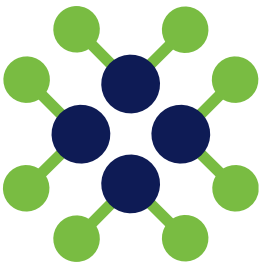
TRONOX

ATLAS-CAMPASPE MINERAL SANDS PROJECT

MODIFICATION 6

APPENDIX D

NOISE REVIEW



Noise Review

Atlas-Campaspe Mineral Sands Project

Modification 6

Tronox Mining Australia Limited

Atlas-Campaspe Mineral Sands Mine
Lot 1198331 Magenta Wampo Road
HATFIELD NSW 2715

Reference: Atlas-Campaspe Mineral Sands Project MOD 6 - Noise Review 20260210

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This report in its finalised version has been prepared and authorised by suitably qualified and experienced personnel from VMS Australia Pty Ltd, who are members of the Australian Acoustical Society. Draft versions of this report may not be subject to this qualification.

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Executive Summary

VMS Australia Pty Ltd (VMS) was engaged to prepare a Noise Review for the proposed application to modify the Development Consent (SSD_5012) under section 4.55(2) of the New South Wales (NSW) *Environmental Planning and Assessment Act 1979* (EP&A Act) to allow for the changes identified during detailed planning for the development of the Campaspe deposit at the Atlas-Campaspe Mineral Sand Project (the Project).

The following items have been presented in this report:

- Review of the potentially impacted noise sensitive receivers;
- Review of the existing meteorological environment of the Project;
- Review of the Project Noise Criteria;
- Description of the fixed plant and mobile equipment that would be used and locations for the Modification;
- Semi-quantitative noise assessment for the Project against the approved Project Noise Criteria at the noise sensitive receivers under neutral and adverse weather conditions; and
- Recommendations for noise control measures, where required.

Project specific noise criteria have been nominated in the latest Development Consent (SSD_5012) dated December 2024.

This Noise Review has been prepared in accordance with NSW *Noise Policy for Industry (NPfI [2017])*.

A semi-quantitative noise assessment has been conducted based on a review of the footprint of the proposed optimised service corridor and the distance attenuation from the proposed and approved service corridor to the surrounding noise sensitive receivers.

Project operational noise levels were calculated based on the distance attenuation of the noise emission from the proposed and approved service corridor (including the transport route) under both neutral and adverse weather conditions. The results are summarised below.

Operational Noise Levels

Operational noise levels are predicted to comply with the Project Specific Operational Noise Criteria at all noise sensitive receivers under both neutral and adverse weather conditions.

Maximum Noise Event

The noise emission from the maximum noise event of the Project is expected to comply with the sleep disturbance noise criteria at all noise sensitive residential receivers during night-time period in accordance with NPfI (2017).

Cumulative Noise Levels

The cumulative noise emission from the Modification and the neighbouring development (Balranald Mineral Sands Project) to the surrounding noise sensitive receivers complies with the cumulative amenity noise criteria.

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Appendix A Acoustic Terminology

1 Introduction

1.1 Background

Atlas-Campaspe Mineral Sands Project (the Project) is operated by Tronox Mining Australia Limited (Tronox). The Project includes the development of a mineral sands mining operation (herein referred to as the Atlas-Campaspe Mine) and the construction and operation of the Ivanhoe Rail Facility (a rail loadout facility) in western New South Wales (NSW).

The Atlas-Campaspe Mine is located approximately 80 kilometres (km) north of Balranald in western NSW. The Ivanhoe Rail Facility is located approximately 135 km north-east of the Atlas-Campaspe Mine. Mineral concentrates produced from operations at the Atlas-Campaspe Mine will be transported by truck to the Ivanhoe Rail Facility, where they will be transferred onto train wagons for rail transport to the existing Broken Hill Mineral Separation Plant (MSP). The Project locality plan is shown in **Figure 1**.

Development Consent (SSD_5012) was granted for the Project under Part 4 of the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act) in 2014. This Development Consent (SSD_5012) has been modified several times, with the latest modification (Modification 5) approved in December 2024 (current Development Consent [SSD_5012]).

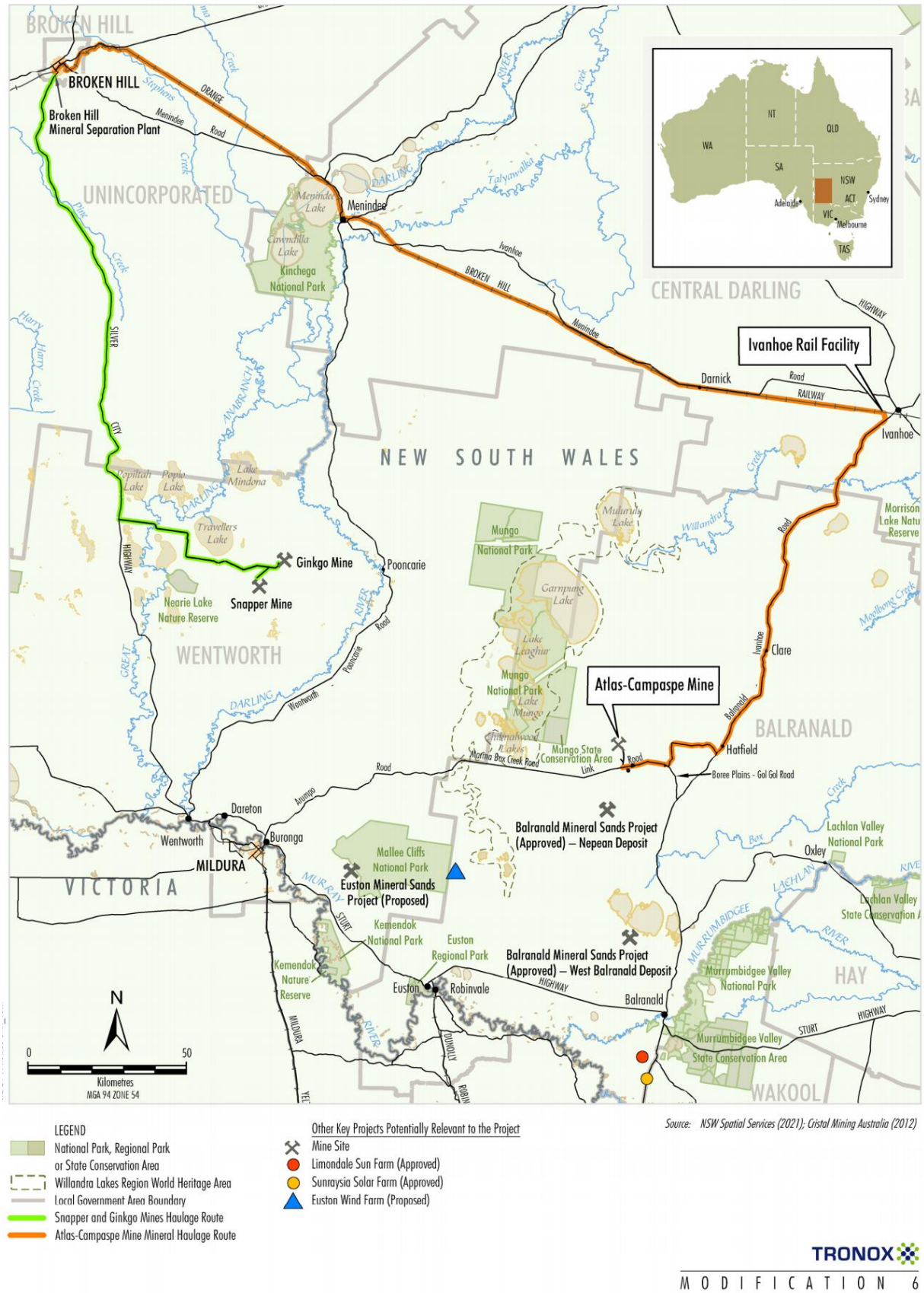
Tronox is now proposing to modify the current Development Consent (SSD_5012) under Section 4.55(2) of the EP&A Act to allow for proposed changes of the Atlas-Campaspe Mine component of the Project (the Modification) (**Section 1.2**).

VMS Australia Pty Ltd (VMS) has been engaged by Tronox to prepare a Noise Review for the Modification. As the Modification would not change the existing/approved product transport route, rail transport or Ivanhoe Rail Facility, this Noise Review focuses on the Atlas-Campaspe Mine.

In the preparation of this assessment, several documents, including the *NSW Noise Policy for Industry (NPfI [2017])* (NSW Environment Protection Authority [EPA], 2017), have been considered.

The acoustic terminology is presented in **Appendix A**.

Figure 1 Regional Location



Note: Figure provided by Tronox.

1.2 Modification Description

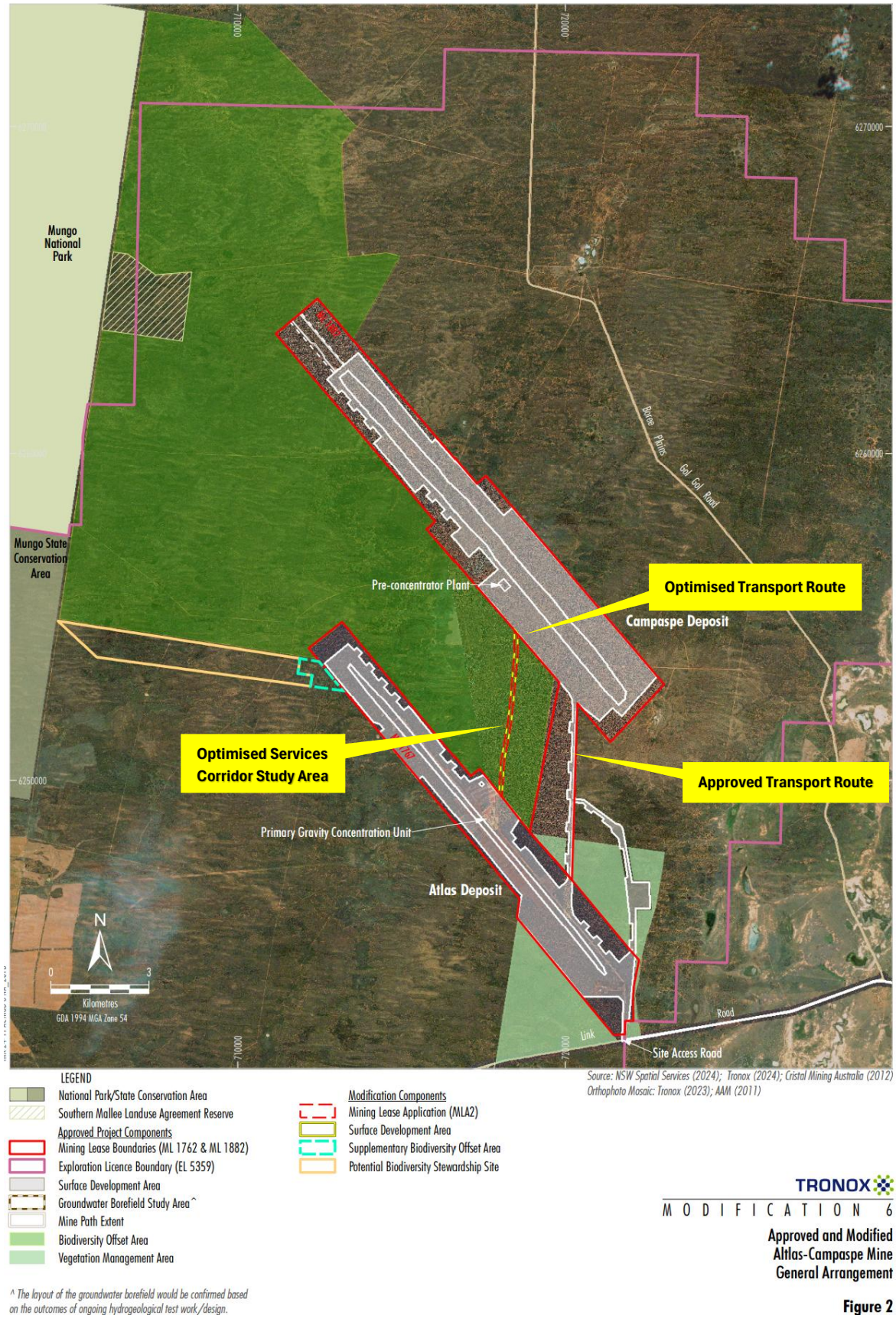
Tronox has prepared detailed planning for the development of the Campaspe deposit. The general arrangements of the approved Project and Modification 6 (the Modification) are shown in **Figure 2**.

The Modification would include the following proposed changes to the Atlas-Campaspe Mine component of the approved Project:

- development of an optimised services corridor between the Atlas and Campaspe deposits, including haul road, pipelines, electricity transmission line, soil stockpiles and water management infrastructure;
- transport of pre-mineral concentrate and ore from the PCP to the PGCU via a pipeline and/or truck along the optimised transport route;
- a supplementary biodiversity offset area to replace a small section of the approved biodiversity offset area that would be impacted by the optimised services corridor; and
- rehabilitation of the optimised services corridor so that it can be incorporated into the existing biodiversity offset area post-mining.

No other changes to the Project would be required.

Figure 2 Approved and Modified Atlas-Campaspe Mine General Arrangement



Note: Figure provided by Tronox.

2 Sensitive Receivers

The nearest noise sensitive residential receivers are presented in **Figure 3,** with receiver ID, property name, receiver distance to the Mine and dwelling coordinates listed in **Table 1**.

Table 1 Noise Sensitive Residential Receivers

Receiver ID	Property Name	Approximate Minimum Distance from Mine to Receiver (km)	Receiver Coordinates (GDA94/MGA Zone 55)	
			Easting	Northing
R1	Wampo	17	697143	6246702
R2	Boree Plains (Tronox owned)	7	720369	6265623
R3	Magenta	15	737487	6250484
R4	Langleydale	18	737882	6243327
R5	Glen Tilt	17	735584	6264556
R6	Marona	14	734268	6261142

Source: Table 3-1 adopted from the Noise Assessment prepared by Wilkinson Murray Pty Ltd dated November 2012.

It is noted that the closest sensitive receiver (R2, Boree Plains) is Tronox-owned and is in a dilapidated state that is not suitable for habitation.

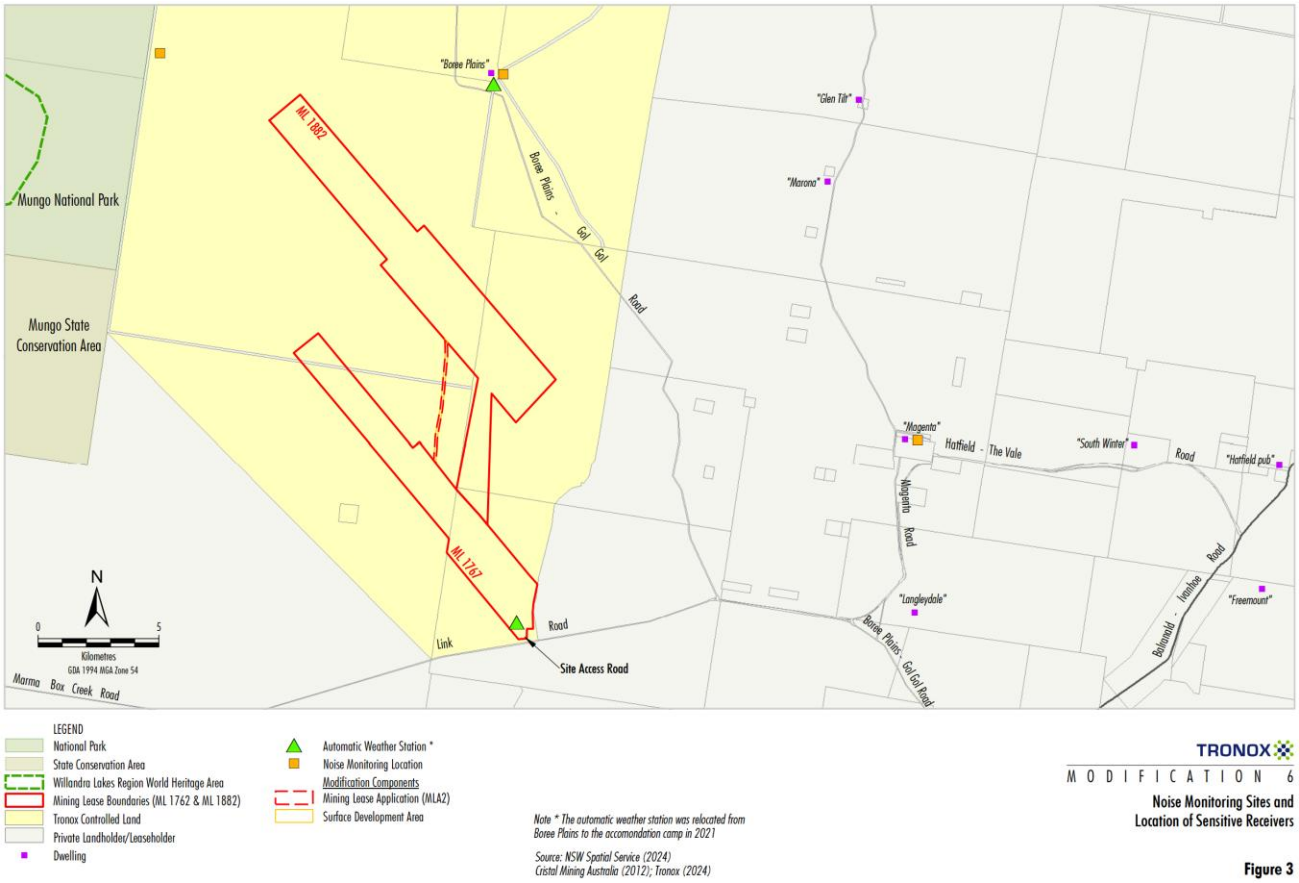
In addition to the residential receivers listed above, the potentially sensitive land uses (located to the west of the Atlas-Campaspe Mine) are presented in **Table 2**.

Table 2 Other Noise Sensitive Land

Receiver ID	Property Name	Approximate Minimum Distance from Mine to Receiver (km)
R7	Mungo National Park	5 (west)
R8	Mungo State Conservation Area	8 (west)
R9	Willandra Lakes Region World Heritage Area	10 (west)

Source: Section 3.1 of the Noise Assessment prepared by Wilkinson Murray Pty Ltd dated November 2012.

Figure 3 Noise Monitoring Sites and Location of Sensitive Receivers



Note: Figure provided by Tronox.

3 Noise Criteria

3.1 Operational Noise Criteria

3.1.1 Approved Project Specific Operational Noise Criteria

The project specific operational noise criteria have been nominated in Condition 16, Schedule 3 of the current Development Consent (SSD_5012) (Modification 5) (December 2024) and are reproduced in **Table 3**.

Table 3 Project Specific Operational Noise Criteria

Location	Day $L_{Aeq\ (15min)}$ dBA	Evening $L_{Aeq\ (15min)}$ dBA	Night	
			$L_{Aeq\ (15min)}$ dBA	$L_{A1\ (1min)}$ dBA
All privately owned land	35	35	35	45
Mungo National Park & Mungo State Conservation Area	48	48	48	-

As per Condition 16B, Schedule 3 of the current Development Consent (SSD_5012), the applicable noise criteria (refer to **Table 3**) are to be increased by 5 dBA for very noise-enhancing meteorological conditions as defined in the NPfI (2017).

Furthermore, Condition 16C, Schedule 3 of the current Development Consent (SSD_5012) also states that the noise criteria presented in **Table 3** do not apply to the residential receivers for which Tronox has an agreement in place that allows higher noise levels.

3.1.2 Maximum Noise Level Event

The approach of assessing the maximum noise level is nominated in Section 2.5 of the NPfI (2017) to protect the potential sleep disturbance and is reproduced below:

> *Where the subject development/premises night-time noise levels at a residential location exceed:*
>
> - $L_{Aeq,15min}$ *40 dB(A) or the prevailing RBL plus 5 dB, whichever is the greater, and/or*
> - L_{AFmax} *52 dB(A) or the prevailing RBL plus 15 dB, whichever is the greater.*
>
> *A detailed maximum noise level event assessment should be undertaken.*

The measured night-time ambient noise level is below the minimum assumed ambient noise level of 30 dBA. The noise criterion for assessing the potential sleep disturbance has been determined as L_{AFmax} of 52 dBA for the Modification.

3.1.3 Project Amenity Noise Levels

The amenity noise criterion is based on land use and associated activities (and their sensitivity to noise emission). The cumulative effect of noise from industrial sources needs to be considered in assessing the impact. The criteria relate only to industrial-type noise sources and do not include road, rail or community noise.

The recommended amenity noise levels are nominated in Table 2.2, Section 2.4 of the NPfI (2017) in order to assess the amenity noise impact at a receiver location. The Project related residential receivers have been categorised as "Rural Residential" in accordance with Table 2.3 of the NPfI (2017) (i.e. Daytime RBL greater than (>) 40 dBA; Evening RBL lesser than (<) 35 dBA and Night RBL <30 dBA) based on the measured ambient background noise levels conducted by Wilkinson Murray Pty Ltd in 2012. Accordingly, the recommended amenity noise levels for the noise sensitive receivers surrounding the Project are presented in **Table 4**.

Table 4 Noise Policy for Industry Recommended Amenity Noise Levels

Receiver Category	Time of Day	$L_{Aeq\ (period)}$ dBA
Rural Residential	Day	50
	Evening	45
	Night	40
Areas specifically reserved for passive recreation (e.g. National Park)	When in Use	50

The calculation method for the Project amenity noise level was also nominated from a single industrial development at a receiver location and reproduced below.

Project amenity noise levels = recommended amenity noise level minus 5 dBA

The NPfI (2017) also suggested the conversion for $L_{Aeq\ (period)}$ levels to $L_{Aeq\ (15min)}$ levels of:

$L_{Aeq\ (15min)} = L_{Aeq\ (period)} + 3$ dBA

The amenity noise criteria for the Modification are calculated and presented in **Table 5**.

Table 5 Noise Policy for Industry Project Amenity Noise Criteria

Receiver Category	Time of Day	$L_{Aeq\ (15\ min)}$ dBA
Rural Residential	Day	50 – 5 + 3 = 48
	Evening	45 – 5 + 3 = 43
	Night	40 – 5 + 3 = 38
Areas specifically reserved for passive recreation (e.g. National Park)	When in Use	50 – 5 + 3 = 48

Project amenity noise levels are also used for assessing the cumulative noise impacts from multiple industries and maintain the amenity for particular land use.

4 Meteorological Conditions

A detailed assessment of the Atlas-Campaspe Mine meteorological environment has been conducted based on the analysis of the wind velocity and temperature gradients derived from the on-site Automatic Weather Station (AWS) for the period between January 2019 and March 2025. It is worth noting that the AWS was initially located at the Boree Plains before it was relocated to the Atlas-Campaspe Mine site in 2021.

The seasonal wind condition based on the meteorological data from the on-site AWS is summarised in **Table 6**.

Table 6 Seasonal Wind Conditions

Season	Frequency of Occurrence (%)					
	Calm - <=0.5m/s	0.5m/s - <=2m/s	2m/s - <=3.0m/s	0.5m/s - <=3.0m/s	3.0m/s - <=5.0m/s	> 5.0m/s
Annual	7.4	35.3	26.2	61.4	25.7	5.4
Spring	6.0	31.7	26.1	57.8	28.1	8.0
Summer	3.9	25.3	29.2	54.5	35.3	6.3
Autumn	9.4	43.4	24.3	67.6	20.3	2.6
Winter	10.6	41.2	24.9	66.1	18.6	4.7

Note: percent (%)

The frequencies of occurrence of stability class during evening and night-time periods are summarised in **Table 7**.

Table 7 Stability Categories - Evening and Night-time

Season	Frequency of Occurrence (%)		
	D Class	E Class	F + G Class
Annual	46	22	32
Spring	49	21	30
Summer	52	20	27
Autumn	41	23	36
Winter	41	24	35

The existing meteorological conditions were generally consistent with the modelled weather conditions in the previous noise studies including EA Noise Assessment prepared by Wilkinson Murray Pty Ltd (dated November 2012), Noise Review (MOD 1) prepared by Wilkinson Murray Pty Ltd (dated July 2019) and Noise Review (Modification 5) prepared by VMS (dated July 2024).

5 Noise Compliance Monitoring Records

5.1 Noise Management Plan

Noise management at the Project is undertaken in accordance with the Noise Management Plan. The Noise Management Plan was prepared in accordance with Condition 18, Schedule 3 of the current Development Consent (SSD_5012) and includes the following noise management measures for the Project:

- Development and implementation of an equipment maintenance schedule to maintain equipment noise emission levels and reduce the likelihood of tonal noise impacts.
- Development and implementation of a noise awareness program to educate employees on the effects of noise and quiet work practices.
- Drivers will be made aware of the potential for noise impact through site-specific inductions and staff education programs to reinforce quiet driving styles/attitudes.
- An awareness of industry developments will be maintained in relation to noise mitigation engineering for individual plant items in order to assess inherent cost and practicability.
- The number of vehicle trips to and from the Atlas-Campaspe Mine will be optimised by ensuring that transport trucks are loaded to their operating capacity.
- All loose and rattling truck body parts will be fixed or tightened to minimise noise emissions from ‘body rumble’ (i.e. when loose panels vibrate when a truck hits a bump, causing noise to emanate from the panel).
- The use of locomotives and rolling stock that are approved to operate on the NSW rail network in accordance with Australian Rail Track Corporation Environment Protection Licence (EPL) 3142.

- Implementation of operational changes to minimise noise impacts during periods of adverse meteorological conditions in accordance with Condition 17(c), Schedule 3 of the current Development Consent (SSD_5012).

5.2 Noise Compliance Monitoring Locations

Operator-attended quarterly noise compliance monitoring was conducted at the nominated noise monitoring locations in accordance with the Noise Management Plan (Cristal Mining Australia, 2018).

The quarterly noise compliance monitoring locations are summarised in **Table 8** and presented in **Figure 3**.

Table 8 Compliance Noise Monitoring Locations

Monitoring Location ID	Corresponding Receiver ID and Name	Site Type	Monitoring Time and Frequency
NAC1	R2 Boree Plains (Tronox owned)	Compliance Noise Monitoring Site	Quarterly
NAC2	R3 Magenta		
MNP	R7 Mungo National Park		

Noise monitoring sites NAC1 and NAC2 are representative of the privately owned receivers most likely to be affected by noise generated by the Atlas-Campaspe Mine (**Figure 3**). Noise monitoring site MNP is representative of the Mungo National Park and Mungo State Conservation Area. The location of this site is also shown in **Figure 3**. Noise monitoring is conducted to the east of the boundary between Tronox Mining-owned land and the Mungo National Park and Mungo State Conservation Area.

5.3 Noise Compliance Monitoring Records

The noise compliance monitoring results have been summarised in the Project's Annual Review Reports. The noise monitoring data is summarised in **Table 9** for the period between 2018 and 2023.

Table 9 Noise Monitoring Data Recorded in the Atlas-Campaspe Mine and Surrounding Area

Year	Quarter	Noise Monitoring Location								
		NAC1 (L_{Aeq}) (dBA)			NAC2 (L_{Aeq}) (dBA)			MNP (L_{Aeq}) (dBA)		
		Day	Evening	Night	Day	Evening	Night	Day	Evening	Night
2018	Q1	-	-	-	-	-	-	-	-	-
	Q2	19.3/ 19.2	-	-	17.5/ 17.7	-	-	19.3/ 18.1	-	-
	Q3	-	-	-	-	-	-	-	-	-
	Q4	-	-	-	-	-	-	-	-	-
2019	Q1	34.7	22.6	17.5	27.7	25.8	22.9	27.7	25.8	22.9
	Q2	28.1	29.5	32.3	25.1	19.7	20.2	32.3	38.2	28.6
	Q3	40.7	32.3	29.6	38	34.9	33.3	43.8	41.5	27.5
	Q4	NS	28.7	27.8	32	27.9	32	31.5	28.6	37
2020[1]	Q1	-	-	-	-	-	-	-	-	-

Year	Quarter	Noise Monitoring Location								
		NAC1 (L_{Aeq}) (dBA)			NAC2 (L_{Aeq}) (dBA)			MNP (L_{Aeq}) (dBA)		
		Day	Evening	Night	Day	Evening	Night	Day	Evening	Night
	Q2	-	-	-	-	-	-	-	-	-
	Q3	-	-	-	-	-	-	-	-	-
	Q4	-	-	-	-	-	-	-	-	-
2021	Q1[1]	-	-	-	-	-	-	-	-	-
	Q2	31.5	27.7	30.6	24.6	20.3	20.3	29.7	31.7	26.5
	Q3	33.6	20.8	24.7	33.8	27.4	27.4	23.7	23.1	23.9
	Q4	27.5	31	26.6	24.4	29.6	29.6	38.7	36.7	32.6
2022	Q1	29	30.9	26	31.2	29.4	29.6	33.8	41.2	29.1
	Q2	34.4	17.2	24.4	29.5	23.9	17.6	39.4	39.3	27.9
	Q3	35	23.6	20.4	32.4	19.8	32.4	45.4	33.7	20.5
	Q4	23.5	21.7	19.8	22.2	20.5	19.8	21.2	21.3	35.9
2023	Q1	35	22.4	29.2	27	21.6	23.2	41	29.2	27.5
	Q2	33.8	24.1	18.3	29.2	23.4	20.8	27.8	36.4	18.3
	Q3	30.5	30.6	19	29.5	27.9	26	32.9	19.5	16.1
	Q4	33.3	30.6	22.8	32	32	35	42	40.2	34.1
2024	Q1	31.6	28.1	19.6	31.4	22.1	22.4	29.5	35.6	18.6
	Q2	30.4	22.7	18.8	29.5	32.4	19.2	41.9	28.8	30.3
	Q3	28.6	17.1	17.6	23.5	18.4	19.2	37.2	20.0	28.6
	Q4	29.3	34.6	31.9	33.4	23.0	32.6	43.4	49.4	44.9

Note : No noise monitoring was undertaken during this reporting period because monitoring requirements were temporarily suspended. Attended noise monitoring resumed in 2021 at the Boree Plains (NAC1), Magenta (NAC2) and the Mungo National Park Boundary (MNP) and Ivanhoe Rail Facility (NI1, NI2 and NI3).

It is noted that the noise from the Atlas-Campaspe Mine site was inaudible during all the operator-attended noise compliance survey period at all locations. The measured $L_{Aeq(15min)}$ noise levels were dominated by environmental noise, including aeroplanes, birds, dog barking, road traffic, wind, etc.

5.4 Noise Complaint Record

Project Annual Reviews reported that no noise related complaints were received from Atlas-Campaspe Mine.

6 Overview of Previous Noise Assessments

6.1 Background

Wilkinson Murray (2012) prepared a Noise Assessment for Project Environmental Impact Statement in accordance with the INP (EPA, 2000) and considered the noise impacts associated with the Atlas-Campaspe Mine, Ivanhoe Rail Facility and mineral concentrate transport between the Atlas-Campaspe Mine and the Mineral Separation Plant.

Wilkinson Murray (2019) and VMS (2024) prepared a Noise Review for Atlas-Campaspe Mine Modification 1 and Modification 5, respectively, in accordance with NSW EPA's NPfI (2017) and considered the noise impacts associated with the Atlas-Campaspe Mine.

6.2 Predicted Operational Noise Levels from the Current Approved Project

The Atlas-Campaspe Mine related noise levels were predicted at the noise sensitive receivers in the latest Noise Review (Modification 5) prepared by VMS dated 5 July 2024. The predicted operational noise levels from the Atlas-Campaspe Mine at the noise sensitive receivers are summarised in **Table 10.**

VMS concluded that the predicted noise emissions from the Modification 5 operation are expected to comply with the Project noise criteria at all noise sensitive receivers under both neutral and adverse weather conditions.

Table 10 Predicted Operational $L_{Aeq(15min)}$ Noise Levels - Current Approved Project[1]

Receiver ID	Property Name	Calm Meteorological Conditions	Worst-Case Meteorological Gradient Wind of 3 m/s Predicted L_{Aeq} Noise Level (dBA)	Worst-Case Meteorological 8°C/100 m Inversion Strength and 1 m/s Wind Source to Receiver Predicted L_{Aeq} Noise Level (dBA)
R1	Wampo	<14	<14	<14
R2	Boree Plains (Tronox owned)	<20	<31	<32
R3	Magenta	<14	<14	<14
R4	Langleydale	<14	<14	<14
R5	Glen Tilt	<14	<14	<14
R6	Marona	<14	<14	<14
R7	Mungo National Park	<24	<24	<24
R8	Mungo State Conservation Area	<24	<24	<24
R9	Willandra Lakes Region World Heritage Area	<24	<24	<24

Note 1: Predicted noise levels from Table 15 of the Noise Review (Modification 5) prepared by VMS dated 5 July 2024.

7 Noise Assessment

7.1 Overview

Potential operational noise impacts of the Modification would be associated with the following:

- development of an optimised services corridor between the Atlas and Campaspe deposits; and
- transport of pre-mineral concentrate and ore from the PCP to the existing PGCU via a pipeline and/or truck along the optimised transport route.

The potential noise impacts associated with the construction and operation of the pipelines, electricity transmission line, soil stockpiles and water management infrastructure would be negligible in the context of full-scale mining operations at the Atlas-Campaspe Mine and therefore has not been assessed further in this Noise Review.

The methodology and potential noise impacts described above are discussed below.

7.2 Methodology

The Boree Plains residence (Tronox-owned) is the closest residence to the Atlas-Campaspe Mine footprint and is located approximately 7 km from the Campaspe deposit and approximately 18 km from the Atlas deposit. Other rural residences (e.g. Marona, Glen Tilt, Magenta and Langleydale) are located at least 14 km from the Atlas-Campaspe Mine footprint.

The proposed Modification optimised services corridor is designed as approximately 3 km to the north-west of the approved transport corridor (**Figure 2**) between Atlas and Campaspe deposits. The acoustic centre of the proposed transport route will be shifted to the north-west accordingly. All other mine-related noise sources would continue to operate in the currently approved Atlas-Campaspe Mine areas.

Accordingly, the difference in distance attenuation between the proposed Modification and the approved Project transport route is considered to be a suitable method for evaluating potential noise impacts on the Boree Plains residence and other rural properties near the Atlas-Campaspe Mine footprint from the Modification.

7.3 Plant and Equipment

The plant and equipment proposed for the Modification will generally be consistent with the approved Project (Modification 5) with minor changes on the number of BIS 140t Pit Haulers. The equipment list for both approved (Modification 5) Project and the proposed Modification are presented in **Table 11**.

Table 11 Approved and Proposed Fixed Plant, Mobile Equipment Details and Sound Power Levels

Equipment	Approved Project			Proposed Modification 6 (Trucking Option)			Proposed Modification 6 (Pumping Option)		
	No. of Units	SWL L_{Aeq}[1]	Total SWL L_{Aeq}	No. of Units	SWL L_{Aeq}[1]	Total SWL L_{Aeq}	No. of Units	SWL L_{Aeq}[1]	Total SWL L_{Aeq}
Primary Gravity Concentration Unit	1	103	103	1	103	103	1	103	103
Sewage Treatment Plant	1	97	97	1	97	97	1	97	97
DMUs	2	112	115	2	112	115	2	112	115
1,000 kVA Generators	4	98	104	4	98	104	4	98	104
Electric Pump	4	103	109	4	103	109	4	103	109
Lighting Tower	8	103	112	8	103	112	8	103	112
Volvo A60H - Scoop	1	113	113	1	113	113	1	113	113
CAT D11T Dozer	1	116	116	1	116	116	1	116	116
CAT D10T Dozer	2	116	119	2	116	119	2	116	119
CAT D9T Dozer	1	114	114	1	114	114	1	114	114
Hitachi EX8000 Face Shovel	1	118	118	1	118	118	1	118	118
Liebherr R9800 Excavator	1	118	118	1	118	118	1	118	118
CAT349FL Excavator	2	106	109	2	106	109	2	106	109
CAT16H Grader	2	109	112	2	109	112	2	109	112
CAT793F Haul truck	6	124	132	6	124	132	6	124	132
CAT794AC Haul Truck	4	125	131	4	125	131	4	125	131
CAT740 Artic Watercart	2	115	118	2	115	118	2	115	118
Scania Watercart	1	109	109	1	109	109	1	109	109
Pre-Concentrator Plant	1	103	103	1	103	103	1	103	103

Equipment	Approved Project			Proposed Modification 6 (Trucking Option)			Proposed Modification 6 (Pumping Option)		
	No. of Units	SWL L_{Aeq}[1]	Total SWL L_{Aeq}	No. of Units	SWL L_{Aeq}[1]	Total SWL L_{Aeq}	No. of Units	SWL L_{Aeq}[1]	Total SWL L_{Aeq}
CAT 854 Wheel Dozer	1	119	119	1	119	119	1	119	119
Hitachi EX2500 Excavator	1	119	119	1	119	119	1	119	119
BIS 140t Pit Hauler	6	109	117	4	109	117	1	109	117
Total			**135.4**			**135.4**			**135.4**

Note 1: SWL adopted from Section 6.3 of the EA Noise Assessment prepared by Wilkinson Murray Pty Ltd (dated November 2012).

7.4 Change in Noise Emission Level

As discussed in **Section 7.2**, the changes (attenuation or enhancement) in noise emission levels from the Modification's proposed optimised service corridor are calculated and presented in **Table 12**.

7.5 Predicted Modified Operational Noise Levels

The predicted operational noise levels for the Modification were calculated under calm and adverse meteorological conditions, and the findings for the trucking option and pumping option are presented in **Table 13** and **Table 14**, respectively, based on the predicted noise levels presented in the Noise Review (Modification 5) prepared by VMS (dated 5 July 2024) for the current Approved Project (Modification 5) (**Table 10**), and the noise level changes from the proposed Modification presented in **Table 12**.

7.6 Maximum Noise Event

Based on the calculated low $L_{Aeq(15min)}$ noise levels at the noise sensitive residential receivers (R1 to R6) presented in **Table 13**, the noise levels from the maximum noise level events at these residential receivers are expected to be below the Project $L_{Aeq(15min)}$ of 40 dBA and L_{AFmax} of 52 dBA in accordance with NPfI (2017) as discussed in Section **3.1.2**.

7.7 Cumulative Noise

The nearest mining operation to the Project is Balranald Mineral Sands Project (Balranald Project), operated by Iluka Resources Pty Limited. The Balranald Project includes construction, mining and rehabilitation of two linear mineral sand deposits, known as West Balranald and Nepean, located approximately 12 km and 66 km northwest of the town of Balranald, respectively.

Development Consent (SSD-5285) was granted for the Balranald Project in 2016. Further modifications of the Balranald Project (MOD 1 and MOD 2) were also approved by NSW Department of Planning, Housing and Infrastructure (formerly NSW Department of Planning and Environment) in December 2022 and August 2023. The Balranald Project would be operating at its northern-most extent during Year 11 of operations at the Atlas-Campaspe Mine. This would result in a distance of approximately 21 km between the Balranald Project (Nepean deposit) and the nearest Project related noise sensitive receivers (R4 Langleydale).

The noise emissions from the approved Balranald Project to the northern noise sensitive receiver are predicted as less than 30 dBA in accordance with the Noise Impact Assessment prepared by EMM (dated 28 April 2022).

Based on the predicted noise levels in **Table 13**, the noise emissions from the proposed Modification to the privately owned noise sensitive receivers are predicted to be less than 33 dBA (**Table 13**) under both calm and adverse weather conditions. Thus, the cumulative noise levels from the proposed Modification and the Balranald Project are likely to comply with the cumulative amenity noise criteria as presented in **Table 5**.

Table 12 Noise Emission Change from Approved Project (Modification 5) to the Proposed Optimised Service Corridor (Modification 6)

Receiver ID	Property Name	Distance from the Service Corridor to the Receiver (m)		Change in Offset Distance (Modification 6 minus Modification 5) (m)	Mobile Plant Noise Change from the Proposed Service Corridor (dB)	Change in Tuck SWLs Utilising the Haul Route (dB)		Overall Noise Change (dB)	
		Modification 5	Modification 6			Trucking Option	Pumping Option	Trucking Option	Pumping Option
R1	Wampo	23227	21842	-1384	+0.5	-0.03	-0.06	+0.4	+0.4
R2	Boree Plains (Tronox owned)	15830	13451	-2380	+1.4	-0.03	-0.06	+1.2	+1.2
R3	Magenta	17338	19331	1994	-0.9	-0.03	-0.06	-0.8	-0.8
R4	Langleydale	18862	21607	2745	-1.2	-0.03	-0.06	-1.0	-1.0
R5	Glen Tilt	21348	21210	-138	+0.1	-0.03	-0.06	+0.0	+0.0
R6	Marona	18103	18281	178	-0.1	-0.03	-0.06	-0.1	-0.1
R7	Mungo National Park	17140	15222	-1918	+1.0	-0.03	-0.06	+0.9	+0.8
R8	Mungo State Conservation Area	16266	14011	-2255	+1.3	-0.03	-0.06	+1.1	+1.1
R9	Willandra Lakes Region World Heritage Area	10000	8082	-1918	+1.8	-0.03	-0.06	+1.6	+1.6

Table 13 Modification Operational $L_{Aeq(15\ min)}$ Noise Levels - Atlas-Campaspe Mine (Modification 6) - Trucking Option

Receiver ID	Property	Calm Meteorological Conditions	Worst-Case Meteorological Gradient Wind of 3 m/s Predicted L_{Aeq} Noise Level (dBA)	Worst-Case Meteorological 8°C/100 m Inversion Strength and 1.0 m/s Wind Source to Receiver Predicted L_{Aeq} Noise Level (dBA)	Noise Criteria	Modification Noise Assessment
R1	Wampo	< 14	< 14	< 14	35	Complies
R2	Boree Plains (Tronox owned)	< 21	< 32	< 33	35	Complies
R3	Magenta	< 13	< 13	< 13	35	Complies
R4	Langleydale	< 13	< 13	< 13	35	Complies
R5	Glen Tilt	< 14	< 14	< 14	35	Complies
R6	Marona	< 14	< 14	< 14	35	Complies
R7	Mungo National Park	< 25	< 25	< 25	48	Complies
R8	Mungo State Conservation Area	< 25	< 25	< 25	48	Complies
R9	Willandra Lakes Region World Heritage Area	< 26	< 26	< 26	48	Complies

Table 14 Modification Operational $L_{Aeq(15\ min)}$ Noise Levels - Atlas-Campaspe Mine (Modification 6) - Pumping Option

Receiver ID	Property	Calm Meteorological Conditions	Worst-Case Meteorological Gradient Wind of 3 m/s Predicted L_{Aeq} Noise Level (dBA)	Worst-Case Meteorological 8°C/100 m Inversion Strength and 1.0 m/s Wind Source to Receiver Predicted L_{Aeq} Noise Level (dBA)	Noise Criteria	Modification Noise Assessment
R1	Wampo	< 14	< 14	< 14	35	Complies
R2	Boree Plains (Tronox owned)	< 21	< 32	< 33	35	Complies
R3	Magenta	< 13	< 13	< 13	35	Complies
R4	Langleydale	< 13	< 13	< 13	35	Complies
R5	Glen Tilt	< 14	< 14	< 14	35	Complies
R6	Marona	< 14	< 14	< 14	35	Complies
R7	Mungo National Park	< 25	< 25	< 25	48	Complies
R8	Mungo State Conservation Area	< 25	< 25	< 25	48	Complies
R9	Willandra Lakes Region World Heritage Area	< 26	< 26	< 26	48	Complies

7.8 Noise Impact Assessment Summary

Based on the noise predictions presented in **Section 7.4** to **Section 7.7**, the noise impacts from the proposed Modification to the noise sensitive residential and non-residential receivers are summarised in **Table 15** and **Table 16**, respectively.

Table 15 Noise Impact Assessment Summary - Residential Receivers

Noise Issue	Applicable Time Period	Noise Criteria	Receiver	Assessment
Operation	Day (7.00 am - 6.00 pm)	35 dBA $L_{Aeq\ (15\ min)}$	All noise sensitive residential receivers	Complies
	Evening (6.00 pm - 10.00 pm)	35 dBA $L_{Aeq\ (15\ min)}$		Complies
	Night (10.00 pm - 7.00 am)	35 dBA $L_{Aeq\ (15\ min)}$		Complies
Maximum Noise Level Event	Night (10.00 pm - 7.00 am)	40 dBA $L_{Aeq\ (15\ min)}$ and/or 52 dBA L_{Amax}		Complies
Cumulative	Day (7.00 am - 6.00 pm)	48 dBA $L_{Aeq\ (15\ min)}$		Complies
	Evening (6.00 pm - 10.00 pm)	43 dBA $L_{Aeq\ (15\ min)}$		Complies
	Night (10.00 pm - 7.00 am)	38 dBA $L_{Aeq\ (15\ min)}$		Complies

Table 16 Noise Impact Assessment Summary - Non-Residential Receivers

Noise Issue	Applicable Time Period	Noise Criteria	Receiver	Assessment
Operation	When in use	48 dBA $L_{Aeq\ (15\ min)}$	Mungo National Park	Complies
			Mungo State Conservation Area	Complies
			Willandra Lakes Region World Heritage Area	Complies
Cumulative	When in use	48 dBA $L_{Aeq\ (15\ min)}$	Mungo National Park	Complies
			Mungo State Conservation Area	Complies
			Willandra Lakes Region World Heritage Area	Complies

8 Summary of Findings

Tronox is seeking approval for modifying the existing approved Development Consent (SSD_5012) for the proposed Modification of the Atlas-Campaspe Mine. VMS was engaged to prepare a Noise Review for the proposed Modification to assess the potential noise impact from the Modification to the noise sensitive receivers.

A semi-quantitative noise assessment has been conducted to assess the noise emissions from the Modification. The proposed optimised services corridor is designed to be located approximately 3 km to the northwest of the existing approved service corridor. The noise attenuation from the proposed Modification has been calculated based on the distance variation from the proposed and the approved transport routes.

The relatively large distances between the Project related noise sources and the surrounding residences, such as the Boree Plains, Marona, Glen Tilt, Magenta, and Langleydale, provide a buffer zone that mitigates the direct impact of noise emissions. This spatial separation reduces the likelihood of significant or even minor noise exposure at sensitive receivers, even with minor changes to the location of noise sources utilising the proposed transport route from the Modification.

Based on the noise assessment presented in **Section 7**, the summary of findings is presented below:

Operational Noise Levels

Operational noise levels are predicted to comply with the nominated Project operational noise criteria outlined in Condition 16, Schedule 3 of the current Development Consent (SSD_5012) (December 2024) at all noise sensitive receivers under neutral and adverse weather conditions.

Maximum Noise Event

The noise emission from the maximum noise event of the Modification is expected to comply with the sleep disturbance noise criteria at all noise sensitive residential receivers during night-time period in accordance with NPfI (2017).

Cumulative Noise Levels

The cumulative noise exposure from both the Modification and neighbouring Balranald Mineral Sands Project will comply with the cumulative amenity noise criteria at the surrounding noise sensitive receivers.

Appendix A

Acoustic Terminology

Glossary of Noise and Vibration Terminology

Sound Pressure	Sound, or sound pressure, is a fluctuation in air pressure over the static ambient pressure.
Sound Power	Sound Power is the rate at which sound energy is emitted, reflected, transmitted, or received, per unit time. Unlike sound pressure, sound power is neither room-dependent nor distance-dependent.
Sound Pressure Level (SPL)	The sound level is the sound pressure relative to a standard reference pressure of 20µPa ($20x10^{-6}$ Pascals) on a decibel scale.
Sound Power Level (SWL)	The Sound Power Level is the sound power relative to a standard reference pressure of 1pW ($20x10^{-12}$ Watts) on a decibel scale. The SWL of a simple point source may be used to calculate the SPL at a given distance (r) using the following formula: $SPL = SWL - 10 \times Log_{10}(4 \times \pi \times r^2)$ Note that the above formula is only valid for sound propagation in the free-field (see below).
Decibel (dB)	A scale for comparing the ratios of two quantities, including sound pressure and sound power. The difference in level between two sounds s1 and s2 is given by 20 log10 (s1 / s2). The decibel can also be used to measure absolute quantities by specifying a reference value that fixes one point on the scale. For sound pressure, the reference value is 20µPa.
A-weighting, dBA	The unit of sound level, weighted according to the A-scale, which takes into account the increased sensitivity of the human ear at some frequencies.
Noise Level Indices	Noise levels usually fluctuate over time, so it is often necessary to consider an average or statistical noise level. This can be done in several ways, so a number of different noise indices have been defined, according to how the averaging or statistics are carried out.
Leq,T	A noise level index called the equivalent continuous noise level over the time period T. This is the level of a notional steady sound that would contain the same amount of sound energy as the actual, possibly fluctuating, sound that was recorded.
Lmax,T	A noise level index defined as the maximum noise level during the period T. Lmax is sometimes used for the assessment of occasional loud noises, which may have little effect on the overall Leq noise level but will still affect the noise environment. Unless described otherwise, it is measured using the 'fast' sound level meter response.
L90,T	A noise level index. The noise level exceeded for 90% of the time over the period T. L90 can be considered to be the "average minimum" noise level and is often used to describe the background noise.
L10,T	A noise level index. The noise level exceeded for 10% of the time over the period T. L10 can be considered to be the "average maximum" noise level. Generally used to describe road traffic noise.
Free-Field	Far from the presence of sound reflecting objects (except the ground), usually taken to mean at least 3.5m
Fast/Slow Time Weighting	Averaging times used in sound level meters.
Octave Band	A range of frequencies whose upper limit is twice the frequency of the lower limit.
DnT,w	The single number quantity that characterises airborne sound insulation between rooms over a range of frequencies.
Rw	Single number quantity that characterises the airborne sound insulating properties of a material or building element over a range of frequencies.
Reverberation	The persistence of sound in a space after a sound source has been stopped.
PPV	The particles of a medium are displaced from their random motion in the presence of a vibration wave. The greatest instantaneous velocity of a particle during this displacement is called the Peak Particle Velocity (PPV) and is typically measured in the units of mm/s.
Hertz, Hz	The unit of Frequency (or Pitch) of a sound or vibration. One hertz equals one cycle per second. 1 kHz = 1000 Hz, 2 kHz = 2000 Hz, etc.
Acceleration	Acceleration is defined as the rate of change of Velocity of a particle over a period of time and is typically measured in the units of m/sec^2.
Vibration Dose, VDV	When assessing intermittent vibration, it is necessary to use the vibration dose value (VDV), a cumulative measurement of the vibration level received over an 8-hour or 16-hour period. The VDV formulae uses the RMS Acceleration raised to the fourth power and is known as the Root-mean-quad method. This technique ensures the VDV is more sensitive to the peaks in the acceleration levels. VDVs are typically measured in the units of $m/s^{1.75}$.