to accommodate both the access track and the gas gathering lines. Noise-generating equipment expected to be used for access track construction includes a grader and water cart.

Construction of the gathering systems would require vegetation clearance, topsoil stripping and stockpiling, trenching, pipe joining and laying, ploughing, horizontal direction drilling (likely to be limited to the Newell Highway), backfilling and restoration.

The equipment used and associated noise levels would depend on the contractor employed. However, typical construction equipment was used for the noise impact assessment including chainsaws, an ultra- logger, dozer, grader, excavator, bobcat skid steer loader, chain trencher / plough in, prime mover and low loader, water cart, front end loader and flat-bed truck. The highest L_{Aeq} sound power levels during construction of the gas and water gathering system would be produced by the chain trencher / plough-in (126 dB(A)) and ultra-logger (116 dB(A)).

Noise source data for the equipment listed above was used in the noise impact assessment to predict the maximum distances required to meet noise management levels.

Assessment of construction noise impacts

For the construction of access tracks and the installation of the gas and water gathering system, the maximum distance required to achieve the noise management levels during standard construction hours were estimated to be 2,021 metres during trenching activities for gathering line installation and 1,438 metres during vegetation clearing for gathering line corridor establishment. A maximum distance of 3,741 metres is predicted to be required to meet noise management levels during trenching activities outside of standard construction hours.

However, noise level exceedances of the construction noise management levels at sensitive receivers would be very short-term as the construction work front proceeds along the corridor. All reasonable and feasible mitigation measures would be implemented if exceedances of the noise management levels were predicted at occupied sensitive receivers during standard construction hours. The project is committed to meeting noise management levels at occupied sensitive receivers outside of standard construction hours unless a written agreement is in place with the landholder.

19.4.7 Construction traffic noise

Construction noise sources

A road traffic noise assessment was undertaken for the following roads where increases in traffic are expected: the Newell Highway, the Kamilaroi Highway, Tibbereena Street, Old Gunnedah Road, X-Line Road, Yarrie Lake Road, Mooloobar Street and internal forest roads.

The impact assessment considered impacts from the following scenarios:

- scenario one – absolute peak traffic generation during construction, which would occur for approximately three days
- scenario two – typical peak daily traffic generation during construction, which would typically occur three days every month
- scenario three – typical daily movements during operation.

The traffic noise prediction methodology and model inputs are presented in Appendix M.

Assessment of construction noise impacts

Based on the noise assessment it is expected that:

- noise levels would not significantly increase as a result of the proposal
- construction road traffic noise during the absolute peak traffic generation period would not increase existing road traffic noise levels by more than 2 dB(A) at sensitive receivers on highways and local roads. Where road traffic noise levels are predicted to exceed the noise criteria, this is due to existing traffic noise. Noise levels are not predicted to significantly increase as a result of the proposal
- noise levels on internal forest roads would increase by more than 2 dB(A), but would comply with the local road noise criteria in the *Road Noise Policy* (DECCW 2011)) within 10 metres of the road
- sensitive receivers near internal forest roads are located greater than 10 metres from the road corridor and therefore would not receive noise levels that exceed the criteria during the absolute peak traffic generation period.

19.4.8 Vibration

Vibration impacts were assessed to determine potential impacts on structures and human comfort. Distances to comply with the recommended vibration screening criteria are presented in Table 19–3. Ground vibration caused by blasting is assessed in Section 19.4.9.

Based on the constraint of no infrastructure being located within 200 metres of a sensitive receiver unless otherwise agreed, the potential for exceedances to the vibration criteria as a result of the project is unlikely. It is not expected that construction activities would be required at distances to sensitive receivers that vibration impacts on human comfort levels or structures would be predicted. Appropriate mitigation and management measures would be implemented if potential exceedances were predicted to occur.

Table 19–3 Distances to comply with recommended peak particle velocity screening criteria

	Human comfort distance (m)		Structural damage distance (m)
Equipment	Day (criteria 1 mm/s)	Night (criteria 0.3 mm/s)	Criteria 5 mm/s
Vibroseis unit	28.3	14.2	9.4
Loader	8.0	4.0	2.7
Roller	8.0	4.0	2.7
Compactor	7.0	3.5	2.3
Dozer	4.0	2.0	1.3
Pavement breaker	6.0	3.0	2.0
Backhoe	1.0	0.5	0.3
Jackhammer	0.5	0.3	0.2
Excavator	2.0	1.0	0.7
Grader	2.0	1.0	0.7
Scraper	2.0	1.0	0.7

19.4.9 Blasting

Although it is not expected that blasting would be required during construction activities, a general assessment of blasting has been undertaken to determine the typical distances required to comply with the blasting criteria. The predicted results shown in Appendix M indicate that blasting would be restricted by the air blast overpressure requirements rather than the ground vibration levels. If blasting were to be required it would most likely occur along the Bibblewindi to Leewood infrastructure corridor (refer to Section 19.4.3). Along this corridor the nearest sensitive receivers are over 2,000 metres away and as such, no exceedances to the blasting criteria from blasting activities that may be required are anticipated.

If blasting is necessary at a particular area, the distance to nearby sensitive receivers would be used to assess the potential for impacts in accordance with the *Technical Basis for Guidelines to Minimise Annoyance due to Blasting Overpressure and Ground Vibration* (ANZEC 1990). If exceedances of the criteria were predicted, management and mitigation measures would be implemented as part of the design for the blast.

19.5 Potential impacts – operation

19.5.1 Bibblewindi

Operational noise sources

The in-field compression station at Bibblewindi would be used to boost the gas pressure to enable it to be transported via the midfield pipeline to the central gas processing facility at Leewood. The facility would consist of 16 operational and four standby compressors. Noise sources would include the compressors and associated after-coolers, pipework and cooling fans. There would also be an electrical substation that would consist of a transformer.

The Bibblewindi facility would also include a safety flare, which would operate beyond its minimum operating flow requirements in order to safely manage excess gas produced during commissioning, scheduled maintenance or non-routine situations (non-routine situations could occur during any time period but are expected to be infrequent).

Seven existing non-operational appraisal wells are also located at Bibblewindi, and these may be converted to production wells if they were suitable for production.

Assessment of operational noise impacts

It is predicted that the operational noise levels from the Bibblewindi facility would comply with the noise criteria of 35 dB(A) (base case and mitigation scenario) at all identified sensitive receivers at all times.

The potential for cumulative noise impacts between Bibblewindi and Leewood is limited. Even without mitigation, noise from Bibblewindi would comply with the 35 dB(A) noise criterion in the order of three kilometres from the facility. Leewood is substantially further away; in the order of 20 kilometres to the north.

The operation of the safety flare at Bibblewindi at its maximum flow rate during adverse meteorological conditions is predicted to exceed the *Industrial Noise Policy* (EPA 2000) intrusive noise criteria of 35 dB(A). However, the requirement to use the flare at its maximum rate is likely to be rare such as during commissioning, maintenance activities or in non-routine situations. It is also unlikely that this event would occur at the same time as a temperature inversion.

Section 7.6 of the *Industrial Noise Policy* (EPA 2000) acknowledges that 'from time to time, managing noise at the source may require a short-term increase in noise beyond the level approved'. The *Industrial Noise Policy* considers 'abnormal operations due to unforeseen breakdown or maintenance requirements' as a potential situation justifying a short-term increase in noise. The safety flare would fall into this category. Therefore, though there is potential for minor noise impacts at surrounding sensitive receivers, such exceedances would be intermittent and are accepted under the *Industrial Noise Policy*.

19.5.2 Leewood

Operational noise sources

Gas processing facility

Noise-generating equipment associated with the gas processing facility would consist of four gas processing trains made up of one two-stage low-pressure compressor (and after-coolers) and one high-pressure compressor with after-coolers. There would also be an electrical substation, which would consist of several transformers, and a safety flare that would operate above its minimal flow rate during scheduled maintenance or other situations where excess gas is required to be safely managed.

Water management facility

The majority of the water processing equipment would be enclosed within the water and brine treatment plants and is not expected to contribute significantly to the noise environment. Supporting infrastructure would be located outside of the treatment plants, including:

- dissolved air flotation component systems – the compressor is expected to be the dominant noise source and would be enclosed
- service water tank and booster pumps
- crystalliser unit and cooling towers – the brine crystalliser would be located within the brine treatment plant and the cooling towers and adjacent to the brine treatment plant area
- pumps – these would be located around the site to transfer water and brine between the storage and treatment infrastructure components.

The cooling towers are predicted to produce the highest noise level during operation of the water management facility at 96 dB(A). Other equipment associated with the treatment plant would not significantly contribute to the noise environment and was not considered in the noise predictions.

Power generation facility

A 100 megawatt gas-fired power generation facility (if required) would be located adjacent to the gas processing facility at Leewood to provide power to the infrastructure at Leewood and Bibblewindi. Electricity may be sourced from the national grid as an alternative to this power generation facility. The noise assessment for Leewood included noise from a typical gas-fired power generation facility that can provide 100 megawatts of power.

The power generation facility is expected to have 10 gas engine generators (and two standby generators) with a silenced exhaust stack of around 28 metre in height, and roof-mounted radiator cooling fans. The gas engines would be contained within an acoustically treated engine hall with a structural height of about 10 metres. For each gas engine there would be an acoustically treated intake ventilation unit on each side of the engine hall and a roof-mounted ventilation outlet. There would also be two transformers on the site.

The highest predicted noise level during operation of the power generation facility would occur within the engine hall with an average internal noise level of 110 dB(A).

Assessment of operational noise impacts

Operational noise levels were predicted during calm and adverse meteorological conditions for the following scenarios:

- base case scenario one – central gas processing facility with unenclosed compressors, transformers, power generation facility (with a moderate level of noise attenuation treatments) and the water treatment plant
- base case scenario two (connection to the national grid) – central gas processing facility with unenclosed compressors, transformers and the water treatment plant
- mitigation scenario one – central gas processing facility with acoustically enclosed compressors, transformers, power generation facility (with a high level of noise attenuation treatments) and water treatment plant
- mitigation scenario two (connection to the national grid) – central gas processing facility with acoustically enclosed compressors, transformers and water treatment plant.

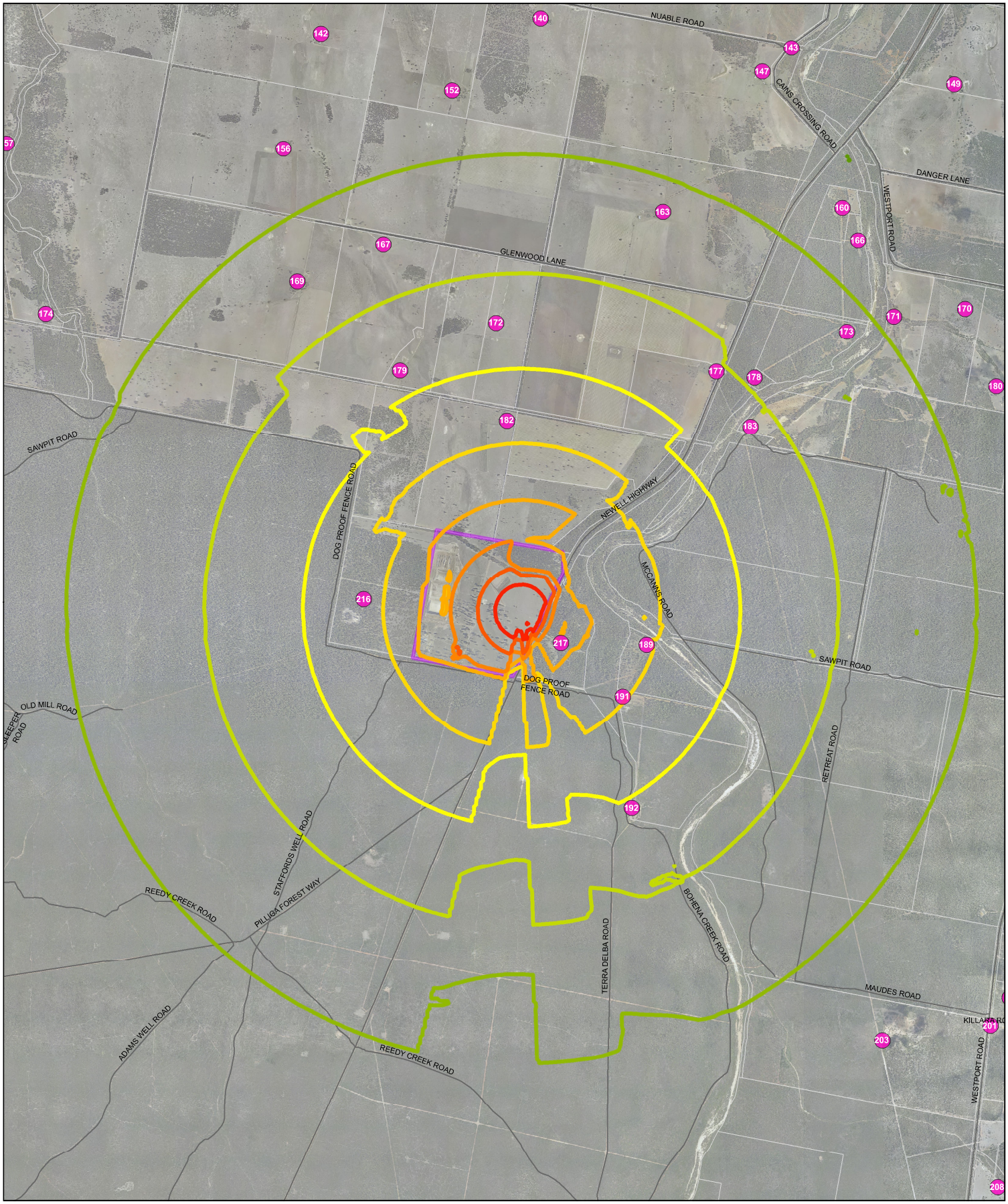
Appropriate modifying factor adjustments were applied to the predicted received noise level in accordance with the *Industrial Noise Policy* (EPA 2000).

'Base case' scenario one with the low frequency correction is the highest unmitigated noise generating scenario. This was modelled for the purpose of the assessment to provide data representative of a 'worst case' scenario. Operational noise contours this scenario are shown in Figure 19-5 for base case scenario one with adverse meteorological conditions. Operational noise levels for this base case scenario are predicted to exceed the noise criteria of 35 dB(A) at 13 surrounding sensitive receivers by up to 20 dB(A) under calm conditions (receivers 167, 169, 172, 177, 178, 179, 182, 183, 189, 191, 192, 216 and 217) and at 20 sensitive receivers by up to 25 dB(A) under adverse conditions (receivers 160, 163, 166, 167, 169, 170, 171, 172, 173, 177, 178, 179, 180, 182, 183, 189, 191, 192, 216 and 217). The dominant noise sources would be the compressors, power generation facility ventilation units, cooling fans and exhaust stacks. As outlined above, two mitigation scenarios were investigated to mitigate this impact. Noise contours for each option are shown in Figure 19-6 and Figure 19-7 under adverse meteorological conditions. With the implementation of mitigation treatments, operational noise levels from Leewood are predicted to comply with the noise criteria at all surrounding sensitive receivers during both calm and adverse meteorological conditions.

The potential for cumulative noise impacts between Leewood and Bibblewindi is limited. As shown in Figure 19-5, even without mitigation the noise from Leewood would comply with the 35 dB(A) noise criterion in the order of three kilometres from the facility, whereas Bibblewindi is substantially further away in the order of 20 kilometres south of Leewood.

Similar to the safety flare at Bibblewindi, the operation of the safety flare at Leewood at its maximum flow rate during adverse meteorological conditions is predicted to exceed the *Industrial Noise Policy* (EPA 2000) intrusive noise criteria of 35 dB(A) when operating at a maximum flow rate during adverse meteorological conditions. However, the requirement to use of the flare at its maximum flow rate is likely to be rare in response to non-routine situations. Flaring may also be required during maintenance activities but is unlikely to be at the capacity of the flare. The Industrial Noise Policy acknowledges that there will be situations from time to time where such exceedances may occur.

Where practical, potentially impacted occupied residences would be informed of the use of the flare, duration and a method of contact to raise complaints.



LEGEND

- Leewood
- Roads
- Sensitive receivers

Noise level contours, db(A)

30 45 60
35 50 65
40 55 70
75

Note - Noise contours include a low frequency modification factor of 5dB(A)

0 0.5 1 2
Kilometers

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 55

N

Narrabri Gas Project
Environmental Impact Statement

Leewood predicted noise levels

base case scenario 1, adverse conditions

Job Number 21-22463
Revision A
Date 10 Mar 2015

Figure 19-5

C:\Users\AFoddy\Desktop\21_22463_KBM29.mxd [KBM: 172]

Level 15, 133 Castlereagh Street Sydney NSW 2000 T 61 2 9239 7100 F 61 2 9239 7199 E sydmail@ghd.com.au W www.ghd.com.au

Data source: NSW Department of Lands: DTDB and DCDB - 2012-13. Santos: Operational and Base Data - 2013. Created by: afoddy

LEGEND

- Leewood
- Roads
- Sensitive receivers

Noise level contours, db(A)

30 45 60
35 50 65
40 55 70
75

Note - Noise contours include a low frequency modification factor of 5dB(A)

0 0.35 0.7 1.4
Kilometers

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 55

N

Narrabri Gas Project
Environmental Impact Statement

Leewood predicted noise levels
mitigation scenario 1, adverse conditions

Job Number 21-22463
Revision A
Date 10 Mar 2015

Figure 19-6

C:\Users\AFoddy\Desktop\21_22463_KBM29.mxd [KBM: 173]

Level 15, 133 Castlereagh Street Sydney NSW 2000 **T** 61 2 9239 7100 **F** 61 2 9239 7199 **E** sydmail@ghd.com.au **W** www.ghd.com.au

Data source: NSW Department of Lands: DTDB and DCDB - 2012-13. Santos: Operational and Base Data - 2013. Created by: afoddy

LEGEND

- Leewood
- Roads
- Sensitive receivers

Noise level contours, db(A)

30 45 60
35 50 65
40 55 70
75

0 0.35 0.7 1.4
Kilometers

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 55

N

Narrabri Gas Project
Environmental Impact Statement

Leewood predicted noise levels
mitigation scenario 2, adverse conditions

Job Number 21-22463
Revision A
Date 10 Mar 2015

Figure 19-7

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Level 15, 133 Castlereagh Street Sydney NSW 2000 **T** 61 2 9239 7100 **F** 61 2 9239 7199 **E** sydmail@ghd.com.au **W** www.ghd.com.au

Data source: NSW Department of Lands: DTDB and DCDB - 2012-13. Santos: Operational and Base Data - 2013. Created by: afoddy

19.5.3 Gas fields

Production wells

Operational noise sources

The operation of production wells was assessed considering one gas-powered generator driving two to three downhole pumps. Diesel generators used during the exploration and appraisal program may be utilised during production for a limited time before transitioning to gas-powered generators. Both modes of power generation were considered to have equivalent noise emissions for the purpose of assessment. The downhole pumps would consist of a combination of progressive cavity and electric submersible types. The electric submersible pump motor would be located down the well and would not produce significant noise emissions at surface level.

Assessment of operational noise impacts

Noise impacts from well pads were assessed for a 'worst case' scenario whereby multiple wells are placed at the minimum planned well spacing of 750 metres. This scenario therefore accounts for potential cumulative noise impacts of multiple well pads operating simultaneously.

Noise from the operation of a well pad would be produced by plant such as generators and motors. The noise from these steady state sources would not feature noticeable noise peaks that can disturb sleep.

The assessment showed that noise 35 dB(A) noise criterion would be met at 218 metres from a well pad with two pumps under 'worst case' noise-propagating weather conditions, or 138 metres in calm weather conditions. These distances would be about 20 metres further if three pumps were utilised.

The assessment also shows the 35 dB(A) noise contours from each of the multiple wells would not overlap, and hence no cumulative effects exceeding this criterion are predicted.

As with all gas field infrastructure, well pads would be situated a sufficient distance from residences to comply with the 35 dB(A) noise criterion, unless subject to a private negotiated agreement.

A surface infrastructure exclusion zone of 200 metres would surround Yarrie Lake. This would mean there would be no exceedances of noise management levels from operational noise sources, should there be infrastructure in this area.

Pilot wells

Operational noise sources

A limited number of pilot wells would be grouped in sets of up to six well pads (which would be at least 250 metres apart) and would produce similar noise levels to the production wells.

If a pilot well set is not connected to the gas gathering system, a pilot flare up to six metres in stack height would be located on one of the well pads in the set to safely manage the gas produced from the pilot. Where required, flares would operate with an average flow rate of between three and five million standard cubic feet of gas per day. A flow rate of five million standard cubic feet of gas per day was modelled to assess impacts at the upper end of this range.

One generator would be located at each pilot well and would produce similar noise emissions to the production wells.

Assessment of operational noise impacts

The operation of a pilot well set with an associated flare on the well pad is estimated to require a maximum distance of 3,412 metres and 2,423 metres (under adverse and calm meteorological conditions respectively) from the flare to meet the noise criteria for sensitive receivers.

As with all gas field infrastructure, all pilot wells would be located at a distance from occupied residences (or configured and designed) to comply with the 35 dB(A) operational noise criteria unless the residence is subject to a private negotiated agreement between the proponent and the landholder.

19.5.4 Operational traffic noise

Road traffic noise levels are not predicted to increase by more than 2 dB(A) as a result of the proposed operation and would not significantly impact sensitive receivers on the traffic routes.

Along the Newell Highway and Yarrie Lake Road, the increase in daily traffic from operations would be insignificant when compared to existing daily traffic volumes, with the predicted noise levels increasing by less than 0.1 dB(A).

Similarly, no operational road traffic noise impacts are predicted along X-Line Road as a result of the project, where the nearest sensitive receivers are over three kilometres away.

19.6 Mitigation and management

A range of mitigation and management measures are proposed to control potential impacts of the project with regard to noise and vibration, including preparation of a number of management plans. These measures are summarised in Table 19–4 and discussed below.

The Noise Management Plan and Vibration Management Plan (if required) would include a suite of measures that could be implemented to address potential noise issues. In general, all reasonable and feasible measures to meet the relevant criteria, unless a written agreement is in place with the landholder.

Potential noise and vibration impacts of gas field infrastructure would be avoided through the placement infrastructure in accordance with the Field Development Protocol. A number of design measures would also be considered to mitigate the potential impacts of the operation of facilities at Leewood. These design measures would include:

- enclosures for compressors at the gas processing facility
- acoustic treatment for buildings comprising the gas processing facility
- exhaust silencers, low noise radiators and engine hall ventilation louvres at power generation facility
- considering the location and orientation of the facilities and their components in the design process.

It is considered that Bibblewindi would be sufficient remotely to avoid noise impacts, however noise mitigation would nonetheless be considered during detailed design.

During construction and operation, potentially affected landholders would be given advanced notice of the nature of the activities, their duration and means of contact. This would include landholders potentially affected by safety flare operation during routine maintenance or non-routine operations.

The Noise Management Plan would also include a noise monitoring program.

Table 19–4 Mitigation and management measures

Potential impact	Phase	Mitigation / management
Noise and vibration exceeding relevant criteria at residences on private land	Construction Operation Decommissioning	Noise from the activity will meet relevant noise criteria at occupied residences unless a written agreement is in place with the landholder. A Noise Management Plan will be implemented. If vibration-generating activities are to be undertaken in the vicinity of occupied residences or buildings, a Vibration Management Plan will be developed and implemented. If blasting is required, the *Technical Basis for Guidelines to Minimise Annoyance due to Blasting Overpressure and Ground Vibration* (ANZECC 1990) will be implemented.

19.7 Conclusion

With a small number of exceptions, construction activities for the major facilities of the project are predicted to comply with noise management levels at all sensitive receivers at all times. Where exceedances are predicted during construction hours, reasonable and feasible mitigation measures would be implemented to meet the relevant noise management level.

For the construction of the gas field infrastructure, including construction of wells involving drilling activities that would be conducted on a continuous basis, the project commitment is that noise management levels under the *Interim Construction Noise Guideline* (DECC 2009) would be met at an occupied sensitive receiver outside of standard construction hours, unless a private negotiated agreement is in place with the landholder. Where exceedances are predicted during standard construction hours, all reasonable and feasible measures would be implemented to meet the noise management levels. Given the localised and temporary nature of works in one location associated with the construction of the gas field infrastructure, exceedances of the noise management levels are expected to be minor and temporary.

In relation to operational noise, the operation of infrastructure at Bibblewindi is not predicted to exceed the noise criteria due to the significant distance from sensitive receivers. With the implementation of mitigation treatments, operational noise levels from Leewood are also predicted to comply with the noise criteria at all surrounding sensitive receivers. The siting of production wells would ensure the operational noise levels are met at occupied sensitive receivers, unless a private negotiated agreement is in place.

A Noise Management Plan would be developed for the construction and operation of the project. It would detail methods to minimise and mitigate construction and operational noise from the project. The selection of measures that would be implemented at each site would depend on the nature of the activities, noise emissions and the proximity of the activities to occupied sensitive receivers. The plan would also include details of the noise monitoring program to be implemented.

The findings in this assessment have informed the noise constraints that have been included in the Field Development Protocol for the siting of infrastructure. This ensures that the noise outcomes required during the construction and operation of this project are considerations during the planning and design process.