Katanning Gold Mining Operations

Environmental Noise Assessment

Prepared for Ausgold Limited

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Executive Summary

Ausgold Limited (Ausgold) is proposing to develop the Katanning Gold Project (KGP) within the Shire of Katanning, approximately 275 kilometres (km) southeast of Perth and 36 km northeast of Katanning Western Australia.

This report provides an overview of an environmental noise assessment undertaken for the KGP.

The aim of this study is to quantify the potential noise impacts of the KGP on surrounding noise sensitive receivers and, where applicable, determine noise mitigation measures.

A noise model has been developed to include the proposed fixed processing plant, mobile equipment fleet, power station and ancillary equipment. Dynamic noise modelling has been undertaken that simulates mobile equipment moving along the haul road network, in pits and on Waste Rock Landforms (WRLs). This provides a realistic representation of actual expected operational movements and statistical noise outputs. Various scenarios were undertaken to represent the mining areas and years.

Noise modelling results, with no controls applied, (see section 5) identified that some receivers can exceed the assigned levels, and that mine design required improvements and/or noise controls. As a result, Ausgold is will undertake to apply the following noise control strategies:

- Using a planning and adaptive noise management system.
- Engineering noise controls including modifications to mine design and the use of equipment noise reduction packages.
- Acquisition of properties.

Evidence provided in sections 6 and 7 shows that the noise control strategies identified by Ausgold have the ability to result in KGP achieving compliance with the most stringent night-time assigned noise levels. The noise strategies will be further optimised for each mining year as the project design matures, and as the mine becomes operational.

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1 Introduction

Ausgold Limited (Ausgold) is proposing to develop the Katanning Gold Project (KGP) within the Shire of Katanning, approximately 275 kilometres (km) southeast of Perth and 36 km northeast of Katanning Western Australia.

This report provides a summary of an environmental noise assessment undertaken for KGP.

1.1 Aim

The aim of this study is to quantify potential noise impacts of the KGP on surrounding noise sensitive receivers and, where applicable, determine noise control measures required to comply with the Environmental Protection (Noise) Regulations 1997 [2].

1.2 Applicable Documents

[1] Environmental Protection Act 1986.

[2] Environmental Protection (Noise) Regulations 1997.

[3] DWER Draft Guideline "Assessment of environmental noise emissions", May 2021.

2 Project Overview

2.1 Mining Operations Overview

The proposed KGP mine will be a conventional open cut mining operation using surface mobile equipment (including excavators, haul trucks, dozers, loaders etc.) which will transport ore, via a ROM, to the fixed plant gold processing circuit and waste to Waste Rock Landforms (WRLs). The staged open cut operations will include the development of various haul roads, pits, services and WRLs.

Once mined, the ore will be processed using crushing, grinding and Carbon in Leach (CIL) technology to produce gold. KGP aims to have an annual average production rate of up to 3.6 million tonnes per annum (Mtpa) operation over a 10-year Life of Mine (LoM).

Noise modelling undertaken for this assessment includes consideration of the mining locations and topographic layers (pits and WRLs) at various stages over the LoM. Operations will be undertaken 24 hours a day, 7 days a week.

2.2 Noise Sensitive Receivers

The proposed KGP is located ~36km from Katanning, adjacent to surrounding agricultural land. There are various noise sensitive receivers surrounding the operation including houses, farms and homesteads.

A combination of information provided by Ausgold and an aerial review of the area have been used to identify the surrounding noise sensitive receivers. Table 2-1 and Figure 2-2 summarise the modelled noise sensitive premises.

Table 2-1 Coordinates of Noise Sensitive Receivers

Receiver Reference	Coordinates UTM (Zone 50H)		Receiver Reference	Coordinates UTM (Zone 50H)	
	x	y		x	y
R1	581462	6295227	R42	594189	6275628
R2	583449	6296519	R43	592474	6275750
R3	581361	6297763	R44	582160	6278034
R4	578946	6297113	R45	581228	6277871
R5	577929	6296688	R46	577784	6283328
R6	578731	6292062	R47	578514	6285016
R7	581895	6289409	R48	574249	6285935
R8	582360	6291284	R49	574114	6287855
R9	585238	6290066	R50	577572	6287930
R10	582757	6293718	R51	574794	6291163
R11	583752	6297692	R52	572954	6290092
R12	582412	6293427	R53	575410	6293883
R13	586645	6292045	R54	573931	6299033
R14	584470	6288639	R55	579557	6300477
R15	585649	6286374	R56	580997	6276366
R16	584717	6286194	R57	580664	6278106

Receiver Reference	Coordinates UTM (Zone 50H)		Receiver Reference	Coordinates UTM (Zone 50H)	
	x	y		x	y
R17	580612	6286064	R58	583449	6296519
R18	577795	6282113	R59	578946	6297113
R19	582247	6283461	R60	582757	6293718
R20	584925	6281851	R61	583752	6297692
R21	581565	6280922	R62	586645	6292045
R22	586012	6277790	R63	580612	6286064
R23	585477	6276740	R64	577794	6282113
R24	588295	6278795	R65	585477	6276740
R25	588079	6276763	R66	588295	6278795
R26	591597	6280629	R67	579830	6303777
R27	581993	6300291	R68	580929	6304162
R28	579830	6303777	R69	580247	6304893
R29	580929	6304162	R70	588455	6297575
R30	580247	6304893	R71	590286	6293436
R31	588455	6297575	R72	589390	6291460
R32	589994	6295459	R73	592474	6275750
R33	591013	6294336	R74	581228	6277871
R34	590286	6293436	R75	577784	6283328
R35	589391	6291460	R76	578513	6285016
R36	590196	6290193	R77	574114	6287855
R37	592720	6287325	R78	575410	6293883
R38	591709	6285568	R79	573931	6299033
R39	591770	6285857	R80	580997	6276366
R40	593834	6282419	R81	580664	6278106
R41	594929	6280991			

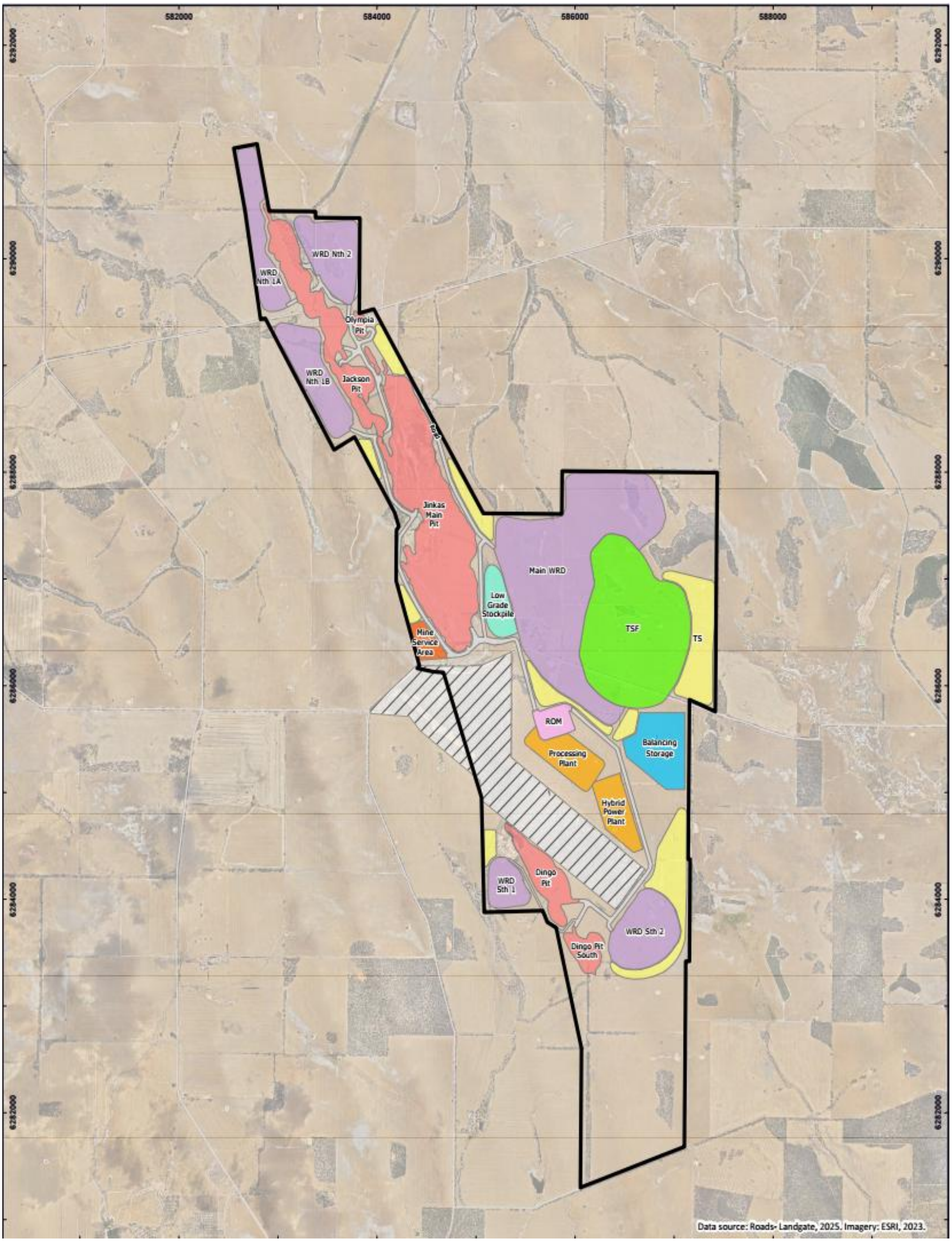

Figure 2-1 Ausgold Katanning Gold Project – General Site Plan

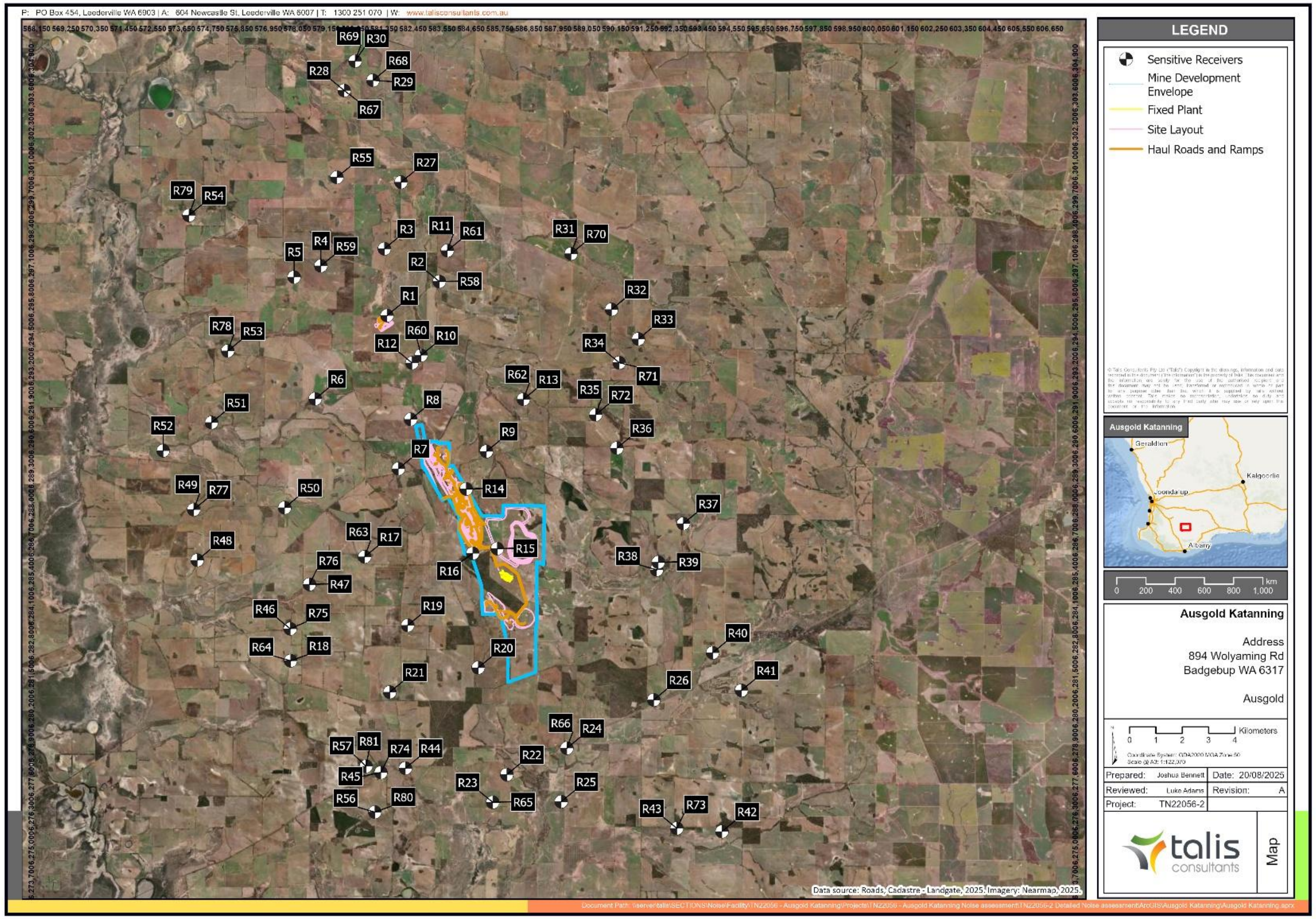

Figure 2-2 Modelled Noise Sensitive Receiver Locations

3 Summary of Legislation

3.1 Environmental Protection (Noise) Regulations 1997

Noise management in Western Australia is implemented via the Environmental Protection (Noise) Regulations 1997 (the Regulations), which operate under the Environmental Protection Act 1986.

The Regulations define maximum allowable noise levels, termed assigned level, which apply to noise received at noise sensitive premises, such as residential areas. These are determined by a combination of a base noise level plus an Influencing Factor (IF).

The assigned noise levels include L_{A1}, L_{A10} and L_{AMAX} noise parameters, defined as:

- L_{ASMAX} means an assigned level which is not to be exceeded at any time.
- L_{AS1} means an assigned level which is not to be exceeded for more than 1% of time.
- L_{AS10} means an assigned level which is not to be exceeded for more than 10% of time.

For noise sensitive premises, the time of day also affects the assigned noise levels. As the KGP will operate 24 hours a day, 7 days a week, the night-time L_{A10} noise emissions have been assessed against the most stringent night-time assigned levels.

3.2 Assigned Noise Levels

Table 3-1 presents the assigned noise levels defined in the Regulations.

Table 3-1 Environmental Protection (Noise) Regulations - Assigned Noise Levels

Sensitive Receiver	Time of day	Assigned Levels (dB)		
		L_{A10}	L_{A1}	L_{Amax}
Noise Sensitive Premises	0700 to 1900 hours Monday to Saturday	45 + influencing factor	55 + influencing factor	65 + influencing factor
	0900 to 1900 hours Sundays and public holidays	40 + influencing factor	50 + influencing factor	65 + influencing factor
	1900 to 2200 hours all days	40 + influencing factor	50 + influencing factor	55 + influencing factor
	2200 hours on any day to 0700 hours Monday to Saturday and 0900 hours Sunday and public holidays	**35 + influencing factor**	**45 + influencing factor**	**55 + influencing factor**
Industry Boundary	all times	65	80	90

3.2.1 Influencing Factors

The Influencing Factor (IF) is based on the surrounding land use adjacent to each of the noise sensitive receivers, including the amount (%) of industrial and commercial premises as well as the number and proximity of major and secondary roads.

The area is primarily rural land, with no major roads or industrial or commercial areas. Therefore, no influencing factors are applicable. Table 3-2 presents applicable IF's.

Table 3-2 Influencing Factors

Receivers	Base LA10 Assigned Level	Influencing Factor (IF)	Assigned LA10 Level
All	35	0	**35**

3.2.2 Adjustments for intrusive or dominant characteristics

Received noise levels are subject to adjustments if the noise exhibits intrusive or dominant characteristics i.e. if the noise is impulsive, tonal or modulating. These adjustments, shown in Table 3-3, are cumulative up to a maximum of 15 dB. Section 9 of the Regulations sets out objective tests to assess whether the received noise is free of these characteristics.

Table 3-3 Adjustments for intrusive or dominant characteristics

Tonality	Modulation	Impulsiveness
+ 5dB	+5 dB	+10 dB

Given the types of equipment proposed, including a heavy mobile equipment fleet, it is likely that the received noise will be tonal at the closest receivers. As a result, a blanket +5dB tonality penalty has been applied to the pre and post control predicted results. If tonality is not present, the quoted results can be adjusted by -5dB.

3.3 Applicable Noise Criteria

The applicable night-time assigned L_{A10} noise level is 35dBA at all noise sensitive receivers assessed.

4 Noise Modelling Overview

4.1 Noise Model Software

Noise modelling has been carried out utilising SoundPlan v9 software in combination with the Nexus noise management system. The SoundPlan software package calculates sound pressure levels at nominated receiver locations and produces noise contours over a defined area of interest. SoundPlan can be used to model different types of noise, such as industrial noise, traffic noise and aircraft noise.

The inputs required by the SoundPlan modelling software are noise sources, ground topographical and absorption data, meteorological data, and sensitive receiver point locations. SoundPlan has been setup for the study to utilise ISO9613 for calculating the attenuation of sound during outside propagation and the CONCAWE[1,2] prediction algorithm. The CONCAWE algorithm is accepted by the Department of Water and Environmental Regulation (DWER).

The model has been used to predict received noise levels at noise sensitive receiver locations and to generate noise contour maps for the wider area.

4.2 Noise Model Inputs

4.2.1 Noise Sensitive Receivers

The noise sensitive receivers listed in section 2.2 have been used for this noise assessment.

4.2.2 Topography and Ground Absorption

Topographical data for the pits, roads, WRLs and surrounding area were provided by Ausgold, which was used to create a digital ground map for the area.

The topographical layers were imported for their respective mining year. For example, for modelling of mining year 5 the pit depths, WRL heights/extents and haul routes planned for that mining year were imported into the noise model.

The acoustic properties of the ground surface influence noise propagation. Flat non-porous surfaces such as concrete, asphalt and water are more reflective whereas soft, porous surfaces such as foliage and grass are more absorptive. A CONCAWE ground factor of 0.5 was applied to the model, which is hard ground and is considered representative of the area during summer when the ground is generally hard.

4.2.3 Meteorological Conditions

Using CONCAWE, SoundPlan calculates noise levels for defined meteorological conditions which include temperature, relative humidity, wind speed and direction data are required as inputs to the model. Table 4-1 summarises the worst-case night-time meteorological conditions applied to the model, as defined by DWER.

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[1] CONCAWE (Conservation of Clean Air and Water in Europe) was established in 1963 by a group of oil companies to carry out research on environmental issues relevant to the oil industry.

[2] The propagation of noise from petroleum and petrochemical complexes to neighbouring communities, CONCAWE Report 4/81, 1981.

Table 4-1 : Worst-Case night-time meteorological conditions applied to the model

Time of day	Temperature	Relative Humidity	Wind Speed	Wind Direction	Pasquil Stability Category (PSC)
Night (19:00 - 07:00)	15° Celsius	50%	3 m/s	worst case	F

4.2.4 Noise Sources

The major noise sources which will be utilised for KGP are a heavy mobile equipment fleet, a fixed processing plant, a power station and ancillary equipment. The noise Sound Power Levels (SWLs) applied to each item of equipment have been calculated based on project equipment lists, drawings, specifications and noise measurements of similar representative equipment types at other mining operations and gold processing plants.

Table 4-2 provides a summary of the modelled SWLs. Spectral information is provided in Appendix B.

Table 4-2 Sound Power Levels

Equipment	Quantities	Sound Power Level (dBA)
Mobile equipment		
Haul Truck	Mining year dependant (See section 4.4)	117
Haul Truck (idle)		107
Excavator		116
Dozer		114
Water Cart		115
Grader		108
Front End Loader		109
Drill Rig		116
Fixed Plant		
Conveyor	4	85 (per metre)
Conveyor Drive	4	92
Transfer Chute	2	106
Apron Feeder	1	102
Primary Crusher	2	104
Chiller	2	94
SAG/Ball Mill	2	101
Mill Gearbox & Motor	2	110
Cyclone Feed Pump	6	101
Lube Pump	4	91
Lube Recirculation Pump	4	86

Equipment	Quantities	Sound Power Level (dBA)
Reducer Lube Pump	2	85
Screens	1	97
Cyclone Cluster	1	105
Pebble Crusher	8	110
Agitator	1	89
Power Station	1	115

4.3 Model Layout

The proposed site layout is shown in Figure 4-1. Dynamic modelling has been undertaken that simulates the mobile equipment operating along the haul road network, in pits and on WRLs. This provides a realistic representation of actual expected operational movements and statistical noise outputs. The remaining mobile equipment fleet (such as diggers, loaders and dozers) has been positioned in the model using spatial files and supporting documentation provided by Ausgold.

The fixed plant gold processing circuit layout (Figure 4-2) shows the location of the power station and processing equipment such as crushing, grinding and conventional gold Carbon in Leach (CIL) processing to produce gold.

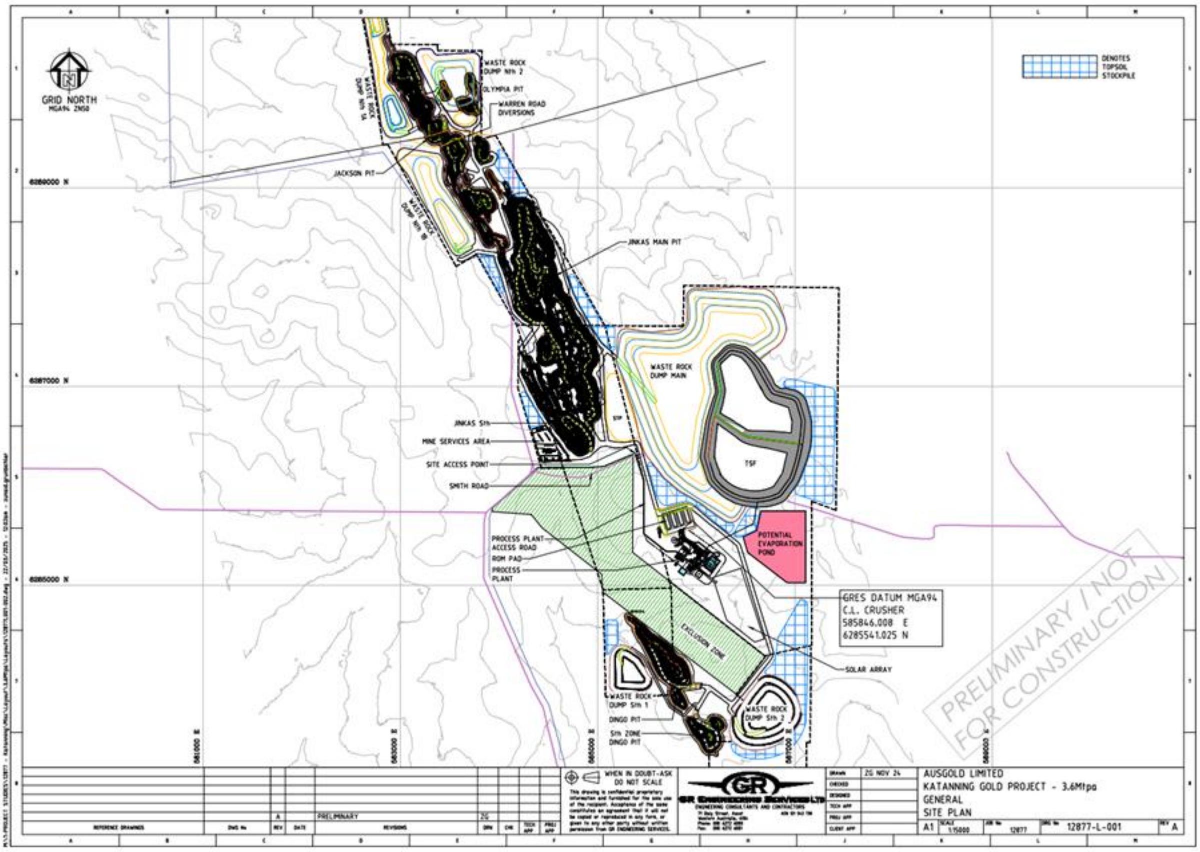

Figure 4-1 Site Layout

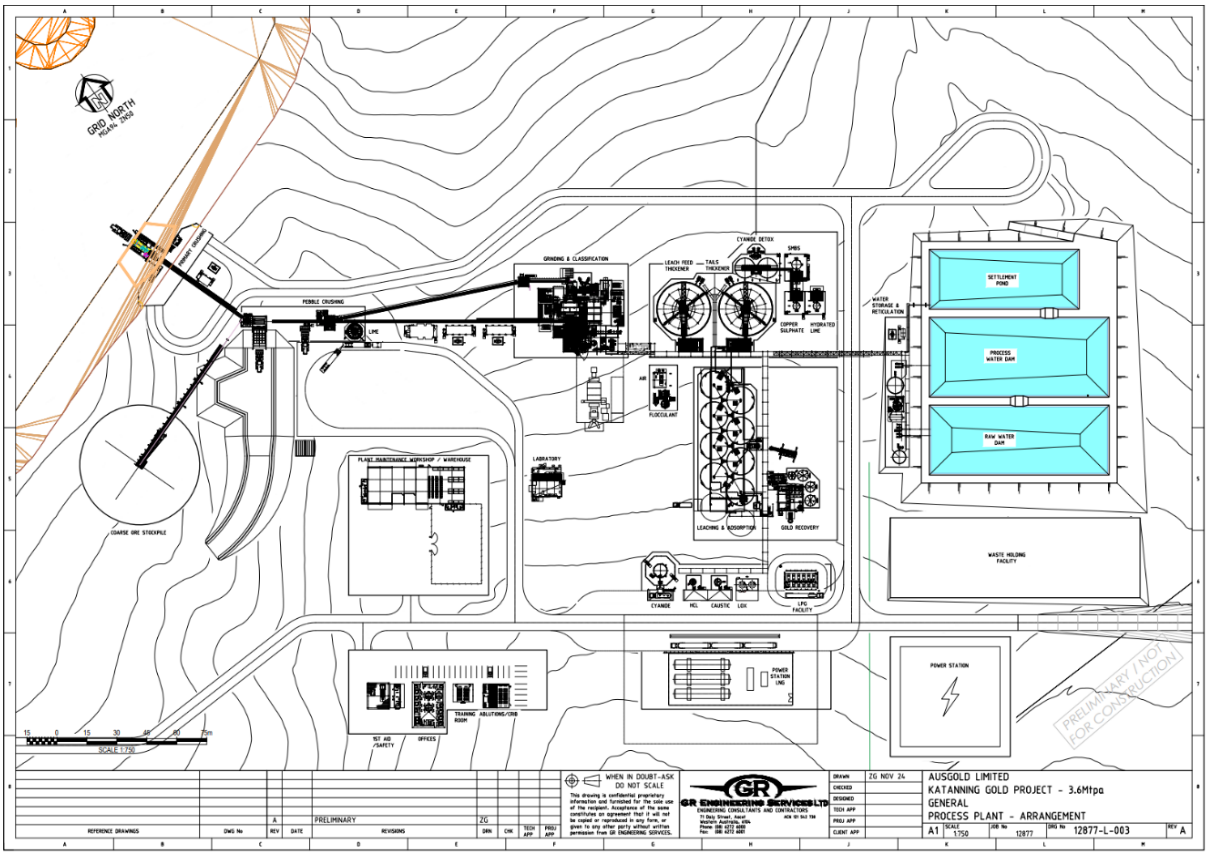

Figure 4-2 Fixed Plant Layout

4.4 Noise Model Scenarios

Noise was identified by Ausgold as a key environmental factor for the community. As a result, significant design effort has been undertaken to ensure that pit layouts, bunding and haul routes are designed to minimise noise impacts in the community. An iterative process has been followed with each iteration, using the noise model to determine the effectiveness of the design changes and provide input into the design of further improvements.

This report summarises the mine layout outcomes related to the initial and final designs. Each layout includes the following three scenarios:

- **Scenario 1 - Mining Year 2**: Mining year 2 operations will operate out of Jinkas 1, 2 and 3 which is centrally located (see Figure 4-3).
- **Scenario 2 - Mining Year 5**: Mining year 5 operations will operate at the northern most area, out of Jinkas 3, 4, 5 and Jackson 1 (see Figure 4-4).
- **Scenario 3 - Mining Year 9**: Mining year 9 operations will operate in the Southern area, out of Olympia and Dingo Pits (see Figure 4-5).

The mobile fleet routes and quantities modelled for each scenario are representative of the fleet proposed for each mine year, based on equipment listed in Table 4-3.

All model scenarios assume worst case operations and weather conditions. This means that all equipment is operating simultaneously and worst-case night-time weather conditions (as defined in section 4.2.3) are applied.

Table 4-3 Ausgold Katanning Equipment in each scenario

Scenario	Pit	Activity	Quantity
Mining Year 2	Fixed Plant		• All equipment ON
	Jinkas 1	Mining Ore	• Haul truck – pit to ROM (4) • Excavator (1) • Dozer (1)
	Jinkas 2	Mining Waste	• Haul truck – pit to WRL (9) • Excavator (1) • Drill Rig (3)
	Jinkas 3	Mining Waste	• Haul truck – pit to WRL (9) • Excavator (1) • Drill Rig (3)
	N/A	Ancillary	• Loader at ROM (1) • Dozer on WRL (3)
Mining Year 5	Fixed Plant		• All equipment ON
	Jackson 1	Mining Ore	• Haul truck – pit to ROM (4) • Excavator (1) • Dozer (1)
	Jinkas 3	Mining Waste	• Haul truck – pit to WRL (6) • Excavator (1) • Drill Rig (2)
	Jinkas 4	Mining Waste	• Haul truck – pit to WRL (6) • Excavator (1) • Drill Rig (2)
	Jinkas 5	Mining Waste	• Haul truck – pit to WRL (6) • Excavator (1) • Drill Rig (2)
	N/A	Ancillary	• Loader at ROM (1) • Dozer on WRL (3)
Mining Year 9	Fixed Plant		• All equipment ON
	Olympia Pit	Mining Ore	• Haul truck – pit to ROM (4) • Excavator (1) • Dozer (1)
	Dingo Pit 2	Mining Waste	• 6 Haul truck – pit at WRL Sth (6) • Excavator (1) • Drill Rig (1)
	N/A	Ancillary	• Loader at ROM (1) • Dozer on WRL (3)

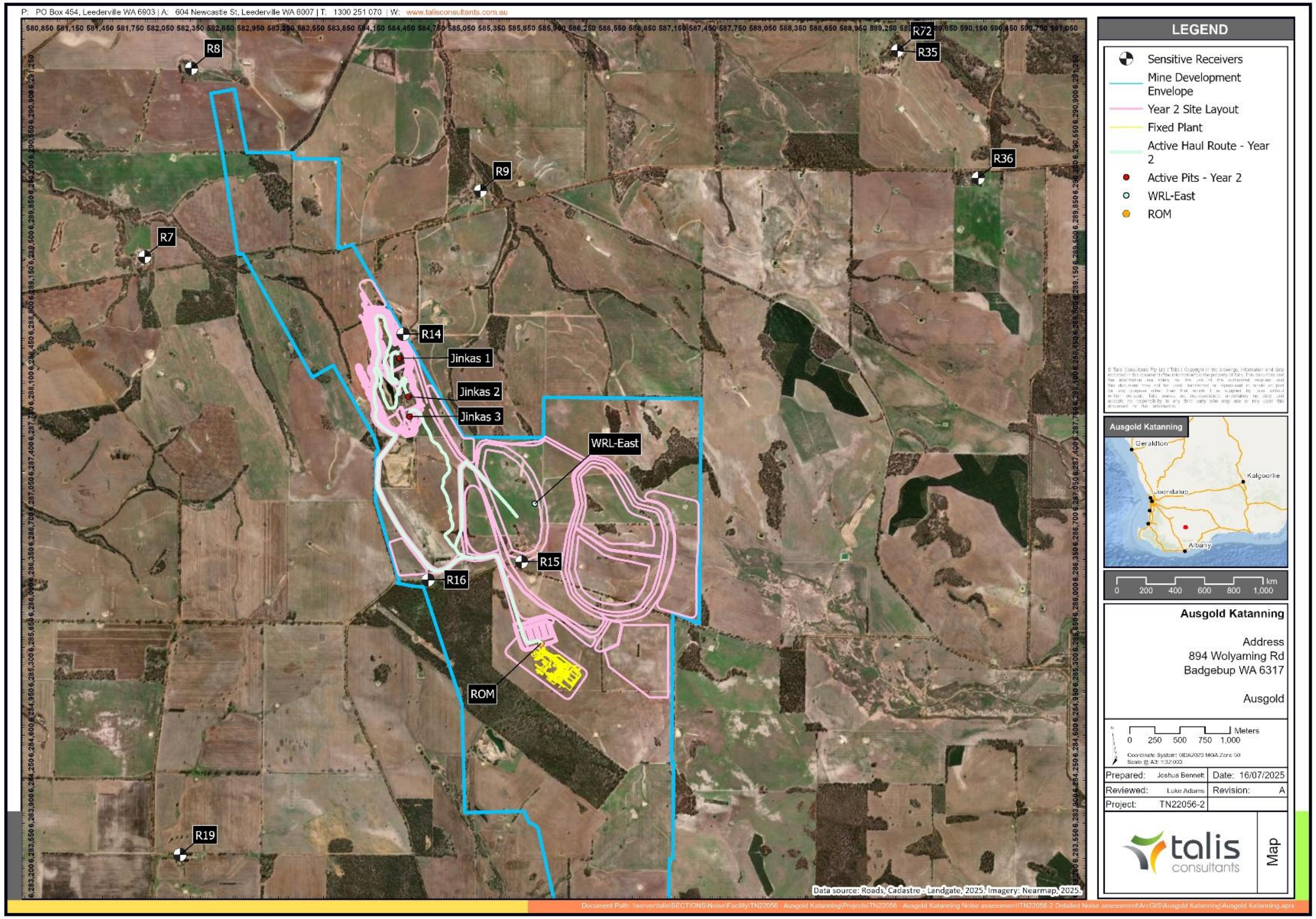

Figure 4-3 Mining Year 2 Layout - Scenario 1

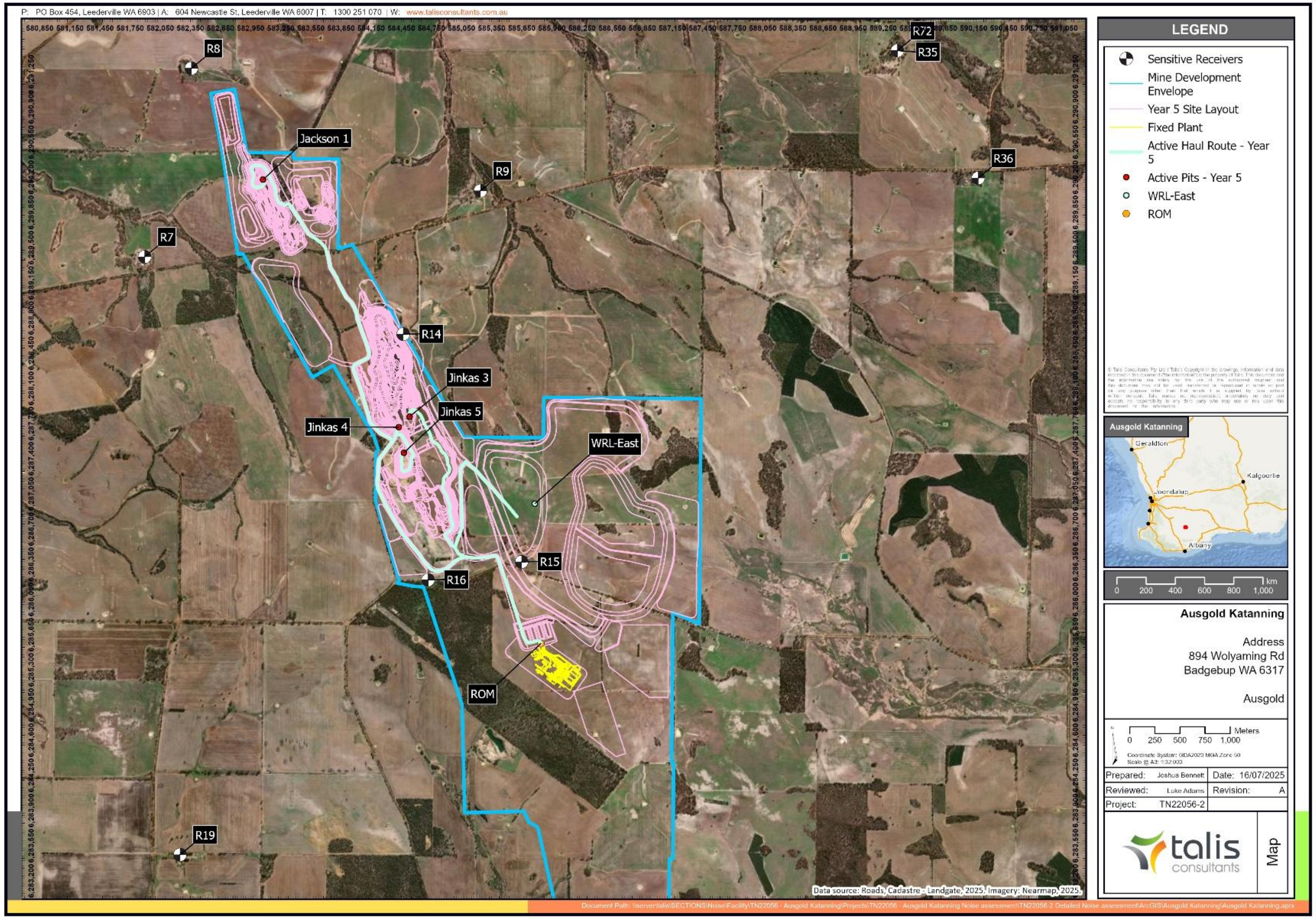

Figure 4-4 Mining Year 5 Layout - Scenario 2

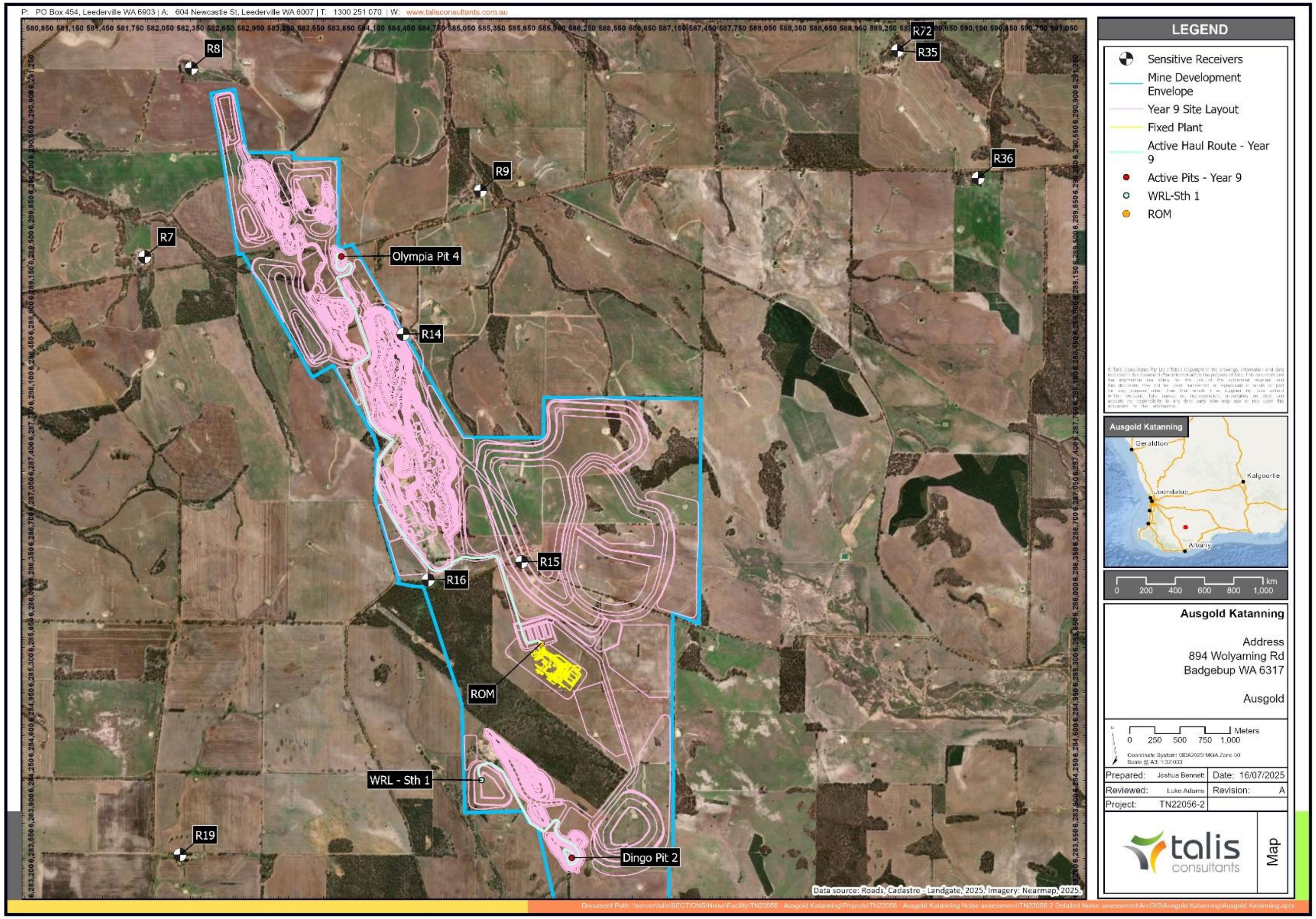

Figure 4-5 Mining Year 9 Layout - Scenario 3

5 Noise Modelling Results (Initial design before noise control)

Table 5-1 shows the model results for KGP mining years 2, 5 and 9 without any noise control. For brevity, only non-compliant receivers are listed. All predicted noise levels include a +5dB tonality penalty adjustment.

As can be seen from the results, the noise levels exceed the assigned noise levels by 1 to 11dB at some noise sensitive receivers including R7, R8, R9, R17, R19 and R20.

Table 5-1 Model Results (includes +5dB tonality penalty)

Receiver	Night-time assigned LA10 Criteria	Exceedance (dB) LA10 Model Results (exceedance)		
		Year 2	Year 5	Year 9
R7	35	41 (+6)	40 (+5)	36 (+1)
R8		37 (+2)	38 (+3)	32
R9		45 (+10)	42 (+7)	38 (+3)
R17		38 (+3)	35	33
R19		39 (+4)	36 (+1)	41 (+6)
R20		38 (+3)	34	46 (+11)

5.1 Noise Contour Maps

A noise contour map for each mining year scenario is shown in Figure 5-1 for KGP.

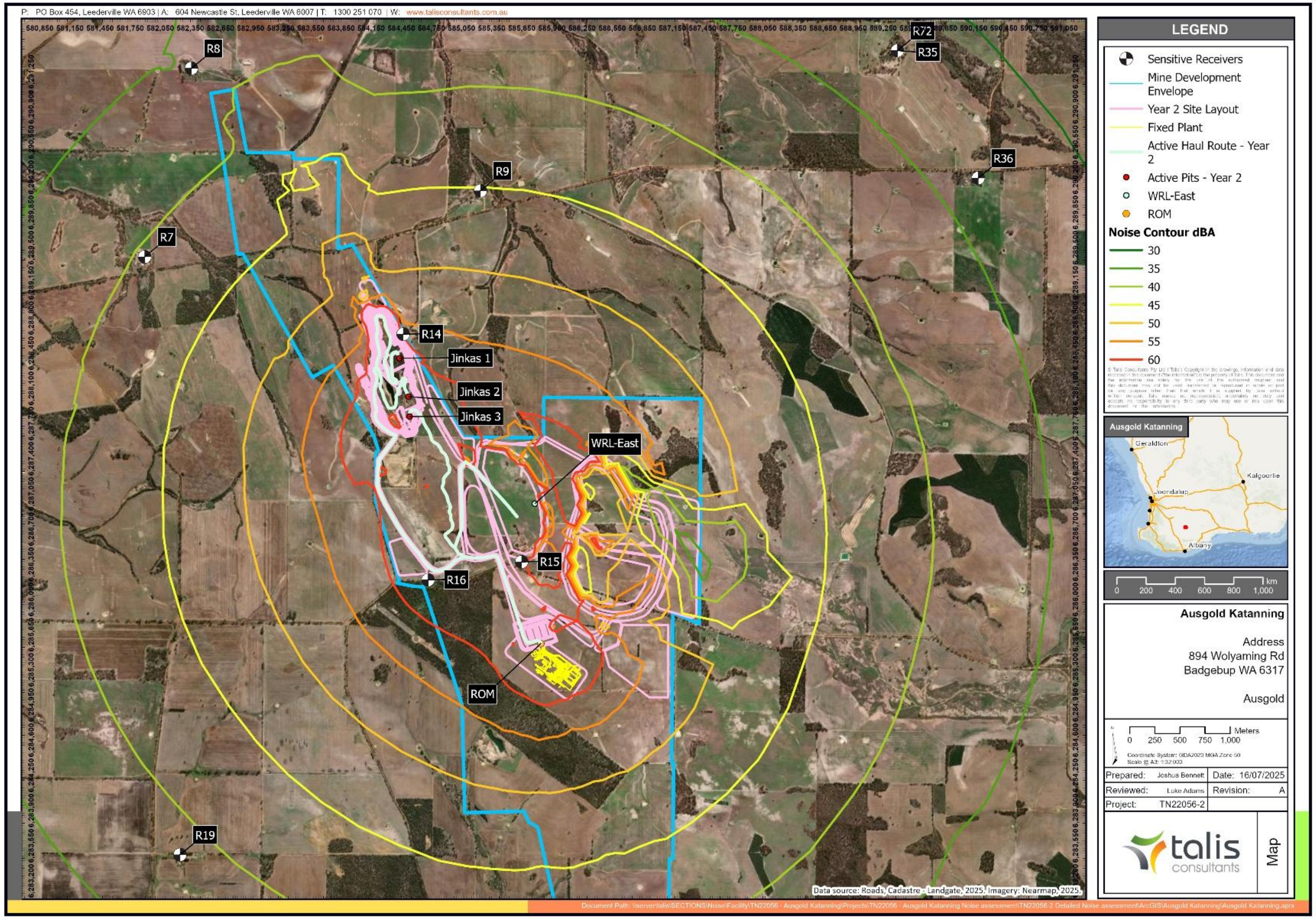

Figure 5-1 Noise Contour Map – Year 2 Mining Operations Scenario 1 (before noise control)

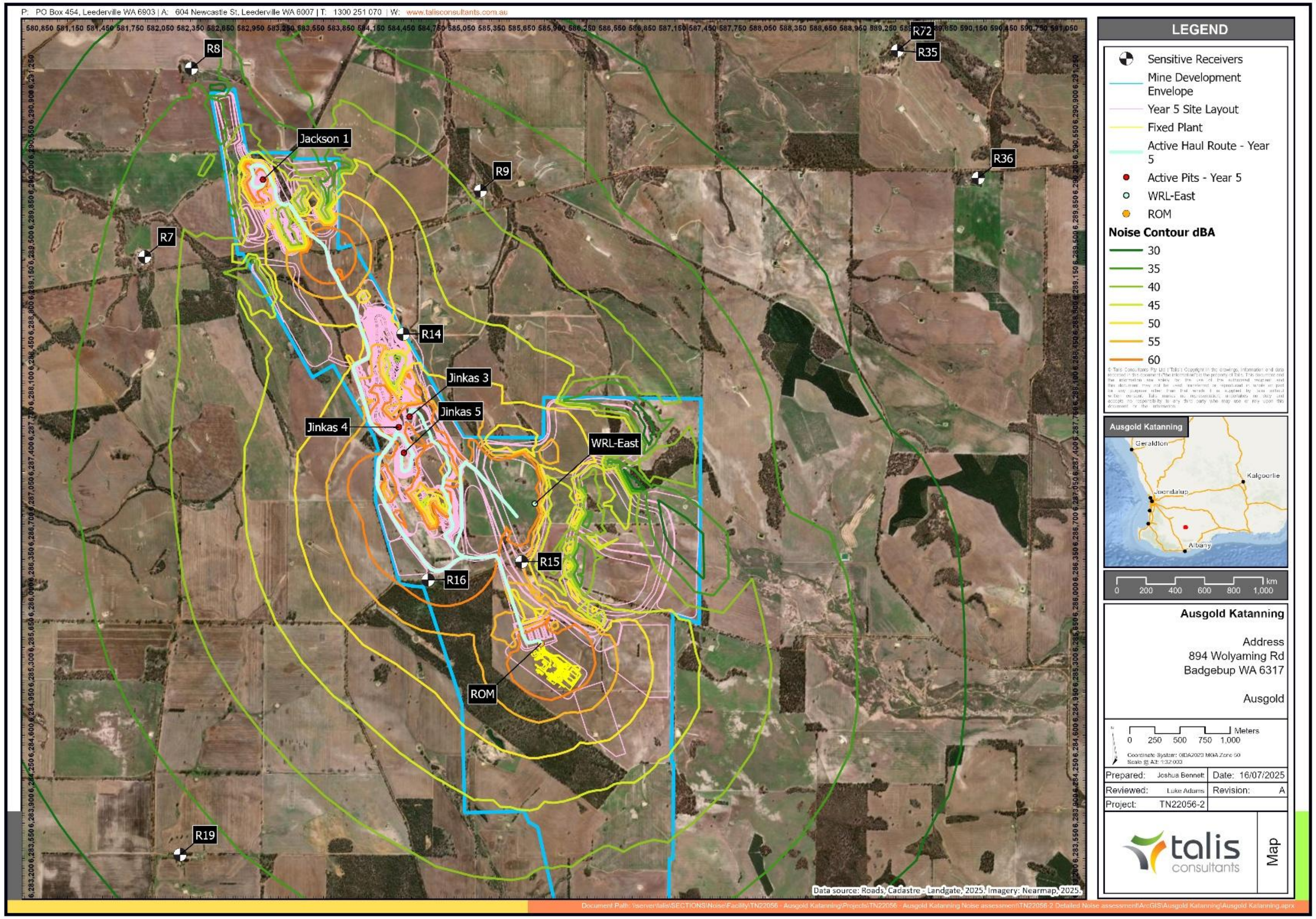

Figure 5-2 Noise Contour Map – Year 5 Mining Operations Scenario 2 (before noise control)

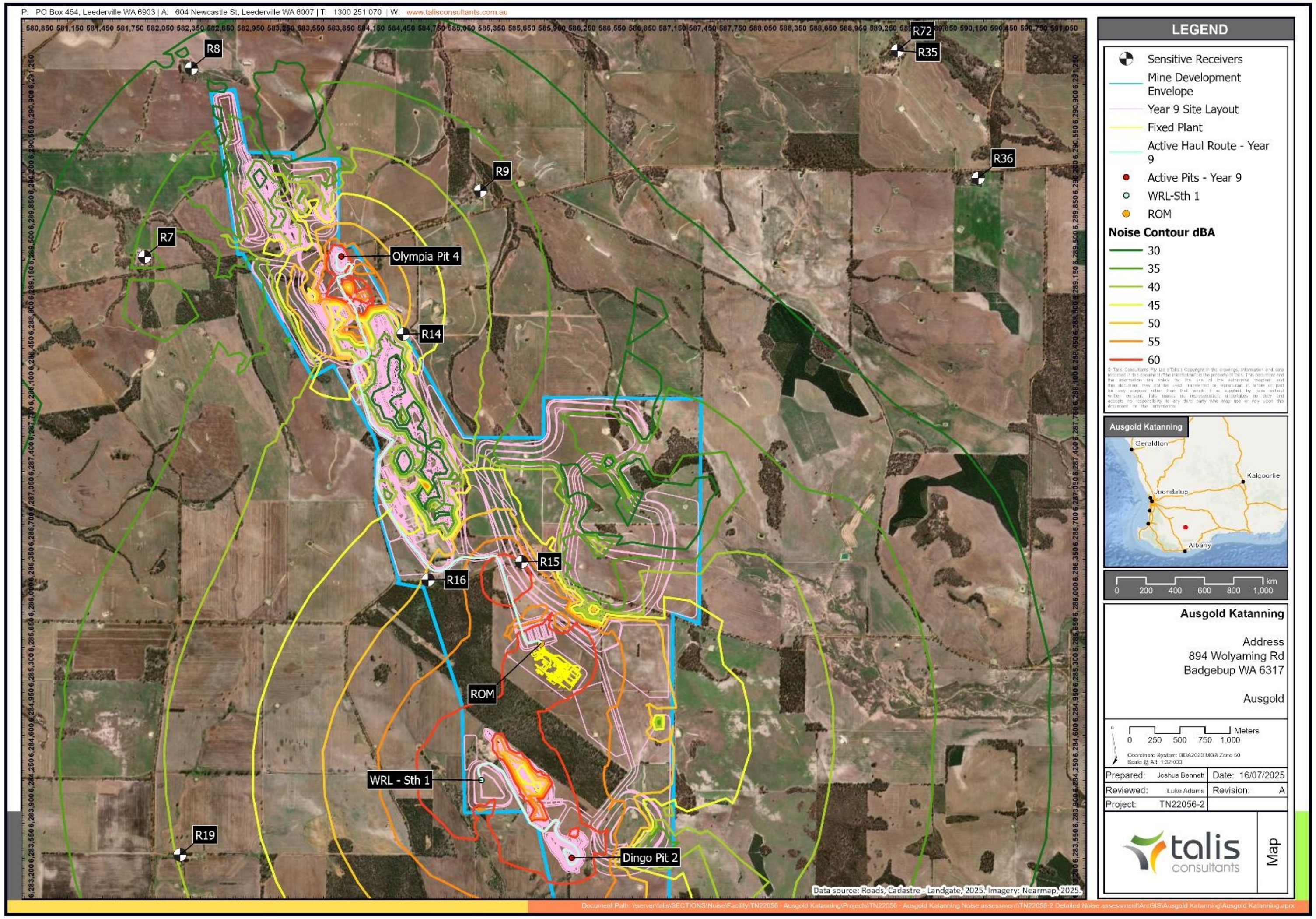

Figure 5-3 Noise Contour Map – Year 9 Mining Operations Scenario 3 (before noise control)

6 Noise Mitigation Strategies

6.1 Overview

The noise modelling results have found that noise mitigation is required to achieve the noise criteria. As a result, Ausgold is considering and evaluating the following noise mitigation strategies:

- **Using a planning and adaptive management system**. The planning component of the noise management system will reduce the likelihood of noise exceedance during short term planning (i.e. weekly and 24-hour planning). The adaptive management component will be used during production to adjust the mining operations to prevent an exceedance.
- **Engineering Noise Control**. The reduction of noise emissions from the mining fleet by applying noise control and the application of strategically placed noise protection bunds.
- **Acquisition of properties**. The purchase of key sensitive receivers within the area.

6.2 Short Term and next 24-hour planning

The noise management system that Ausgold is considering has a predictive planning capability, that uses scheduled mine plan data and forecast weather to identify planned mining activities that might result in an exceedance of threshold levels. Once identified, the system will provide guidance to the planner on how to change the plan to reduce the risk of exceedance (as shown in Figure 6-1).

6.3 Adaptive Management

The noise management system that Ausgold is considering has an adaptive management capability that can be used during production to prevent an exceedance from occurring by proactively changing operations due to unplanned events that occur during a shift and when conditions (e.g. weather) differs from what was used in the planning phase (as shown in Figure 6-1). It visualises and combines noise monitoring and predictive data using the following datasets: Fleet Management System; live weather data (from a local weather station); and fixed plant data (from the mines SCADA system).

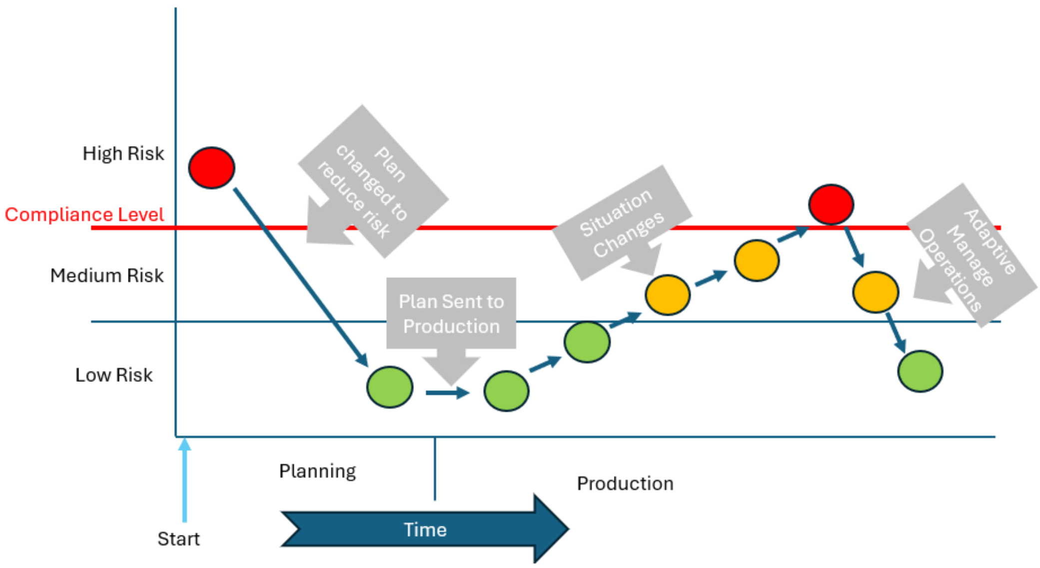

Figure 6-1 Conceptual visualisation of the system managing noise risk in planning and production

6.4 Engineering Noise Control

An integrated noise control approach was followed, taking the following factors into account:

- Equipment noise source contribution rankings.
- Assigned noise levels.
- Pit design, mine planning, noise protection bunds and haul route optimisation.
- Investigation and prioritisation of noise controls.

To effectively reduce the received noise levels, it is necessary to first address the most significant contributing noise sources before addressing the less significant noise sources. This is important, because without addressing the top sources, the overall noise level will not be significantly reduced. Table 6-1 shows the top noise contribution equipment at the most affected sensitive receivers. As can be seen from the results, dozers and haul trucks on both the WRLs and haul roads are most significant and require attention.

The noise reduction approach being considered by Ausgold is firstly to reduce noise levels using smart mining methods, haulage route design and noise protection bunds. Followed by supplementary noise controls including fleet engineering packages.

Note: in Table 6-1, "HT" refers to haul truck and "DZ" refers to Dozer.

Table 6-1 Top Contributing Noise Sources

Mining Year 2		Mining Year 5		Mining Year 9	
Item	**Received Level dBA**	**Item**	**Received Level dBA**	**Item**	**Received Level dBA**
R7					
DZ – WRL East	32.2	DZ – WRL East	32.2	DZ – Olympia Pit4	21.3
HT Jinkas 3 to ROM	28.9	HT Jackson 1 to ROM	30.1	DZ – WRL Sth 1	20.7
HT Jinkas 2 to WRL East	27.6	HT Jinkas 4 to WRL East	27.5	HT Olympia Pit4 to ROM	17.5
R8					
DZ – WRL East	27.9	DZ – WRL East	28.0	HT Olympia Pit4 to ROM	21.4
HT Jinkas 3 to ROM	23.9	DZ – Jackson 1	26.4	DZ – Olympia Pit4	18.5
Drill - Jinkas 2	23.6	HT Jinkas 4 to WRL East	22.1	DZ – WRL Sth 1	15.7
R9					
DZ – WRL East	38.2	DZ – WRL East	38.2	HT Olympia Pit4 to ROM	28.0
HT Jinkas 3 to ROM	32.9	HT Jackson 1 to ROM	31.9	DZ – Olympia Pit4	24.6
HT Jinkas 2 to WRL East	32.0	HT Jinkas 3 to WRL East	31.6	DZ – WRL Sth 1	21.9
R17					
DZ – WRL East	29.9	DZ – WRL East	29.9	DZ – WRL Sth 1	25.3
HT Jinkas 3 to ROM	26.2	HT Jinkas 4 to WRL East	25.1	HT Olympia Pit4 to ROM	20.8
HT Jinkas 2 to WRL East	25.3	HT Jinkas 5 to WRL East	23.6	HT Dingo Pit 2 to WRL Sth	20.3

Mining Year 2		Mining Year 5		Mining Year 9	
Item	**Received Level dBA**	**Item**	**Received Level dBA**	**Item**	**Received Level dBA**
R19					
DZ – WRL East	31.2	DZ – WRL East	31.2	DZ – WRL Sth 1	34.4
HT Jinkas 3 to ROM	27.1	HT Jinkas 4 to WRL East	25.5	HT Dingo Pit 2 to WRL Sth	24.7
HT Jinkas 2 to WRL East	25.5	HT Jinkas 5 to WRL East	25.2	HT Olympia Pit4 to ROM	20.4
R20					
DZ – WRL East	30.0	DZ – WRL East	30.0	DZ – WRL Sth 1	38.4
HT Jinkas 3 to ROM	25.7	HT Jinkas 5 to WRL East	22.3	HT Dingo Pit 2 to WRL Sth	33.7
HT Jinkas 2 to WRL East	22.6	HT Jinkas 4 to WRL East	22.1	HT – WRL Sth 1	18.2

6.4.1 Noise Control Options Evaluated

Ausgold is considering and evaluating the following noise control options:

- Haul road and WRL noise protection bunds.
- Engineering noise control.

6.4.2 Mining Design (Haul Road and WRL Noise Protection Bunds)

A number of noise protection bunds have been evaluated using an iterative process and incorporated into the mine design. The design changes incorporated include:

- **Noise protection bunds** – noise bunds will be developed along the WRLs, pit edges and ramps. Currently, these are designed to be 15m high.
- **Haul Road Bunds -** Bunds will also be developed flanking the haul roads, which have been strategically placed, as close as practicable to the roads.
- **Mining method** – WRLs will be strategically staged to create a level change (i.e. shielding) between the operations on WRLs and the receivers.

The current noise protection bunds in the design are shown as purple in Figure 6-2. The design will be further optimised as the design matures.

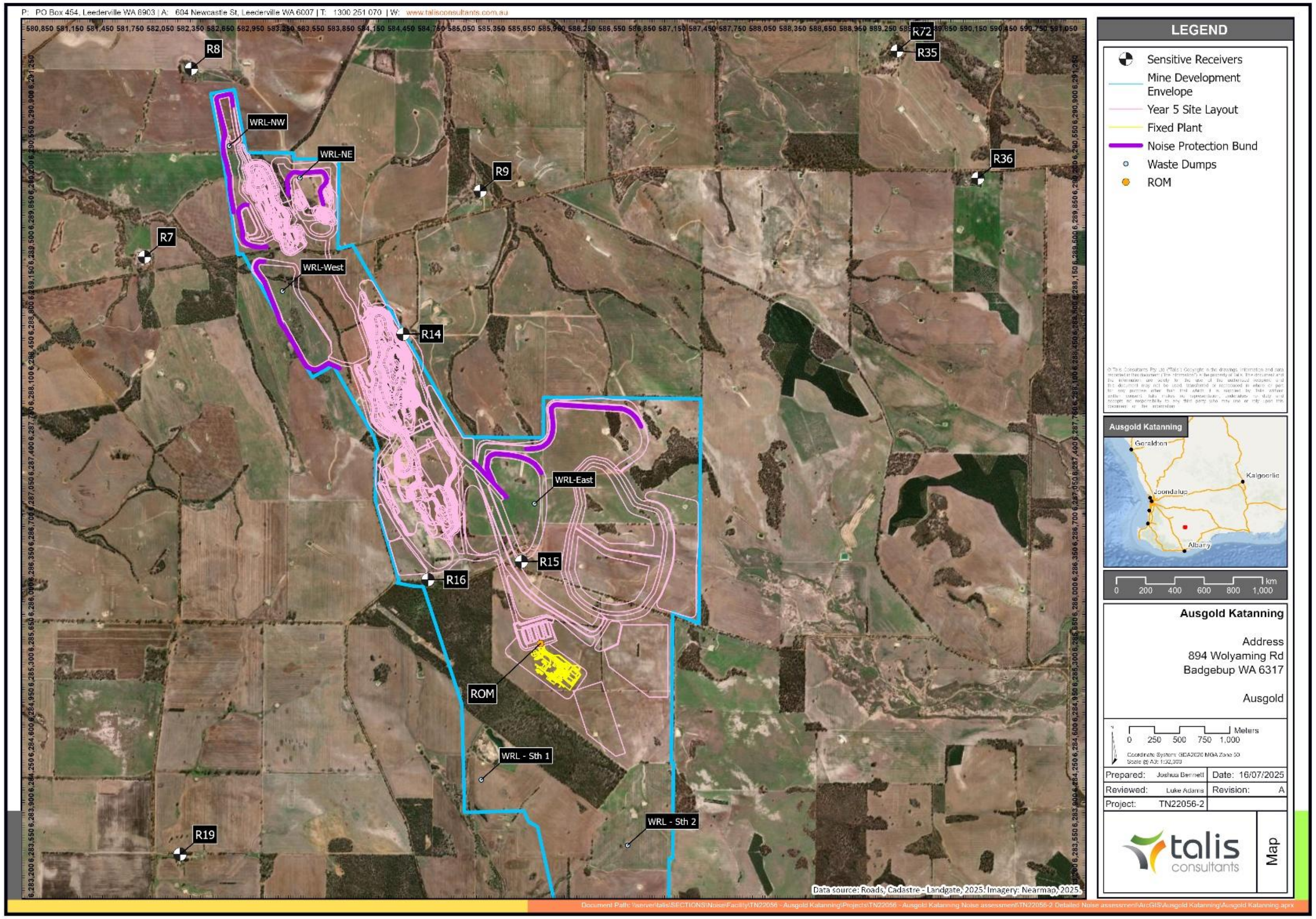

Figure 6-2: Proposed Bund Design Layout (Year 5)

6.4.3 Engineering Noise Control

As trucks were the most significant contribution equipment, the effectiveness of a noise control package applied to haul trucks is being considered and evaluated by Ausgold. Table 6-2 provides and example of unmitigated and mitigated truck noise controls that are being considered.

Table 6-2 Noise Control Haul Truck Package Spectrum

Equipment	Octave Bands									
	31.5Hz	63Hz	125Hz	250Hz	500Hz	1kHz	2kHz	4kHz	8kHz	SWL dBA
Haul Truck	71	87	103	106	110	112	111	108	98	**117.1**
Haul Truck (6dB Noise Control Package)	70	90	98	101	103	105	108	99	96	**111.7**

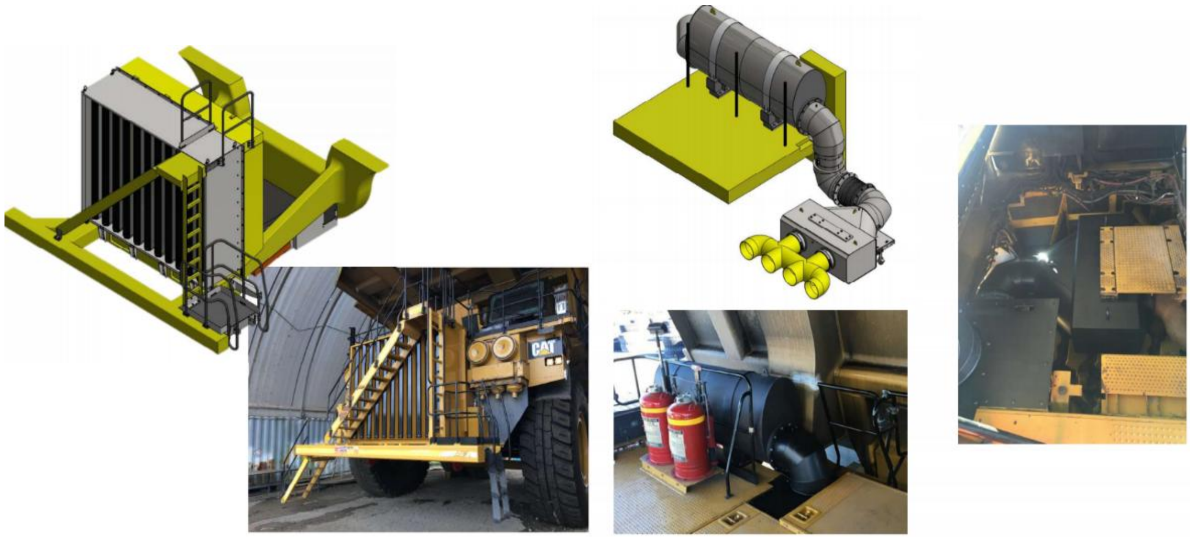

Figure 6-3 Truck Engineering Control Package Components Examples (Radiator Left, Exhaust Right)

6.5 Acquisition

Receivers R14, R15 and R16 have been acquired by Ausgold as they are located within the proposed disturbance footprint. Some future acquisitions may occur, however to be conservative, the noise control approach utilised for the study assumes the assigned levels are to be achieved until acquisition is confirmed.

7 Noise Modelling Results (Post Noise Control)

Table 7-1 shows the before and after noise control results for mining year 5 (noise controls include strategically placed bunding and 6dB engineering noise control package on trucks). For brevity, only previously listed non-compliant receivers are listed. All predicted noise levels include a +5dB tonality penalty adjustment.

The results show that KGP can achieve compliance with the most stringent night-time assigned noise levels with noise control applied. The noise controls will be further optimised and designed as the project matures and supplemented with an operations noise management system. A post noise control contour map is given in Figure 7-1.

Table 7-1 Model Results for Year 5 with and without Noise Control (tonality penalty applied)

Receiver	Noise Criteria LA10 Assigned Level	Model Predicted LA10	
		Before NC	After NC
R7	35	40 (+5)	33
R8		38 (+3)	28
R9		42 (+7)	34
R17		35	29
R19		36 (+1)	30
R20		34	31

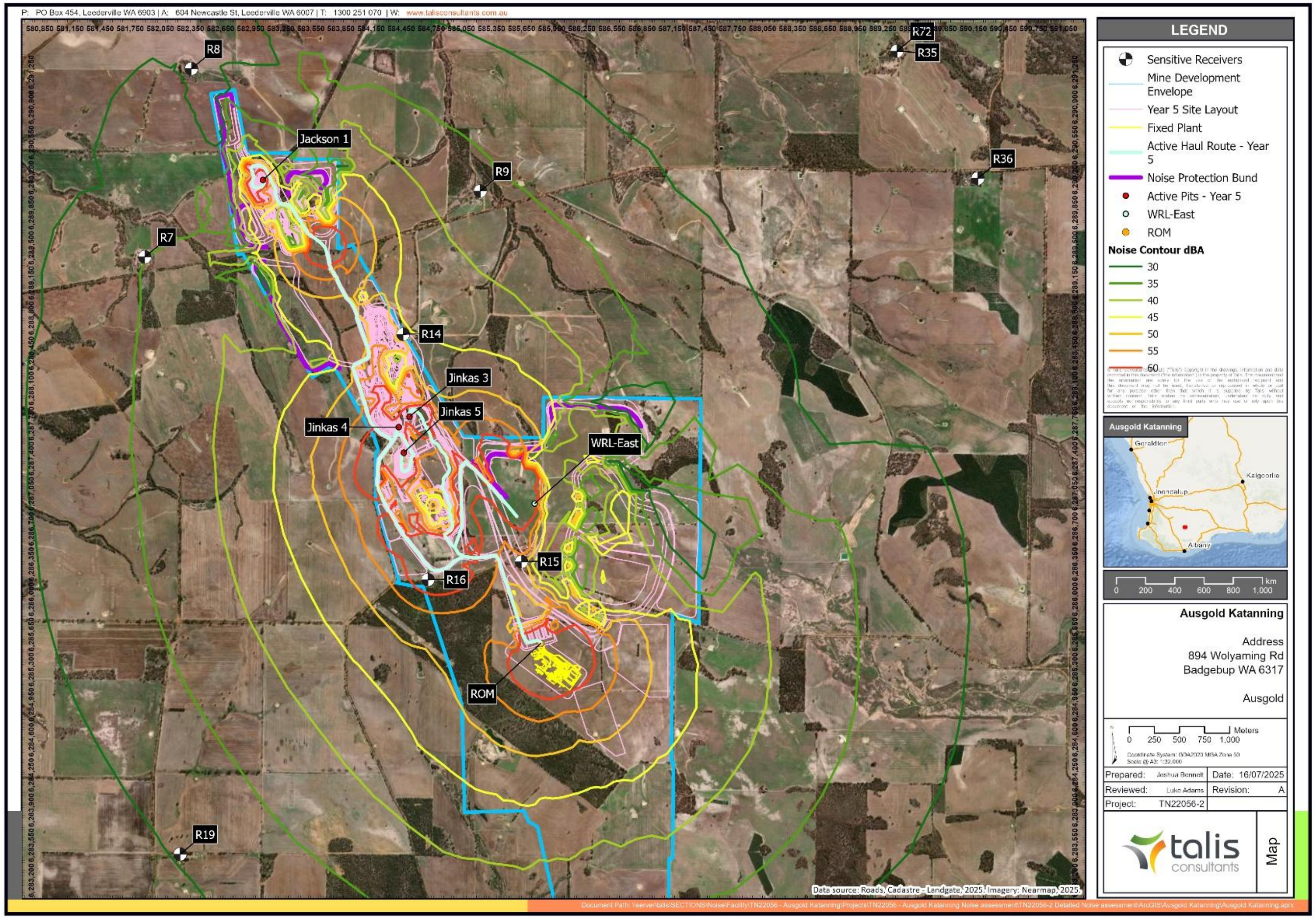

Figure 7-1 Noise Contour Map – Post Noise Control (Year 5)

8 Conclusions

The study has developed a noise model using data provided by Ausgold for each mine year. The model showed that there were several receivers that could exceed the night-time assigned noise levels. As a result, Ausgold is adopting the following noise control strategies:

- Using a Planning and Adaptive Management System.
- Engineering Noise Controls including modifications to mine design and the use of equipment noise reduction packages.
- Acquisition of properties.

Evidence provided in sections 6 and 7 shows that the strategies identified by Ausgold have the ability to result in KGP achieving compliance with the most stringent night-time assigned noise levels. The noise strategies will be further optimised for each mining year as the project design matures, and as the mine goes operational.

APPENDIX A
Noise Legislation

Noise management in Western Australia is implemented through the Environmental Protection (Noise) Regulations 1997 (the Regulations), which operate under the Environmental Protection Act 1986. The Regulations specify maximum noise levels (assigned noise levels) which are the highest noise levels that can be received at noise-sensitive (residential), commercial and industrial premises.

Assigned noise levels are defined differently for noise sensitive premises, commercial premises, and industrial premises. For noise sensitive premises, an Influencing Factor (IF) is included in the assigned noise levels. The IF depends on the presence of major/minor roads and commercial/industrial land use zonings within circles of 100 metres and 450 metres radius from the noise receiver.

For noise sensitive residences, the time of day also affects the assigned levels. The regulations define three types of assigned noise level:

- L_{ASMAX} means an assigned level that is not to be exceeded at any time;
- L_{AS1} means an assigned level that is not to be exceeded for more than 1% of time;
- L_{AS10} means an assigned level that is not to be exceeded for more than 10% of time.

Table A1: Assigned Noise Levels for Noise Sensitive Receivers

Type of premises receiving noise	Time of day	Assigned Levels (dB)		
		L_{A10}	L_{A1}	L_{Amax}
Noise sensitive premises: highly sensitive area	0700 to 1900 hours Monday to Saturday	45 + influencing factor	55 + influencing factor	65 + influencing factor
	0900 to 1900 hours Sunday and public holidays	40 + influencing factor	50 + influencing factor	65 + influencing factor
	1900 to 2200 hours all days	40 + influencing factor	50 + influencing factor	55 + influencing factor
	2200 hours on any day to 0700 hours Monday to Saturday and 0900 hours Sunday and public holidays	35 + influencing factor	45 + influencing factor	55 + influencing factor
Noise sensitive premises: any area other than highly sensitive area	All hours	60	75	80

Type of premises receiving noise	Time of day	Assigned Levels (dB)		
		L_{A10}	L_{A1}	L_{Amax}
Commercial premises	All hours	60	75	80
Industrial and utility premises other than those in the Kwinana Industrial Area	All hours	65	80	90
Industrial and utility premises in the Kwinana Industrial Area	All hours	75	85	90

Environmental Protection (Noise) Regulations 1997

A.1 Influencing Factors

The Influencing Factor (IF) is based on the surrounding land use adjacent to each of the noise sensitive receivers, including the amount (%) of industrial and commercial premises as well as the number and proximity of major and secondary roads.

The following steps were taken to calculate IF.

1. Two circles of radius 100m and 450m centred on each of the identified receivers were drawn.
2. The circles were used to determine and calculate the area of industrial and commercial premises and the presence major/secondary roads within the circles.

The calculated IF and applicable assigned levels for each receiver are summarised in section 3.2.1.

A.2 Adjustments for intrusive or dominant characteristics

Received noise levels are subject to adjustments if the noise exhibits intrusive or dominant characteristics i.e. if the noise is impulsive, tonal or modulating. These adjustments, shown in Table A 1, are cumulative up to a maximum of 15 dB.

Section 9 of the Regulations sets out objective tests to assess whether the received noise is free of these characteristics.

Table A 1 Adjustments for intrusive and dominant characteristics

Tonality	Modulation	Impulsiveness
+ 5dB	+5 dB	+10 dB

A.3 Assigned Noise Levels

The applicable night-time LA10 assigned levels for the modelled noise sensitive receivers, including influencing factors and penalties, are presented in section 3.3.

APPENDIX B
Noise Source Sound Power Levels (SWLs)

Noise source	Octave Band Levels, dBA									Overall dBA
	31 Hz	63 Hz	125 Hz	250 Hz	500 Hz	1 KHz	2 KHz	4KHz	8KHz	
Excavator	70	93	100	110	110	110	105	99	87	**115**
Water Cart	95	99	101	102	109	108	108	100	90	**114**
Front End Loader	75	90	98	101	102	103	101	94	89	**108**
Haul Truck	71	87	103	106	110	112	111	108	98	**117**
Haul Truck (idle)	74	92	97	92	95	102	103	94	82	**107**
Dozer	78	81	99	105	110	108	105	99	89	**114**
Grader	78	86	96	99	100	104	103	97	87	**108**
Drill Rig	83	90	104	111	110	113	112	103	94	**118**
Primary Crusher	62	75	84	91	98	104	106	106	96	**111**
CV-01 Primary Crusher Discharge Conveyor	28	54	67	75	87	88	86	80	70	**92**
CV-01 Drive Motor	52	70	80	83	86	87	81	82	74	**92**
CV-01 Transfer Chute	58	76	85	91	102	102	97	90	81	**106**
FE-01 Primary Crusher Apron Feeder	45	59	62	71	84	98	95	97	86	**102**
Primary Crusher Transfer Chute	58	76	85	91	102	102	97	90	81	**106**
CV-02 Stockpile Feed Conveyor	30	56	69	77	89	90	88	82	72	**94**
CV-02 Drive Motor	52	70	80	83	86	87	81	82	74	**92**
CV-03 SAG Mill Feed Conveyor	32	58	71	79	91	92	90	84	74	**96**
CV-03 Drive Motor	52	70	80	83	86	87	81	82	74	**92**
Mill Cooling Water Chiller 1 Duty	61	76	82	85	89	90	85	78	66	**94**
Mill Cooling Water Chiller 2 Duty	61	76	82	85	89	90	85	78	66	**94**
SAG Mill	63	73	87	93	97	95	89	82	71	**101**
SAG Mill Gearbox & Motor	69	84	93	102	106	105	100	95	87	**110**

Noise source	Octave Band Levels, dBA									Overall dBA
	31 Hz	63 Hz	125 Hz	250 Hz	500 Hz	1 KHz	2 KHz	4KHz	8KHz	
Ball Mill	63	73	87	93	97	95	89	82	71	**101**
Ball Mill Gearbox & Motor	69	84	93	102	106	105	100	95	87	**110**
Cyclone Feed Pump 1	63	77	87	92	94	94	94	95	86	**101**
Cyclone Feed Pump 2	63	77	87	92	94	94	94	95	86	**101**
SAG Mill Pump 1	53	67	77	82	84	84	84	85	76	**91**
SAG Mill Pump 2	53	67	77	82	84	84	84	85	76	**91**
SAG Mill Pump 3	53	67	77	82	84	84	84	85	76	**91**
Ball Mill Pump 1	53	67	77	82	84	84	84	85	76	**91**
Ball Mill Pump 2	53	67	77	82	84	84	84	85	76	**91**
Ball Mill Pump 3	53	67	77	82	84	84	84	85	76	**91**
SAG Mill Discharge Screen	64	78	82	88	90	91	90	87	83	**97**
Ball Mill Trunnion / Recirculation Pump 1	48	62	72	77	79	79	79	80	71	**86**
Ball Mill Trunnion / Recirculation Pump 2	48	62	72	77	79	79	79	80	71	**86**
Ball Mill Reducer Lube Pump 1	47	61	71	76	78	78	78	79	70	**85**
Ball Mill Reducer Lube Pump 2	47	61	71	76	78	78	78	79	70	**85**
SAG Mill Trunnion / Recirculation Pump 1	48	62	72	77	79	79	79	80	71	**86**
SAG Mill Trunnion / Recirculation Pump 2	48	62	72	77	79	79	79	80	71	**86**
SAG Mill Reducer Lube Pump 1	47	61	71	76	78	78	78	79	70	**85**
SAG Mill Reducer Lube Pump 2	64	78	82	88	90	91	90	87	83	**97**
Ball Mill Trommel Screen	64	78	82	88	90	91	90	87	83	**97**
Cyclone Cluster	62	77	84	92	95	99	100	98	94	**105**
FE-01 Surge Bin Apron Feeder	45	59	62	71	84	98	95	97	86	**102**
Pebble Crusher	62	69	84	97	104	106	104	98	88	**110**
CV-04 Conveyor	29	55	69	76	88	89	87	82	72	**94**
Pebble Crusher Transfer Chute	58	76	85	91	102	102	97	90	81	**106**
CV-04 Transfer Chute	58	76	85	91	102	102	97	90	81	**106**
CV-04 Drive Motor	47	65	75	78	81	82	76	77	69	**87**
AG-01 Leach Tank 1 Agitator	55	67	75	82	83	84	83	80	74	**90**

Noise source	Octave Band Levels, dBA									Overall dBA
	31 Hz	63 Hz	125 Hz	250 Hz	500 Hz	1 KHz	2 KHz	4KHz	8KHz	
AG-02 Leach Tank 2 Agitator	55	67	75	82	83	84	83	80	74	**90**
AG-03 Adsorption Tank 1 Agitator	55	67	75	82	83	84	83	80	74	**90**
AG-04 Adsorption Tank 2 Agitator	55	67	75	82	83	84	83	80	74	**90**
AG-05 Adsorption Tank 3 Agitator	55	67	75	82	83	84	83	80	74	**90**
AG-06 Adsorption Tank 4 Agitator	55	67	75	82	83	84	83	80	74	**90**
AG-07 Adsorption Tank 5 Agitator	55	67	75	82	83	84	83	80	74	**90**
AG-08 Adsorption Tank 6 Agitator	55	67	75	82	83	84	83	80	74	**90**
Power Station	75	88	102	107	109	109	106	99	90	**115**

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