KUR-World

Noise and Vibration

Chapter 14.0

Environmental Impact Statement

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14.0 NOISE AND VIBRATION

The purpose of this chapter is to:

- Describe the existing regulatory frameworks regarding the assessment of the project on noise and vibration
- Provide the findings of the survey work undertaken on the site
- Identify the impacts of the project on noise and vibration
- Identify current regulatory management tools
- Provide mitigation and management measures to support those regulatory tools which will be applicable throughout the life of the project.

14.1 Statutory framework and standards

The noise impacts from the proposed KUR-World development are regulated by the Queensland *Environmental Protection Act 1994*. The Queensland *Environmental Protection (Noise) Policy 2008* provides the framework for determining criteria for assessing noise impacts in accordance with the Act. The policy specifies criteria for assessing 'background creep' noise (for continuous or varying noises) and assessing noise against acoustic quality objectives. These criteria have been adopted for assessment of noise impacts for the KUR-World development where applicable. Where noise impacts from an activity cannot be effectively assessed by the 'background creep' criteria, the best available information has been used to derive appropriate noise impact criteria.

The Mareeba Shire Council Planning Scheme (MSC 2016[1]) also provides general requirements for managing noise impacts. The Department of Environment and Heritage Protection's Guideline: Planning for Noise Control (EHP 2016) provides procedures and methods applicable for setting conditions relating to noise emitted from industrial premises for planning purposes, including assessment of low frequency noise.

14.1.1 Environmental values

The environmental values to be enhanced or protected are defined by the Queensland *Environmental Protection (Noise) Policy 2008*:

(a) the qualities of the acoustic environment that are conducive to protecting the health and biodiversity of ecosystems; and

(b) the qualities of the acoustic environment that are conducive to human health and wellbeing, including by ensuring a suitable acoustic environment for individuals to do any of the following:
(i) sleep;
(ii) study or learn;
(iii) be involved in recreation, including relaxation and conversation; and

(c) the qualities of the acoustic environment that are conducive to protecting the amenity of the community.

[1] ASK (2017b) referenced the Mareeba Shire Council Planning Scheme as 8 January 2016; the most recent version of this scheme is July 2016.

These values are protected by the standards adopted for the KUR-World Noise and Vibration Impact Assessment (Appendix 14).

14.2 Surveys

The results of the desk-based review informed the design of the field surveys and predictions regarding the assessment. KUR-World Noise and Vibration Impact Assessment (Appendix 14) documents a detailed description of the approach to the investigation with the following being a summary:

- The statutory information described earlier was used to inform the assessment of existing receptors that have the potential to be impacted by the proposed project.
- A survey of potential noise sources in the surrounding area was conducted on 22nd and 23rd February 2017.

14.3 Findings

14.3.1 Existing Noise and Vibration Environment

The KUR-World site currently consists of a farmhouse, dam, animal yards, organic garden, cleared land for grazing and rainforest. Cattle grazing and the organic garden are currently operating at the site. The surrounding land uses include residences, a small orchard, a hotel and a dog kennel business. A diagram of the site location and nearby uses is presented in Figure 14-1. A noise and vibration investigation and impact assessment study was completed by ASK Consulting Engineers Pty Ltd (ASK). The results of this work inform this chapter of the EIS, and the ASK report (Appendix 14).

The nearest sensitive receptors (or sensitive receiver), as defined by Schedule 1 of the *Environmental Protection Policy (Noise) 2008*, are summarised in Table 14-1: including their northing and easting locations and are shown in Figure 14-2.

Table 14-1: List of sensitive receptors with UTM coordinates (WGS84 Z55).

ID	Address	Real Property Description	Indicative Distance and Direction from Proposed Developments	Easting (m)	Northing (m)
1	7 Hilltop Close	86/RP746616	300m to the south of the villas	351965	8138646
2	10 Hilltop Close	79/RP746616	"	352033	8138670
3	2 Warril Drive	76/RP742969	100m to the south of the villas	351995	8138883
4	4 Warril Drive	75/RP742969	"	352043	8138831
5	6 Warril Drive	74/RP742969	"	352102	8138776
6	8 Warril Drive	73/RP742969	"	352147	8138829
7	10 Warril Drive	72/RP742969	"	352184	8138865
8	1 Warril Drive	77/RP742969	"	352301	8138852
9	10 Punch Close	44/RP737515	300m to the east of the villas 5-star resort	352481	8139138
10	8 Punch Close	43/RP737515	"	352512	8139179

ID	Address	Real Property Description	Indicative Distance and Direction from Proposed Developments	Easting (m)	Northing (m)
11	6 Punch Close	42/RP737515	"	352524	8139218
12	4 Punch Close	41/RP737515	"	352549	8139245
13	Punch Close	40/RP737515	"	352578	8139273
14	77 Barnwell Road	16/N157227	200m to the east of the equestrian centre	351384	8140301
15	78 Barnwell Road	1/RP735374	100m to the north-east of the farm accommodation	351275	8140479
16	62 Barnwell Road (Church)	2/SP218094	300m to the north of the farm accommodation	351272	8140708
17	2 Leilas Way	2/RP748612	300m to the north-east of the farm accommodation	351438	8140530
18	78 Monaro Close	8/RP737018	100m to the north of farm accommodation	350979	8140493
19	68 Monaro Close	9/RP737018	"	350920	8140523
20	77 Monaro Close	7/RP737018	"	351055	8140569
21	64 High Chapparal Road	1/RP748876	500m to the north-west of the equestrian centre	350230	8140570
22	76 High Chapparal Road	3/RP748876	"	350351	8140363
23	73 High Chapparal Road	8/RP728075	"	350437	8140516
24	131 Boyles Road (Pet Resort)	4/RP749637	300m to the north-west of the villas	349941	8139832
25	165 Boyles Road	3/RP749637	600m to the west of the villas	349640	8139572
26	197 Boyles Road	1/RP866988	"	349449	8139375
27	265 Boyles Road	2/RP734821	700m to the south-west of the villas	349765	8138872
28	186 Mount Haren Road (Billabong Hotel)	44/RP851441	100m to the south-east of the small education centre	351217	8137600

Note: Table 14-1 sourced from ASK 2017b, Appendix 14, refer Table 2.1.

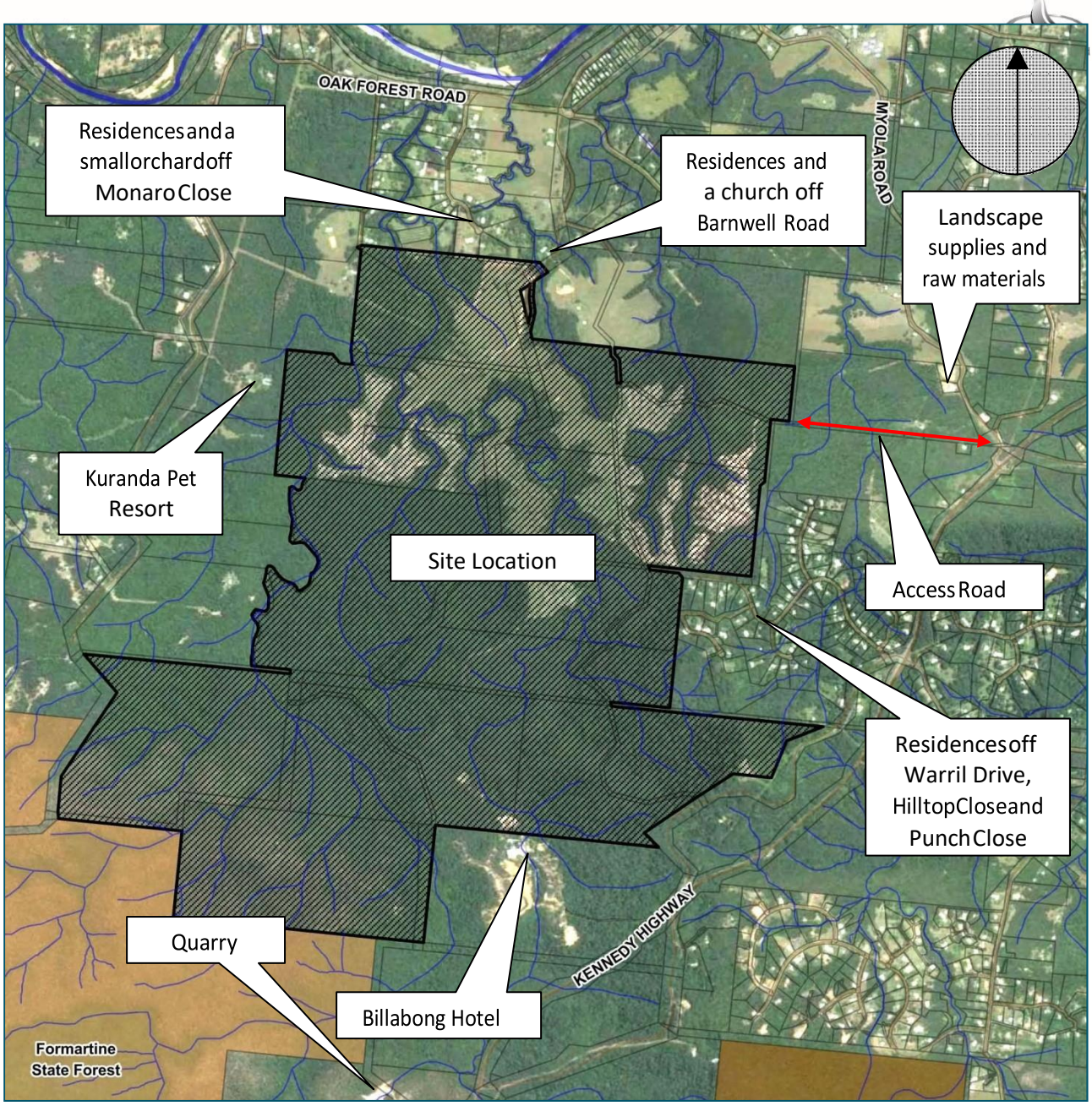

Figure 14-1: Site location and nearby uses.
Note: Figure 14-1 sourced from Appendix 14 (ASK 2017b, refer to Figure 2.3)

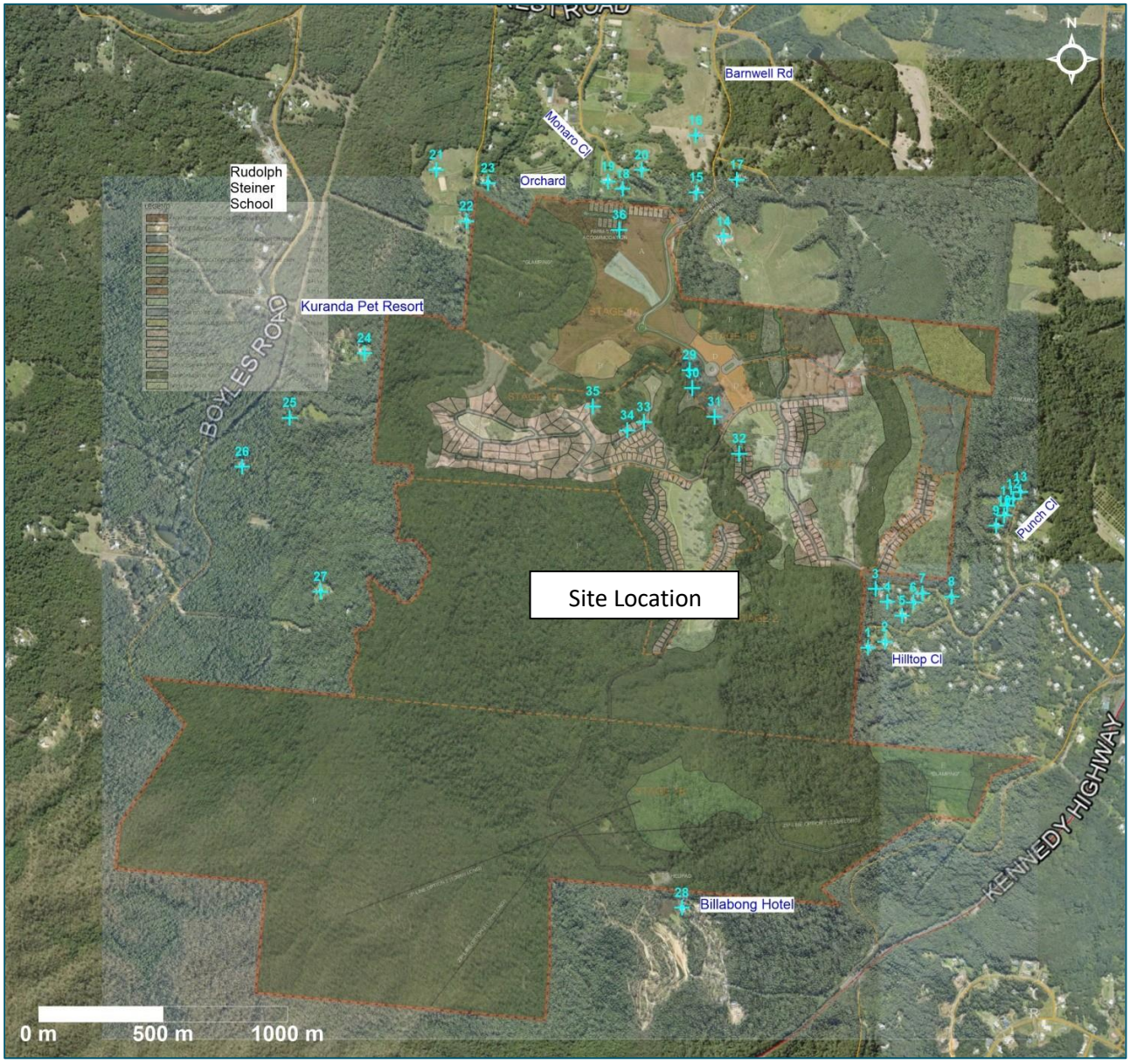

Figure 14-2: Aerial photo, site layout, location of existing off-site receptors (1-28), proposed future on-site sensitive receptors (29-36) and existing off-site noise sources.
Note: Figure 14-2 sourced from Appendix 14 (ASK 2017b, refer to Figure 2.4)

14.3.2 Existing Noise and Vibration Sources

The existing potential noise sources in the vicinity of the KUR-World site were identified by a field survey, and the probability of noise emissions from these sources was considered (Table 14-2:). Of the existing potential noise sources, the Billabong Hotel (approximately 75 metres south of the development) and the Kuranda Pet Resort dog kennel business were nominated as requiring further consideration, and the noise originating from these sources was investigated (Figure 14-2).

Table 14-2: List of nearby noise sources.

Address	Name	Location relative to development (refer Figure 14-1)	Potential Noise Emissions impacting onto Development
45 Myola Rd	Kuranda Landscape Supplies	Approximately 800m east of the development	Equipment and vehicles
47 Myola Rd	Kuranda Raw Materials	Approximately 800m east of the development	Equipment and vehicles
46/RP851443	Quarry on Kennedy Highway opposite Windy Hollow Road	Approximately 1.5km south of the development	Equipment and vehicles
56 Monaro Close	A small orchard	Approximately 75m north of the development	Occasional farm equipment
186 Mount Haren Road	Billabong Hotel	Approximately 75m south of the development	Recreational activities
131 Boyles Road	Kuranda Pet Resort	Approximately 75m west of the development	Dogs

Note: Table 14-2 sourced from ASK 2017b, Appendix 14, refer Table 2.2.

14.3.3 Existing Noise and Vibration levels

The existing noise levels were measured by long-term noise logging at four sites for one week (sites A, B, D, E) and short-term attended noise measurements at the four logging sites and an additional site (site C). The location of the sites is presented on Figure 14-3, and the monitoring followed appropriate methodology as described in Appendix 14 (refer to Section 5.2). The Rating Background Noise Levels (RBLs) were determined from the long-term noise logging; the results are presented in Table 14-3:. The RBLs less insects is provided as a more representative value for cooler months when insect noise is reduced and because insect noise is likely to be higher frequency and have minimal masking effect on noises in lower frequency bands.

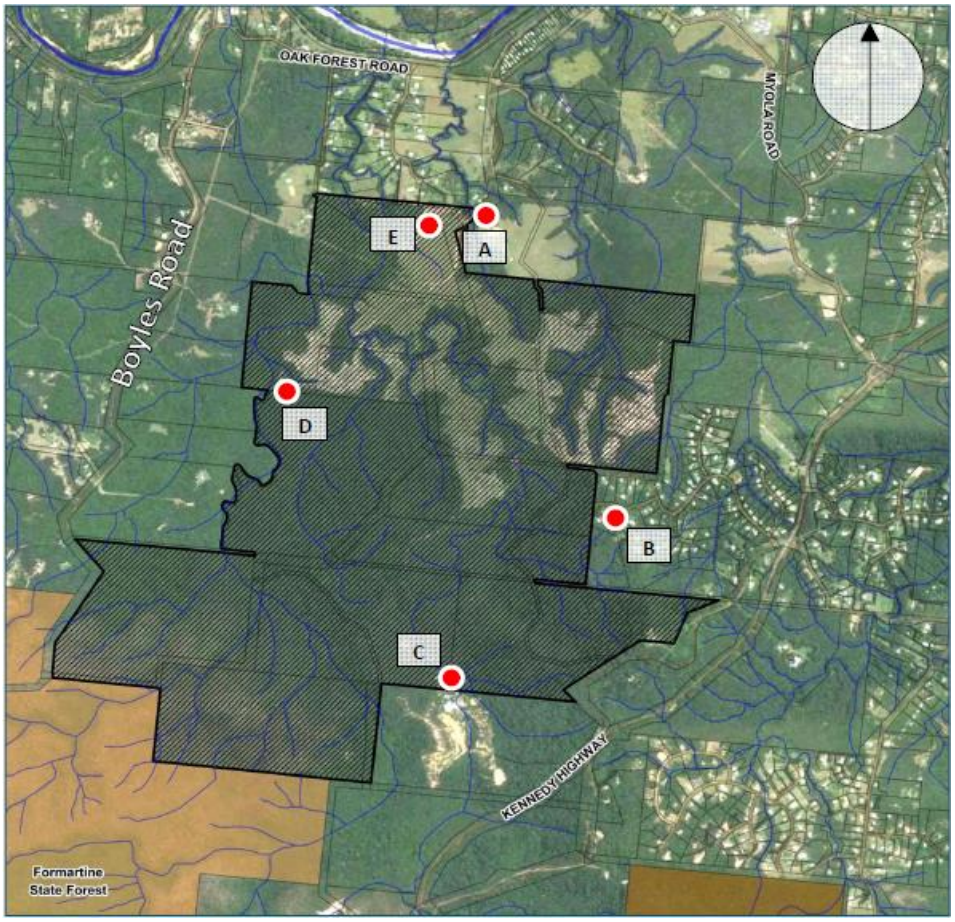

Figure 14-3: Noise monitoring locations A to E.
Note: Figure 14-3 sourced from Appendix 14 (ASK 2017b, refer to Figure 5.1)

Table 14-3: Rating background noise levels (RBL's) from noise logging.

Location	Rating Background Noise Level (RBLs) L_{90}			RatingBackgroundNoiseLevel(RBLs)L_{90}(lessinsects)		
	Day	Evening	Night	Day	Evening	Night
A –north	44	46	43	33	25	25[1]
B – east	49	42	42	36	29	25
D – west	41	45	44	32	27	26
E –north	48	45	42	34	31	25[2]

[1] At Location A, the RBL at night was measured as 20dBA; however, a minimum background noise level of 25dBA is applied as per EHP guidelines (EHP 2016).

[2] At Location E, the RBL at night was measured as 23dBA; however, a minimum background noise level of 25dBA is applied as per EHP guidelines (EHP 2016).

Note: Table 14-3 sourced from ASK 2017b, Appendix 14, refer Table 5.2.

14.3.4 Sensitive receptors

Sensitive receptors to noise relevant to the KUR-World development were identified and reported (refer Appendix 14). Twenty-eight off-site sensitive receptors (refer Table 14-1:) and eight proposed future on-site sensitive receptors were identified Figure 14-2. The KUR-World construction and operation noise and vibration impacts on these sensitive receptor sites were considered.

14.4 Construction Noise and Vibration Impacts

The proposed delivery of the KUR-World development requires construction activity on-site for at least nine-years. Activity will include earthworks and infrastructure and building construction.

14.4.1 Construction noise criteria

The construction noise level targets for the project are adopted from the New South Wales Interim Construction Noise Guideline (ICNG) (DECC 2009). The ICNG targets are screening criteria for assessing whether construction noise is likely to have adverse noise impacts on sensitive receptors and whether work practices should be implemented to reduce noise levels. Where noise levels exceed the noise affected level, some community reaction to construction noise is expected and the project should implement mitigation measures to reduce noise impacts. The noise level targets for construction are based on ambient background noise level plus an allowance of 10dB for activity during Monday to Saturday from 6.30am to 6.30pm, or an allowance of 5dB (as a guide) for activity outside standard hours Table 14-4:.

Table 14-4: Construction noise screening criteria.

Location	Rating Background Noise Level (RBLs) L_{90} (less insects)			ICNGNoise Affected Level dBA $L_{eq(15\ minute)}$ (Highly Noise Affected Level in Brackets)		
	Day	Evening	Night	Day	Evening	Night
A – north	33	25	25	43(75)	30	30
B – east	36	29	25	46(75)	34	30
D – west	32	27	26	42(75)	32	31

Note: The highly noise affected level only applies in the daytime.

Note: Table 14-4 sourced from ASK 2017b, Appendix 14, refer Table 8.1

14.4.2 Construction noise impacts

Environmental noise calculations were made for the assessment of noise impacts from construction work associated with the development. It was assumed that plant equipment items will be required to complete the construction of the project, and the noise calculations used sound power levels determined from a noise source database. The typical construction sound power levels for construction vehicles and piling are presented in Table 14-5:.

Table 14-5: Typical sound power levels for construction activities and equipment.

Equipment Type	Sound Power Level, $L_{w,eq}$ dBA
Dozer	108
Excavator	116
Front end loader	112
Grader	111
Profiler	113
Road truck	111
Rock breaker	118
Vibratory Roller	105
Water cart	111
Piling	117

Note: Table 14-5 sourced from ASK 2017b, Appendix 14, refer Table 8.2

14.4.2.1 General construction

The predicted noise levels at distance for construction equipment are presented in Table 14-6:. These predicted construction noise levels exceed the day time noise affected level at all distances calculated (up to 200 metres) and exceed the highly noise affected day time noise level at distances of up to 20m for the various equipment types.

Table 14-6: Predicted noise levels for construction equipment at various distances.

Equipment Type	Predict Noise Level, $L_{eq, adj, 15min}$ dBA								
	5m	10m	20m	35m	50m	75m	100m	150m	200m
Dozer	83	77	71	66	62	59	56	52	49
Excavator	91	85	78	73	69	66	63	59	56
Front end loader	87	81	74	69	66	62	59	55	52
Grader	86	80	73	68	65	61	58	54	51
Profiler	88	81	75	70	67	63	60	56	53
Road truck	86	79	73	68	65	61	58	54	51
Rock breaker	93	87	80	75	71	67	64	60	58
Vibratory Roller	80	73	67	62	58	54	52	48	45
Water cart	85	79	73	67	64	60	57	53	50
Piling	92	86	79	74	70	66	63	59	57

Note: Table 14-6 sourced from ASK 2017b, Appendix 14, refer Table 8.3.

14.4.2.2 Trucks on access roads

Trucks will access the site from the secondary access road (Barnwell Road) and the Primary Access Road. The calculated noise level from a single truck to the nearest residence is 55dBA, which will result in the residence being noise affected. The use of Barnwell Road and Myola Road by haul trucks for construction traffic will have noise impact on nearby residences; this will also be considered in the Construction Noise and Vibration Management Plan.

14.4.3 Operational Noise and Vibration Impacts

14.4.3.1 Zip line

Noise criteria

A zip line is proposed for the southern portion of the development. The noise criteria used to assess the zip line is the 'background creep' criteria for noise that varies over time, where the noise level is not to exceed the RBL by more than 5dBA. The quietest RBL noise measurements were used to assess potential zip line noise impact (Table 14-3: sourced from ASK 2017b).

Noise levels and Assessment

The calculated noise levels and assessment are provided in Table 14-7:. For day time operations, the zip line is expected to be compliant with the criteria. If the zip line is to operate in the evening or night, investigation of mitigation measures will be required to achieve compliant noise levels.

Table 14-7: Calculated noise levels from ziplines (All 3 zipline locations in use).

Receiver	Noise Levels, $L_{Aeq,15mins}$, dBA	
	1 movement per 15 minutes (for each of 3 ziplines)	5 movement per 15 minutes (for each of 3 ziplines)
R28-186 Mount Haren Road (Billabong Hotel)	33	40

133 Mount Haren Road	30	37
R01 - 7 Hilltop Close	25	32
R02 - 10 Hilltop Close	24	31
5 Perry Close	21	28

Note: Table 14-7 sourced from ASK 2017b, Appendix 14, refer Table 6.1.

14.4.3.2 Helipad

Noise criteria

A privately-owned helipad is proposed to be located adjacent to the southern boundary of the site, approximately 100 metres from the Billabong Hotel and 1 kilometre from existing dwellings. The Billabong Hotel is understood to have a cooperative relationship with the KUR-World development and accepts the use of the helipad at its proposed location. The relevant noise limit is derived from ASA (2002), under which the limit is 40dBA for rural areas.

Noise levels and Assessment

If a minimum distance of 500 metres is maintained for the flight path, the predicted noise level at the existing nearest dwelling (excluding the Billabong Hotel) will be compliant with the ASA (2002) noise limit. The 500 metres minimum flight path distance also enables the helipad to comply with the EPA Noise Control Guidelines (EPA 2008) and the permit relaxation conditions for the Victorian Department of Planning and Community Development Practice (DELWP 2012 and updated in 2015).

14.4.3.3 Sewage Treatment Plant

Noise criteria

An on-site sewage treatment plant is proposed for the northern zone, with potential to impact sensitive receptors within the KUR-World development site Table 14-8:. The 'background creep' criteria for noise that is continuous are appropriate for this impact and require that the operation does not exceed the existing noise level. The quietest RBL noise measurements (Table 14-3:) were used to assess potential sewage treatment plant noise impact.

Table 14-8: List of proposed sensitive receptors with UTM coordinates (WGS84 Z55).

ID	Property Description	Approximate Distance and Direction from Proposed Sewage Treatment Plant	Easting (m)	Northing (m)
29	Business and Leisure Hotel	130 m to the east	351248	8139764
30		130 m to the east	351259	8139691
31		250 m to the south-east	351348	8139576
32	Premium Villas	410 to the south-east	351447	8139427
33		140 m to the south-west	351064	8139554
34		200 m to the south-west	350998	8139521
35	Lifestyle Villas	250 m to the south-west	350859	8139618
36	Queenslander Lot (Farm- Stay Accommodation)	620 m to the north	350966	8140327

Note: Table 14-8 sourced from ASK 2017b, Appendix 14, refer Table 6.2.

Noise levels and Assessment

Noise levels for a sewage treatment plant of a capacity expected to be operating at KUR-World will comply with day time noise limits, though exceed evening and night limits at the nearest sensitive receptor (the business hotel). The sewage treatment plant will require a detailed assessment, and mitigation measures may be required.

14.4.3.4 Mechanical plant (general)

Noise criteria
A mechanical plant that houses air-conditioning, refrigeration, generators, exhaust and supply fans is expected to be located within the development. It is proposed that the plant and all equipment be compared to the 'background creep' noise criteria for continuous noise.

Noise levels and Assessment
No details for the mechanical plant were available to compare expected noise to noise limits. However, it is noted that a mechanical plant has the potential to exceed the noise criteria; therefore, care should be taken in design of this component of the development.

14.4.3.5 Amplified music and patron noise

Noise criteria
Venues with amplified music and the capacity for large numbers of patrons are planned for the KUR-World development. The 'background creep' criteria for noise that varies over time is the appropriate noise limit. The RBL used for assessment was taken from the quietest RBL (Table 14-9), and the criteria requires noise to not exceed the RBL by more than 5dBA.

Noise levels and Assessment
The expected noise from the amplified music venues is presented in Table 14-9. The day time noise limit would be achieved at 50 metres from 10 patrons, 100 metres from 25 patrons and 200 metres from 50 patrons. The night time noise limits are lower, and compliance will require approximately double the setback distance. Noise from activities within buildings can be controlled by construction measures, though outdoor amplified music will require separation distances from sensitive receptors and consideration of other mitigation measures. It is not expected that low frequency energy will be an issue for the project, as sources of this energy are not planned, other than possibly for amplified music. There could be low frequency noise emissions from amplified music, which if it was the case, would need be limited (that is management measures) to achieve compliance.

Table 14-9: Patron noise calculations

Patrons	Sound Power Level, $L_{w,eq}$ dBA	Noise Levels at Various Distances, L_{eq} dBA				
		10m	25m	50m	100m	200m
10	79	51	43	37	31	25
25	85	57	49	43	37	31
50	89	61	54	48	41	35
100	94	66	58	52	46	40
200	99	71	63	57	51	44

Note: Table 14-9 sourced from ASK 2017b, Appendix 14, refer Table 6.3.

14.4.3.6 Vehicles

Noise criteria

There are three access roads proposed for the KUR-World development, and a fourth under consideration. The locations of the three access roads are provided in Figure 14-4, Figure 14-5 and Figure 14-6. The road access locations are within existing road reserves; therefore, the Transport Noise Management Code of Practice (TMR 2013) provides the appropriate criteria to assess noise impacts. The primary and secondary access roads will receive traffic to the KUR-World development, and noise impacts have been considered. The tertiary access road will be gated and designated for emergency access and will not produce substantial noise impacts on sensitive receptors.

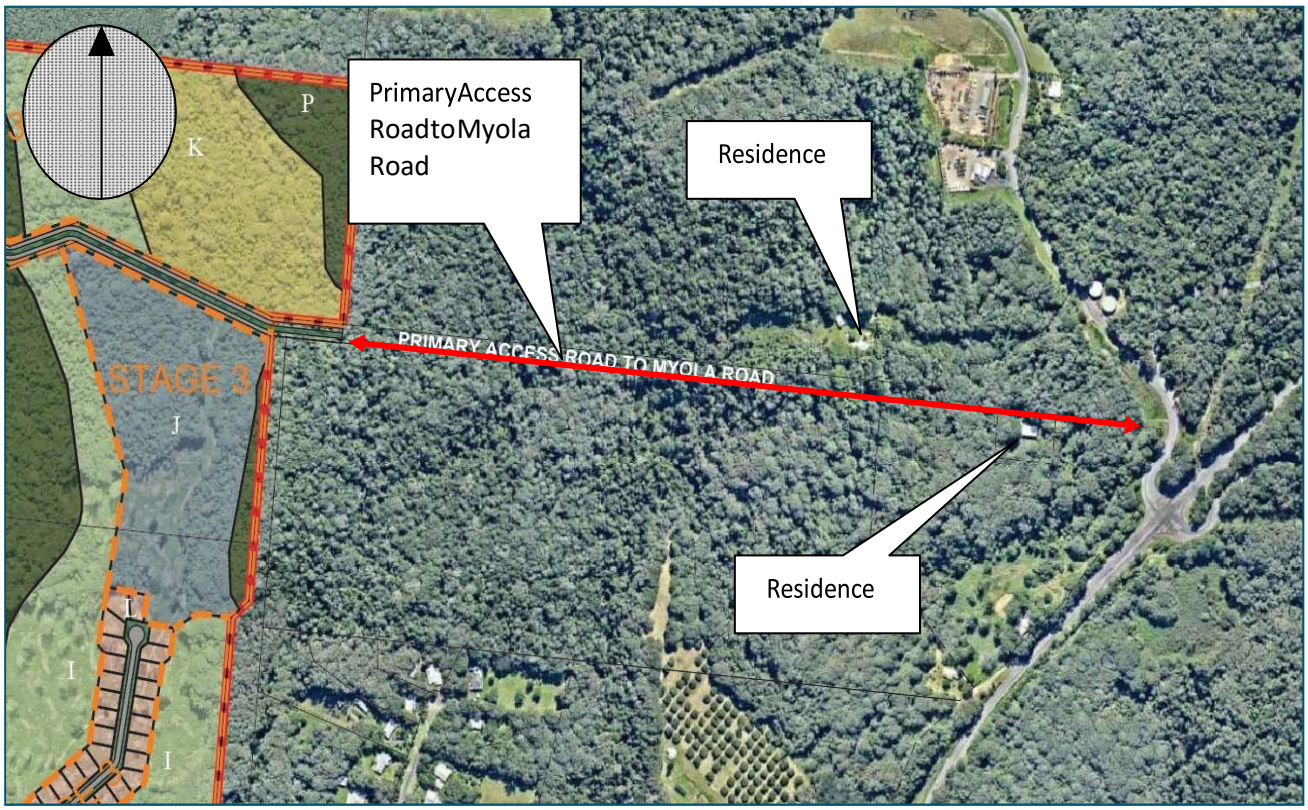

Figure 14-4: Primary access from Myola Road to North-East.

Note: Figure 14-4 sources from Appendix 14 (ASK 2017b, refer to Figure 6.2)

Figure 14-5: Secondary access from Barnwell Road to North.
Note: Figure 14-5 sources from Appendix 14 (ASK 2017b, refer to Figure 6.3)

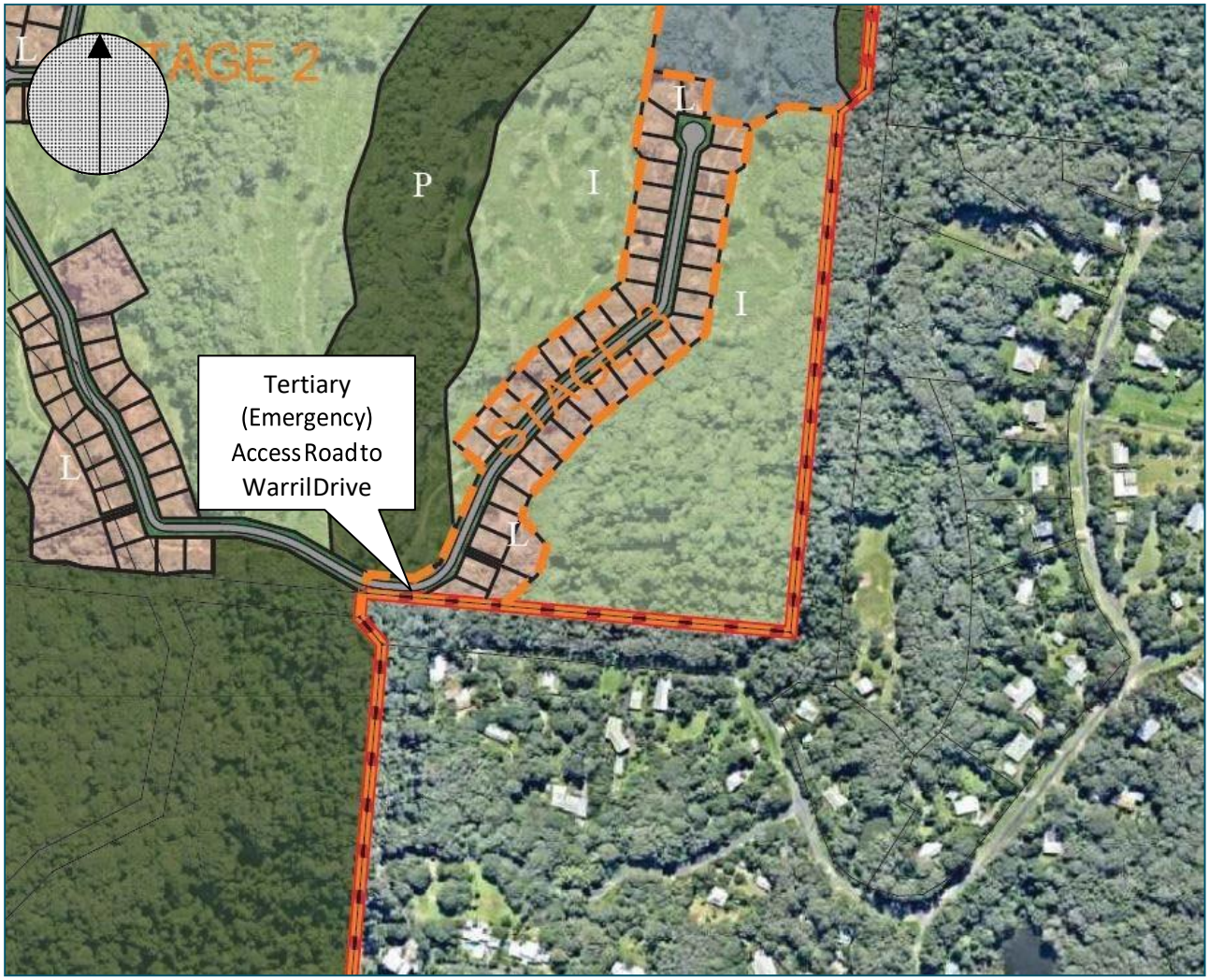

Figure 14-6: Tertiary (emergency access) from Warril Drive to East/South-East.
Note: Figure 14-6 sources from Appendix 14 (ASK 2017b, refer to Figure 6.4)

Noise levels and Assessment
Noise impacts from vehicles on off-site sensitive receptors were assessed. For the primary access road, compliance with the noise limit can be achieved if the road is limited to 2,100 vehicles per day, 5 % heavy vehicles and 5 % road gradient, 16.5 metres from residential façade to kerb and absorptive material (vegetation) is located between sensitive receptors and the road. Further mitigation measures can increase the number of vehicles per day and remain within the noise limit.

For the secondary access road, compliance with the noise limit can be achieved if the road is limited to 2,000 vehicles per day, 5 % heavy vehicles and 2 % road gradient, 13.5 metres from residential façade to kerb and absorptive material (vegetation) is located between sensitive receptors and the road.
More detailed assessment of the primary and secondary access roads can occur when further details of the roads and surrounding sensitive receptors are available.

14.4.3.7 Noise intrusion assessment (pet resort)

Noise criteria

Noise sources external to the KUR-World development are provided in Table 14-2. Of the potential noise sources, the Billabong Hotel and Kuranda Pet Resort dog kennels were considered to have potential to create noise impacts on the sensitive receptors in the KUR-World development. The locations of these potential noise sources are provided on Figure 14-7. The noise limits appropriate for assessing impacts of dog kennels were derived from a Planning and Environment Judgment (No. 936 of 2014) (as referenced in ASK 2017b). The relevant noise limits for the Kuranda Pet Resort impacting a sensitive receptor within the western portion of the KUR-World development were calculated and provided in ASK (2017b: refer to Section 7.1.2).

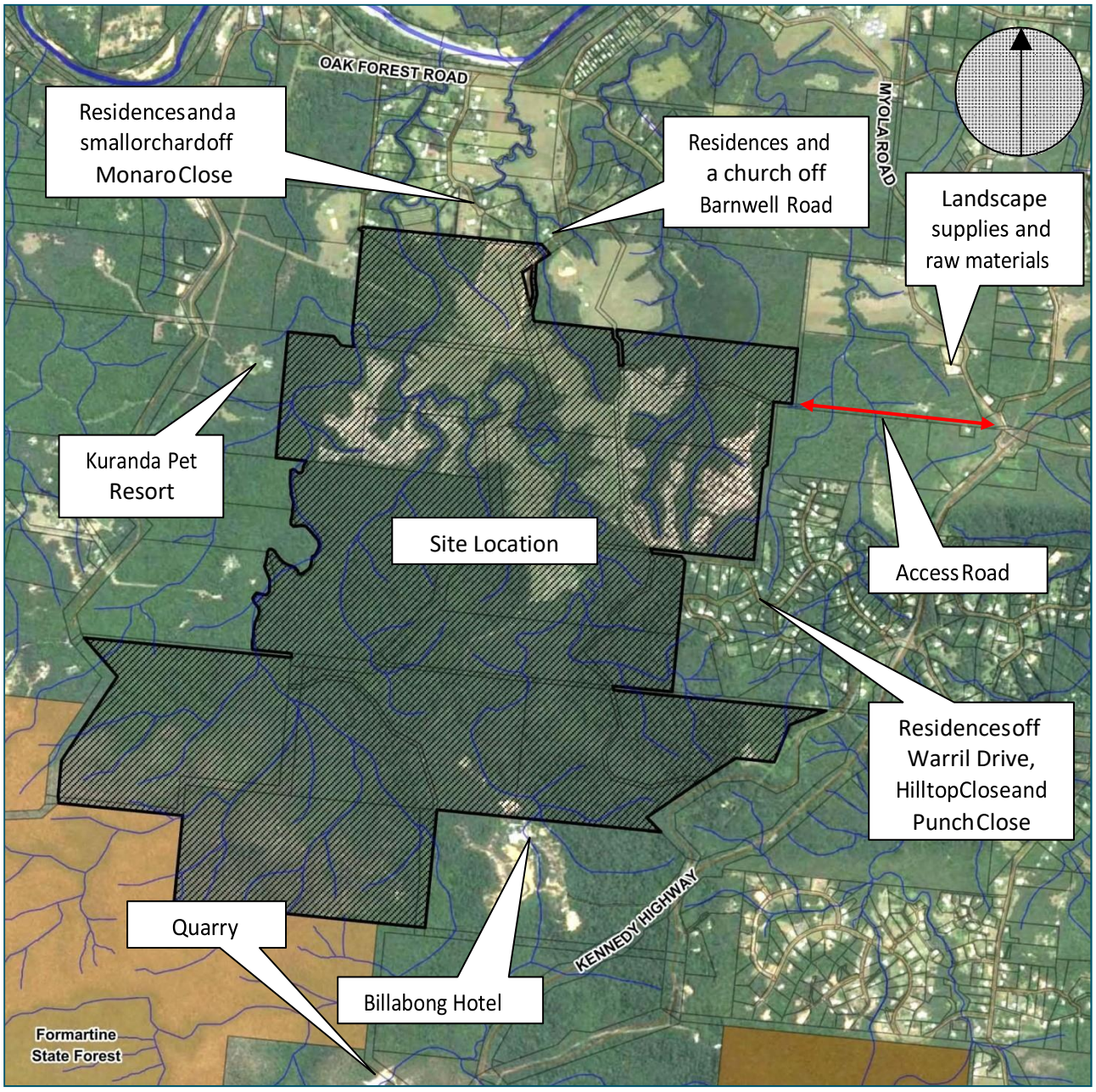

Figure 14-7: Site location and nearby uses.

Note: Figure 14-7 sourced from Appendix 14 (ASK 2017b, refer to Figure 2.3**)**

Noise levels and Assessment
The noise impacts of the dog kennels on the KUR-World development were modelled using generic assumptions of noise production and conservative noise attenuation. The modelled noise from the dog kennels will achieve the nominated noise limit if mitigation measures can achieve a reduction of 0-3dBA in the day time and 8-14dBA in the evening and night time. With the expectation that the noise produced by the dog kennels will be limited in the evening and night, compliance with the noise limit will be achieved by placing screening between the dog kennels and any on-site sensitive receptors. It is also noted that existing off-site sensitive receptors are closer to the dog kennels than the proposed KUR-World development. It is assumed that the dog kennel noise impacts on existing sensitive receptors are compliant and therefore that the noise impacts at the proposed KUR-World sensitive receptors will also be compliant.

14.4.3.8 Noise intrusion assessment (Billabong hotel)

Noise criteria
The Billabong Hotel is approximately 100 metres from proposed locations for the KUR-World development activities, and numerous activities with noise production potential occur at the hotel. The proposed KUR-World southern residences and glamping area will be approximately 1 kilometre from the Billabong Hotel. Noise impacts modelled for existing sensitive receptors outside of the KUR-World development have been used to allow assessment of potential noise impact on KUR-World on-site sensitive receptors.

Noise levels and Assessment
The amplified music venues at the Billabong Hotel are assumed to be the greatest noise sources from the property. Generic amplified noise was modelled from the two music venues and noise levels at the potential sensitive receptors determined. The results are provided in ASK (2017b: refer to Section 7.2.3). Because the absolute noise levels are not known, and generic noise levels were assumed, a comparison with other off-site existing sensitive receptors is considered appropriate to determine potential noise impacts. Modelled noise impacts at existing off-site sensitive receptors are no greater than modelled impacts at the proposed KUR-World on-site sensitive receptors. The off-site sensitive receptors have not reported any noise impacts; therefore, the KUR-World on-site sensitive receptors are not predicted to be exposed to noise impacts from the Billabong Hotel.

14.5 Potential Impact & Mitigation Measures

14.5.1 Construction phase

For the construction phase, predicted construction noise levels exceed day time noise affected levels at all distances assessed and exceed the highly noise affected level at distances of up to 20 metres. Therefore, all works will be carried out in accordance with the best practicable methods to reduce noise impacts. The implementation of noise control methods, including maximising distance, applying screening, enclosure and silencing, will apply at all stages of construction. Where practicable, screening and silencing are expected to provide the best reduction in construction noises.

General mitigation measures to mitigate the impacts associated with noise are also proposed. These include the following (ASK 2017b).

- Modern and well-maintained equipment should be used to undertake the works.
- Noisy or vibration generating plant, equipment and activities should be substituted with lower impact options where possible.

- Arrange work flow to minimise the use of reversing alarms on vehicles and plant. Use equipment with broadband alarms where possible.
- Locate noisy plant, site vehicle entrances and off-site truck parking areas away from sensitive receptors where possible.
- Plant equipment known to emit noise strongly in one direction should, where possible, be orientated so that the noise is directed away from the closest noise-sensitive areas.
- Where machines are fitted with mufflers, these should be kept in good condition and replaced if degradation has led to noticeably increased noise emissions.
- There should be continuous training of operators, labourers, subcontractors and supervisors through induction training and ongoing meetings on the need to minimise noise impacts on surrounding residences.
- Where machines are fitted with engine covers, these should be kept closed when the machine is in use.
- The drivers of machinery should be provided with appropriate communication equipment to ensure that signalling by other means (e.g. horns) is kept to a minimum.
- Noise sensitive receptors should be informed of any nearby construction works, or significant changes to nearby construction works, in advance (preferably at least one-week notice, except for emergency works) of works occurring.
- Provide advanced notice, where possible, to stakeholders when loud construction or demolition activity is proposed to be undertaken.
- Open communication should occur with stakeholders near construction areas who could potentially be impacted by activities resulting in noise and vibration emissions. A construction engagement programme should be developed and implemented to create a dialogue with stakeholders during the construction phase.
- A designated communication channel, i.e. email and phone number, should be established, to facilitate communication with stakeholders. This communication method should be actively managed to ensure complaints and issues can be addressed as soon as practically possible.

A Construction Noise and Vibration Management Plan should be developed for the KUR-World development and include these mitigation strategies. Noise from trucks using Barnwell Road and Myola Road during the construction phase is predicted to impact sensitive receptors. The Construction Noise and Vibration Management Plan should specifically address this traffic noise issue and relevant noise control measures.

14.5.2 Operational phase

The operation of the KUR-World development is predicted to result in noise and vibration impacts. A summary of operational noise impacts and management mitigation measures is provided in Table 14-10.

Table 14-10: Operational noise impacts and mitigation measures.

Potential operational impact	Predicted compliance status	Mitigation measure		Noise management plan requirement
		Design	Operation	
Zip line	Compliant at specified conditions	• Low noise trolleys and cables can be substituted to allow more frequent use or extended hours of use.	• At standard specifications, zip lines can be operated in day time only and at frequency of 2 runs per 15 minutes.	Requires completion of detailed noise management plan.
Helipad	Compliant at specified conditions	• Retain the proposed helipad location at 1 kilometre from sensitive receptors (excluding the Billabong Hotel).	• A minimum distance of 500 metres required for the flight path. • Maximum 20 flights per day.	-
Sewage treatment plant	Potentially non-compliant	• Noise mitigation measures are recommended dependent on detailed design of sewage treatment plant.	• Post construction testing required to determine compliant noise levels.	Requires completion of detailed noise management plan.
Mechanical plant (general)	Potentially non-compliant	• Consideration of plant location, design and selection is required to prevent non-compliance.	-	-
Amplified music and patron noise	Compliant at specified conditions	• Locate activities as far from on-site sensitive receivers as possible. Required distances provided in Table 6.3 (ASK 2017b). • Provide shielding (from topography, non-sensitive buildings, barriers).	-	-
Vehicles	Compliant at specified conditions	• Access roads constructed and operated to the specifications given in Sections 6.6.3 and 6.6.4 (ASK 2017b) achieve compliance. • Additional road side noise barrier is required adjacent to the house on the southern side of the primary access road (ASK 2017b: refer to Section 6.6.5).	-	Requires completion of detailed noise management plan.

Potential operational impact	Predicted compliance status	Mitigation measure		Noise management plan requirement
		Design	Operation	
Pet resort noise intrusion	Compliant	• Vegetation be placed between the dog kennels and proposed residences. • Minimal screening at the dog kennels is a further mitigation measure.	-	-
Billabong Hotel noise intrusion	Compliant	-	-	-

Note: Table 14-11 sourced from ASK 2017b, Appendix 14, refer Section 6.

14.6 Conclusions

The noise and vibration assessment has predicted exceedances of noise relevant limits for the construction and operation phases of the KUR-World development. Cumulative impacts are not considered to be of significance. Noise sources are located in different parts of the site near to different sensitive receivers. Each source will need to be limited (that is management measures) to achieve compliance at the nearest sensitive receivers.

General noise mitigation measures to manage noise impacts have been provided, and a Construction Noise and Vibration Management Plan will be prepared to address general construction and traffic noise during the construction phase. Noise impacts from the external pet resort and Billabong Hotel on sensitive receptors in the KUR-World development are expected to be compliant with noise limit criteria. Operational noise impacts exceeding relevant criteria were identified in the noise and vibration assessment. The sewage treatment plant is predicted to potentially exceed noise limit criteria. Operation of the sewage treatment plant requires completion of a detailed noise assessment during its design development to assess impacts with greater certainty and determine appropriate mitigation measures. The mechanical plant is determined to be potentially non-compliant; however, specifications for this operation are not yet available for thorough assessment. The operation of the zip line and operational phase vehicle traffic has been determined to be compliant with noise limit criteria under assumed operation conditions. The helipad and amplified music venues are predicted to be compliant with noise limit criteria under the conditions used for assessment.

Relevant mitigation measures have been identified and further measures to mitigate identified potential impacts will be provided in the detailed noise management plans.

14.7 References

ASA 2002, *Environmental Principles and Procedures for Minimising the Impact of Aircraft Noise*, Air Services Australia, revised 21 November 2002.

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DELWP 2012, *Planning Practice Note 75: Planning requirements for heliports and helicopter landing sites*, State of Victoria Department of Environment, Land, Water and Planning.

EHP 2016, *Guideline: Planning for Noise Control,* Version 1, Queensland Department of Environment and Heritage Protections, 15 January 2016.

EPA 2008, *Noise Control Guidelines*, Environment Protection Authority Victoria, October 2008.

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