Noise Management Plan- Happy Valley Titanium Minerals Project

DRAFT 2

CD 914

March 2009

INTENTIONALLY LEFT BLANK

Noise Management Plan-
Happy Valley Titanium Minerals Project

DRAFT 2

CD 914

REVISION STATUS RECORD

Controlled Document:	**CD914**				
Document Title:	**NMP – Happy Valley Project**				
Version	Issue Date	Reviewed by	Copies To	Description of Revision	Sections amended
Draft 0	August 2008	Bemax	Internal	New document	
Draft 1	August 2008	Bemax, EPA	Bemax, EPA	Drafting changes	all
Draft 2	March 2009		Bemax, EPA	Changes in response to EPA comments, revised modelling, revised influencing factors	all
3					

TABLE OF CONTENTS

1. INTRODUCTION 1

1.1 PURPOSE 1

1.2 SCOPE 1

1.3 STRUCTURE AND CONTENT 1

1.4 RELATIONSHIP TO ENVIRONMENTAL MANAGEMENT SYSTEM 2

1.5 RELATIONSHIP TO OTHER DOCUMENTS 2

2. NOISE FROM MINING 4

2.1 OVERVIEW 4

2.2 SENSITIVE PREMISES 4

2.3 POTENTIAL IMPACTS 4

2.4 ENVIRONMENTAL NOISE ASSESSMENT 5

3. MANAGEMENT OBJECTIVES AND ACTIONS 13

3.1 ENVIRONMENTAL OBJECTIVES 13

3.2 PERFORMANCE INDICATORS / CRITERIA 13

3.2.1 Environmental Protection (Noise) Regulations 1997 13

3.2.2 Bemax Environmental policy 14

3.3 MANAGEMENT ACTIONS 15

3.3.1 Planning measures 15

3.3.2 Operating measures 15

3.3.3 Haulage Noise Measures 19

3.4 COMMUNITY CONSULTATION 19

3.4.1 Community Consultation 19

3.4.2 Complaint Response Procedures 20

3.4.3 Operating Agreements 20

4. MONITORING, REVIEW AND REPORTING 21

4.1 NOISE MONITORING 21
4.1.1 Noise Monitoring Equipment 21
4.1.2 Noise Monitoring Program 22
4.1.3 Benchmarking. 23
4.2 PERFORMANCE MONITORING 23
4.3 PERFORMANCE REVIEW 23
4.4 COMPLIANCE AUDITING 23
4.5 NON-COMPLIANCES 23
4.6 REPORTING 23
4.7 DOCUMENT REVIEW AND REVISION 24

5. CONTINGENCY MEASURES 24

6. REFERENCES 29

6.1 EXTERNAL DOCUMENTS 29
6.2 INTERNAL DOCUMENTS 29

LIST OF TABLES

Residential Influencing Factors and Assigned Levels 6
Predicted worst case noise levels at private residences. 7
Frequency of 'Worst Case' wind conditions. 9
Prescribed noise limits (from *Environmental Protection (Noise) Regulations 1997*) 13
Prescribed penalties for noise characteristics (from *Environmental Protection (Noise) Regulations 1997*) 14
Happy Valley Noise Monitoring Program. 22
Summary of management commitments and monitoring measures for noise at Happy Valley. 27

LIST OF FIGURES

Location of the proposed mining operations 3
Happy Valley North timeline of key activities. 8
Location of noise sensitive premises relative to the proposal. 11
Happy Valley Haulage Route options. 12
Happy Valley North Acoustic Barrier locations 18
Contingency decision tree. 25

1. INTRODUCTION

1.1 PURPOSE

The purpose of this Noise Management Plan is to describe management actions to be implemented prior to, during and post mining of the Happy Valley Mineral Sands Project, necessary to:

- Ensure that operations do not adversely affect environmental values or the health, welfare or amenity of people and land uses by meeting statutory requirements and acceptable standards
- To minimise emissions to levels as low as practicable on an on-going basis (i.e. continuous improvement)
- To respond effectively to complaints
- To minimise off-site impacts on fauna

This management plan describes those strategies and procedures that will be implemented to ensure Bemax complies with its obligations and management objectives so that as far as practicable the amenity of nearby residences is protected from noise impacts resulting from mineral sands mining, transport and related activities.

1.2 SCOPE

This Noise Management Plan (NMP) has been prepared as part of the Environmental Review and Management Program (ERMP) for the Bemax Happy Valley mining proposal. The purpose of the plan is to describe how Bemax will manage impacts of noise generated by the mining operation on the amenity of neighbouring residents and fauna. The plan addresses the commitments made, advice received and conditions placed during the public ERMP process.

The management plan applies to all activities associated with the construction, mining and rehabilitation phases of the project that may have the potential to impact on the amenity of local residents.

1.3 STRUCTURE AND CONTENT

This management plan includes a description of:

- the environmental setting of the proposal, as it relates to noise
- potential environmental impacts associated with elevated or annoying noise emissions
- principle objectives and/or criteria relevant to noise management
- the strategies and actions to manage noise emissions that are specified within various EMS documents
- site-specific strategies and actions to manage noise emissions associated with the Happy Valley project

- monitoring and revision mechanisms to ensure that the performance of noise management measures is routinely assessed against the objectives
- processes for the reporting of performance and the identification and/or implementation of change, based on feedback.

The management plan includes review mechanisms to ensure that the noise management techniques are kept up to date with community and government expectations and industry performance benchmarks. The plan also includes a management actions table (Table 5-1) to assist in the implementation of the plan.

1.4 RELATIONSHIP TO ENVIRONMENTAL MANAGEMENT SYSTEM

Bemax operates in accordance with its Environmental Management System (EMS), which is certified in accordance with AS/NZ ISO 14001. The purpose of the EMS is to ensure that company policy requirements relating to the environment are fulfilled and progress is made towards corporate environmental objectives. The EMS includes a framework for identifying environmental risks, applying appropriate controls and monitoring implementation and effectiveness. The EMS also includes continuous improvement programs to achieve key environmental objectives and targets.

Components of the EMS include an extensive array of procedures, documents and work instructions for all aspects of the Bemax operations, including workforce training, document control, emergency preparedness, performance monitoring and review, and roles and responsibilities of staff and contractors. The EMS is one component of an Integrated Management System (IMS) also covering Safety (AS4801) and Quality (AS/NZS ISO 9001) management systems.

This management plan is a directory to those EMS documents associated with noise management. It also provides the objectives for noise management that must be adhered to when preparing or modifying EMS documents that relate to noise management.

1.5 RELATIONSHIP TO OTHER DOCUMENTS

The background setting and investigation of the risks to the amenity of neighbouring residents that have been used to identify the risks that are manageable under this document are described in the ERMP, as well as the independent Environmental Noise Assessment conducted by Herring Storer Acoustics (2008). In addition, results from noise monitoring and community feedback in relation to the existing Gwindinup mine have been considered in the development of the document.

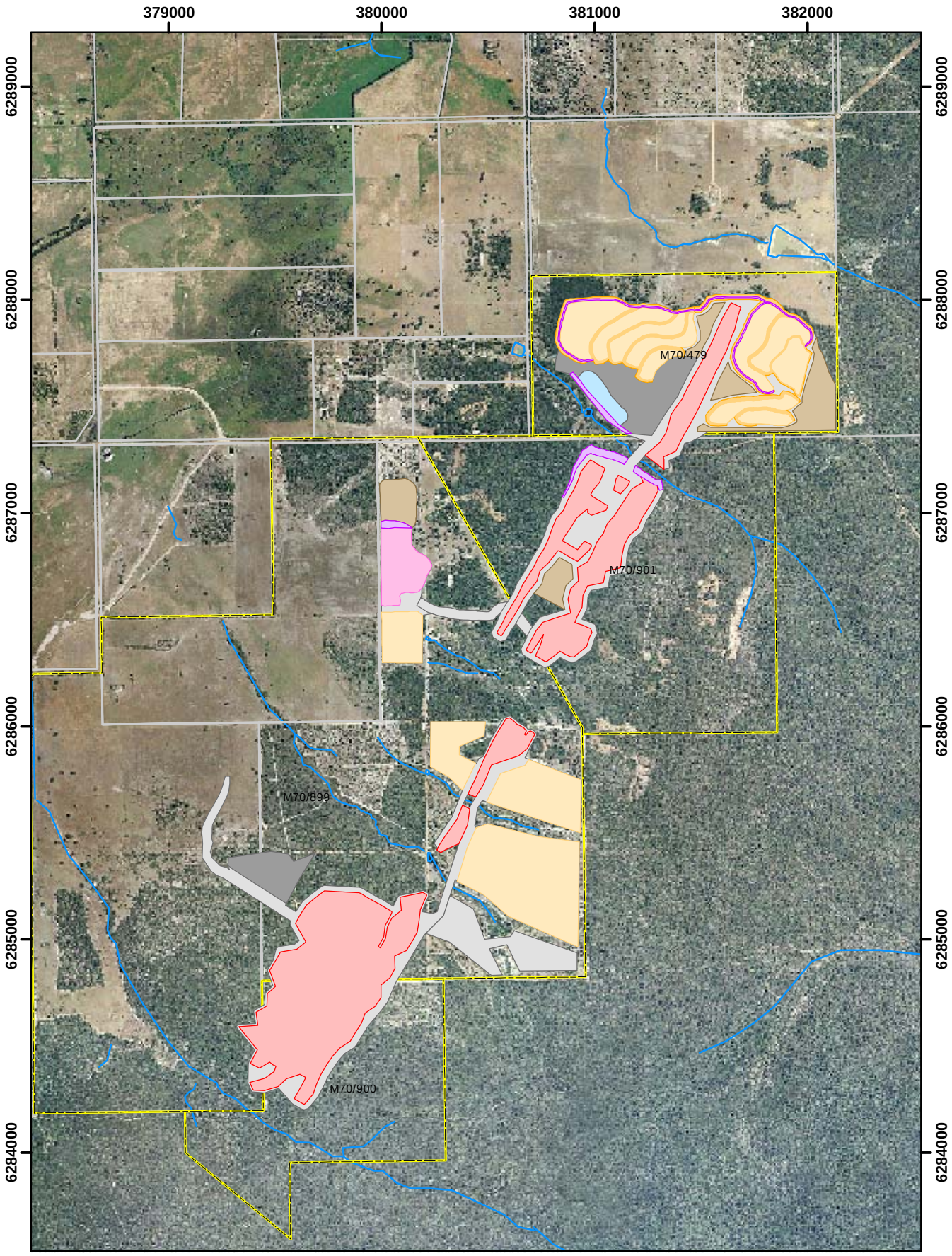

Figure 1-1
Location of proposed mining operations

Legend

Disturbance	Noise Bund	Plant Site	Tenement Boundaries
Fines	OB	TS	Cadastral Boundaries
Fines (Wall)	Pit	Water Dam	Creeks

0 250 500 1,000
Meters

Datum: GDA 1994 MGA Zone 50
Drawn: DH
Date: 8/4/09

BEMAX
INCORPORATING CABLE SANDS

2. NOISE FROM MINING

2.1 OVERVIEW

Mining operations result in noise emissions, which have the potential to impact on the amenity of nearby residents. Mining activities include ripping, excavating, loading, screening, etc. Mined ore is processed in the wet separation plant to produce HMC, which is trucked to the North Shore Mineral Separation Plant in Bunbury.

Mining occurs on a continuous basis (24 hours a day) and is subject to the controls outlined in this management plan, which ensures compliance with noise regulations (Section 3.2.1).

The extent that mining noise may be audible at residences is strongly dependant on atmospheric conditions, proximity to mining activities, and local topography. The intrusiveness (i.e. annoyance factor) not only depends on the noise level, but also by the noise characteristics, such as tonality, duration and impulsiveness, existing background levels and the time at which the noise is experienced.

The potential for exceedance of the noise regulations has been predicted using recognised specialists, as per EPA Guidance No. 8. The results of this exercise are described below.

2.2 SENSITIVE PREMISES

A review of residences in proximity to the proposed Happy Valley sites has identified six residences within 2km of the site. The location of these residences is shown in Figure 2-2. It is these residences that were considered in the environmental noise assessment. Two of these residences (R7 & R8) are located on property owned by Bemax Resources, and therefore Bemax can control occupancy during operations if required.. The nearest of the six residences is approximately 50 m from the boundary of the mining lease, and 350m from anticipated activity. Some of these residences are also in proximity to Bemax's current Gwindinup North mine. It is not anticipated that there will be cumulative effects as mining of these operations will be sequential. Some overlap will occur with early development work at Happy Valley and final rehabilitation at Gwindinup, both considered to be 'construction' activities.

To date community consultation has occurred primarily via the Happy Valley Working Party which has met four times since September 2007 to discuss the outcomes of studies conducted as part of the EIA process. Noise was identified by members of the party as a key concern given the proximity of residences to the Happy Valley North sites. Key issues related to construction noise, night-time noise emissions and the impacts of these emissions on residents' amenity.

2.3 POTENTIAL IMPACTS

Specific noise generating aspects that may impact on the amenity of nearby residents include:

1. **Mobile earthmoving equipment operation**; which may result in excessive noise levels.
2. **Fixed plant and equipment operation**; which may result in excessive noise levels.
3. **Vehicle operation**; which may result in excessive noise levels.

The level of impact that may result will be determined by background sound levels, prevailing weather conditions, the characteristics of the sound emitted and the distance of the source from residences.

Results of noise modelling indicate that key noise sources include loader and wet plant during night time operations and heavy earth moving equipment during day-time operation / overburden removal phases. Night time activities at the minesites are significantly less noise-intensive than week day activities. For example, heavy earthmoving equipment such as scrapers and excavators, are only used during daylight hours. Because wind noise competes with mine noise and can often mask it if the wind is strong and consistent enough, most noise complaints are received during the quieter periods, such as during light breezes or temperature inversions.

For transport noise, i.e. that associated with heavy haulage from the site, the impact on residents along the transport route will be dependent upon the transport route selected and existing exposure to heavy haulage.

2.4 ENVIRONMENTAL NOISE ASSESSMENT

The potential for exceedance of the noise regulations has been predicted using recognised specialists, as per EPA Guidance No. 8. Herring Storer Acoustics (HSA,, 2009) developed an acoustic model on behalf of Bemax to predict noise emissions from the proposed Happy Valley North site. The Happy Valley South site was not considered as there are no sensitive residences within proximity of the site. A complete summary of the environmental noise assessment is provided in the ERMP.

Method

Predictions of noise levels in the surrounding area were achieved utilising the computer program SoundPlan version 6.5. This program incorporates various parameters including source sound power levels, ground topography and atmospheric conditions in determining propagation of noise from the site. Using recognised algorithms (Concawe) the program calculates the sound levels at distances from the source resulting in noise levels at receiver locations.

Seven scenarios were modelled to determine noise emissions for a range of mining options. The scenarios included various contingencies for reducing the number of units of mobile equipment operating.:

- construction phase (scenario 1) - initial daytime only works to construct a 6m acoustic bund along the northern edge of the operations); This wall would also form the outer wall of the northern fines dams.

- daytime operations / overburden phase - modelled in two stages - construction of a 10m bund around the northern end of the southern overburden stockpile (scenario 5), and subsequent stockpile construction behind this bund, both with concurrent mining in the northern pit (scenario 2);

- night-time operating phase - both north (scenario 3) and south (scenario 4) pits;

- two scenarios representing the potential cumulative effects of Scenario 1 at Happy Valley concurrently with mining & rehabilitation at Gwindinup (2010, scenario 6), and Scenario 2 at Happy Valley concurrently with rehabilitation at Gwindinup (2012, scenario 7).

These scenarios were modelled with 'worst case' daytime conditions of 4m/s wind from source to receiver, Pasquil Stability Class B and 20 degree temperature, and for the night scenario with winds at 3 m/s from source to receiver, Pasquil Stability Class E (conditions representing a temperature inversion) and 15 degree temperature. Herring Storer (2009) noted that "wind conditions other than the 'worst case' conditions will occur for a significant proportion of the time, with predicted noise levels some 3 – 6 dB (A) less than shown for the 'worst case' conditions".

The scenarios are also designed to represent the 'worst case' operating conditions, with machinery operating at the closest points to residents &/or operating at surface or elevated. Locations of the constructed acoustic barriers are shown in Figure 3-1.

Results

Noise emissions were assessed against acoustic criteria in accordance with the *Environmental Protection (Noise) Regulations 1997*. As per the regulations two factors were considered when assessing the assigned levels for residences in proximity to the proposal area these were the tonal characteristics of the noise and the influencing factor. At locations closer than 450m from the proposed mining operation the 'industrial land use' as characterised by the mining operation results in an increase in the 'influencing factor' and the 'assigned level' applicable under the regulations. The assigned levels for residences within 2km of the Happy Valley Project are provided in Table 2-1. Note the influencing factors presented are those calculated by Bemax based on GIS mapping, and differ from those used by HSA in their assessment, which were based on manual area estimations.

Table 2-1 Residential Influencing Factors and Assigned Levels

RESIDENTIAL LOCATION	INFLUENCING FACTOR	NIGHT-TIME L_{A10} ASSIGNED LEVEL (dB)	DAY-TIME L_{A10} ASSIGNED LEVEL (dB)
R1	1	36 (31)	46 (41)
R2	1	36 (31)	46 (41)
R5	9	44 (39)	54 (49)
R6	1	36 (31)	46 (41)
R7 (Bemax)	19	54 (49)	64 (59)
R8 (Bemax)	20	55 (50)	65 (60)

Note: ( ) For tonal noise emissions an adjustment of +5 to the measured level applies.

Construction (Scenario 1) - Herring Storer (2009) found that three residences had noise levels as high as 53 dB during the construction of the northern acoustic bund. These are the residences identified as R1, R2 and R5. Reducing equipment numbers reduced noise levels slightly, but would increase the duration to complete the barrier.

Daytime Operation / Overburden Removal – predictions of noise emissions whilst mining is occurring in the northern pit, and overburden removal is occurring in the southern pit at surface indicate that exceedances of 1 to 4 dB(A) are possible when allowance is made for tonality. During construction of the northern barrier on the southern overburden stockpile levels at R6 are approximately 2dB higher because of direct line of sight to equipment on top of the barrier. Contingency reductions in equipment numbers are effective in reducing noise levels by 1 to 5 dB depending on the number of mobile equipment items shut down.

Night-time mining (Northern pit) –Results for mining in the northern pit indicate an exceedance of up to 6 dB (A) (allowing for tonality) at R1, with noise levels at all other locations shown to be acceptable. Limiting operations to one loader reduces the exceedance to 3 dB (A) (allowing for tonality).

Night-time mining (Southern pit) – Mining in the southern pit results in potential exceedance of 1 to 3 dB (allowing for tonality) at the four private residences. Limiting operations to one loader in the pit reduced the exceedances to 3 dB at R1 and 1 dB at R6, with levels at other residences being acceptable. HSA note that the noise emissions will not always be assessed as tonal, particularly where there are windy conditions or winds are from the east or north. Under these circumstances all predicted levels comply with assigned levels. Bemax monitoring data from Gwindinup supports the conclusion that night-time noise is unlikely to be tonal.

Table 2-2 Predicted worst case noise levels at private residences.

SCENARIO	Contingency	R1	R2	R5	R6
Night Assigned Level, L_{A10} dB(A)		36	36	44	36
Day Assigned Level, L_{A10} dB(A)		46	46	54	46
1. CONSTRUCTION of northern acoustic barrier	100% equipment	53	52	53	46
	25% equipment reduction	52	52	52	45
	50% equipment reduction	51	48	50	43
2. DAYTIME mining in northern pit, overburden removal from southern pit to southern stockpile	100% equipment	41	42	53	45
	25% equipment reduction	40	40	51	44
	50% equipment reduction	39	38	48	41
5. DAYTIME mining northern pit, overburden removal southern pit, raising acoustic barrier on southern stockpile (CONSTRUCTION)	100% equipment	41	42	53	47
	25% equipment reduction	39	39	51	46
	50% equipment reduction	38	37	48	44
3. NIGHTTIME mining in northern pit	100% equipment	37	31	33	28
	50% equipment reduction	34	29	32	26

SCENARIO	Contingency	R1	R2	R5	R6
Night Assigned Level, L_{A10} dB(A)		36	36	44	36
Day Assigned Level, L_{A10} dB(A)		46	46	54	46
4. NIGHTTIME mining in southern pit	100% equipment	34	32	39	34
	50% equipment reduction	34	30	38	32
6. As for Scenario 1, (CONSTRUCTION) cumulative with mining and rehabilitation at Gwindinup 2010	100% equipment	53	52	53	46
	25% equipment reduction at HV	52	52	52	45
	50% equipment reduction at HV	51	48	50	44
7. As for Scenario 2, cumulative with rehabilitation at Gwindinup 2012 (CONSTRUCTION)	100% equipment	44	44	53	46
	25% equipment reduction at HV	43	43	51	45
	50% equipment reduction at HV	43	42	48	41

Note: Pink background = predicted exceedances of 'assigned noise level' under 'worst case' wind conditions, yellow background = exceeded only due to 'tonal characteristic' adjustment.

The sequencing and timing of key activities are summarised in Figure 2-1. This represents the proponent's preferred timeline, but may need to be adjusted depending on the timing of all required approvals.

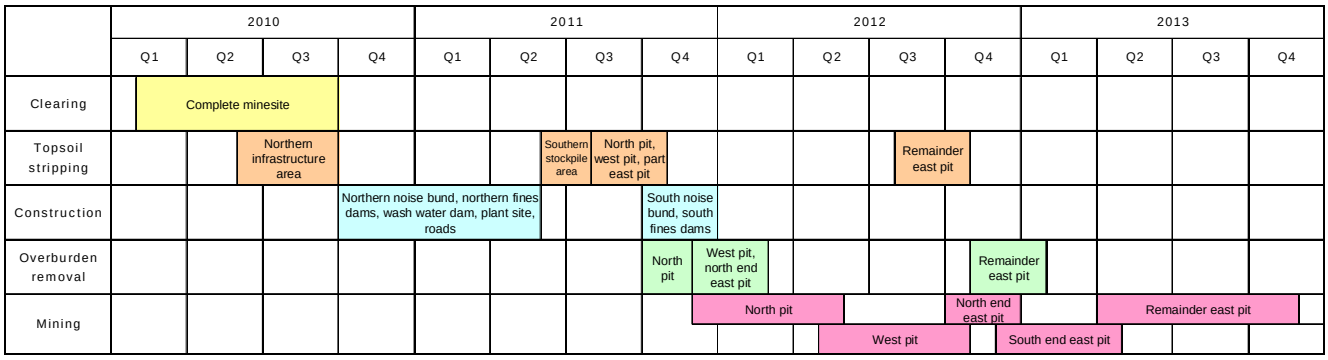

Figure 2-1 Happy Valley North timeline of key activities.

Assessment of Tonality.

HSA noted that at times noise emissions from the mining operation may be tonal in characteristic, with a +5dB adjustment required to the acoustic criteria. Tonality of noise as received at sensitive premises will be influenced by factors such as ambient noise and wind generated noise causing masking. Most of the mobile earthmoving equipment modelled emits some tonal components when measured at the point of emission, but this may not be present at the point of receipt some distance away.

Bemax reviewed data from existing monitoring equipment at the boundary of the Gwindinup minesite. Night time mining operations have been occurring between 1000 and 1500m from this location, with daytime construction activities as close as 400m. Hence this data is more likely to represent "as received" noise than recordings made close to machinery. In addition to recording sound levels, this equipment records third octave band frequency distributions over 15 minute intervals, and makes audible recordings on a level trigger.

The data set was reviewed to select night time intervals where the L_{AS10} was between 34 and 37 dB for the 15 minute interval, and loader &/or trommel noise was audible in recordings. Assessments of tonality were made on the third octave $L_{Aeq\ 15\ min}$ levels. In most cases there were no tonal components present, or if present, the frequency did not match the emission spectrum of the mining equipment. Similar assessments were made during daytime recordings, with tonal frequencies matching machinery emissions present in some recordings, but not in others.

Assessment of wind conditions.

Wind speed and direction data have been recorded at the nearby Gwindinup minesite since late 2007. This data has been analysed to determine the frequency of 'worst case' wind conditions for each scenario and residence, where noise modelling indicated a potential exceedance of assigned levels. 'Worst case' has been assumed to be calm or less than 4 m/s wind blowing from the active area towards the receiver for day time scenarios, and less than 3 m/s at night. Data was assessed for selected months of the year, based on the proponents preferred timeline for establishing the Happy Valley project.

Table 2-3 Frequency of 'Worst Case' wind conditions.

Scenario	Estimated timing	Frequency & Direction of 'Worst Case' Winds				
		R1	R2	R5	R6	Any Residence
1 & 6 Nth bund	October to November, day	49% SE-WSW	49% E-S	40% NNE-ESE	31% ENE-ESE	78% NNE-WSW
2, 5 & 7 Nth mine, Sth o'burden	December to February, day	33% SSE-WSW	61% E-SW	67% NE-WSW	59% ENE-S	67% NE-WSW
3 Nth mine	December to May, night	30% SSE-SSW	N/A	N/A	N/A	30% SSE-SSW
4 Sth mine	Year round, night	30% S-SW	37% SE-S	N/A	53% E-SSE	65% ENE-SW

Implications for Management

Noise scenarios and modelling were all completed utilising a 'worst case' scenario. The scenarios selected by the proponent for modelling were those anticipated to generate the most noise during the life of the mining operation. HSA (2009) noted that "wind conditions other than the 'worst case' modelled scenarios will occur for a significant proportion of the time, with predicted noise levels some 3 – 6 dB (A) less than shown for the 'worst case' conditions". This in combination with the modelling of overburden removal with equipment at surface or elevated, and location of operating pits in areas where they are likely to generate most noise for the surrounding residents suggests that the modelling is very conservative. Results of the modelling indicate that even under a 'worst case' climatic scenario, and including allowances for potential tonality, noise criteria are exceeded at 3 residences during construction of the southern overburden stockpile, at one residence during nighttime mining in the northern pit and at three residences during night time mining operations in the southern pit. Reductions in numbers of operating equipment are effective in overcoming most of these exceedences.

Where tonality is not present the scenarios were either fully compliant or compliant with contingencies for 'worst case' conditions. Based on Bemax data tonality in noise as received is unlikely during night time operations and will vary during day time construction operations.

Construction of the 6m acoustic bund at the northern end of the minesite generates the highest noise levels of any scenario. However it is anticipated that construction of any bund, fines dam or overburden stockpile on Location 215 will occur as part of the construction phase and as such assigned levels do not apply. This bund will also form the northern outer walls of the fines dams in this area. Construction of this bund is expected to be completed within four weeks.

As noted by HSA, assumptions were made during the modelling about the orientation of the wet plant. In the night-time scenarios the wet plant is a significant source of noise and as such the orientation of the wet plant during construction of infrastructure must be carefully planned to minimise its noise emissions. The open side is oriented towards the south east, away from residences.

Due to the characteristics of sound propagation, acoustic bunds are most effective when either the source or the receiver or both are in close proximity to the bund. As the distances increase the effectiveness of sound attenuation is reduced. This effect can be used during construction of overburden stockpiles by raising the outer edge of the stockpile (closest to residents) initially and having subsequent construction occur behind this raised edge. Additional height can be added to the barrier as the internal stockpile is raised.

Analysis of the noise modelling results indicate that the proponent will be compliant with noise criteria under most operating conditions. Under 'worst case' conditions and assuming that tonality is present, noise criteria are slightly exceeded at some locations for some scenarios. Given the conservative nature of the modelling and the limited time that such conditions are likely to be in evidence Bemax believes that compliance with the noise regulations is achievable. Contingency measures will be implemented to further reduce noise emissions under the scenarios identified as being at risk. Measures may include reduction in the number of heavy earthmoving equipment operating, construction of additional acoustic bunds, installation of additional acoustic baffles on equipment, etc. Further details on potential contingency measures are provided in Section 5.

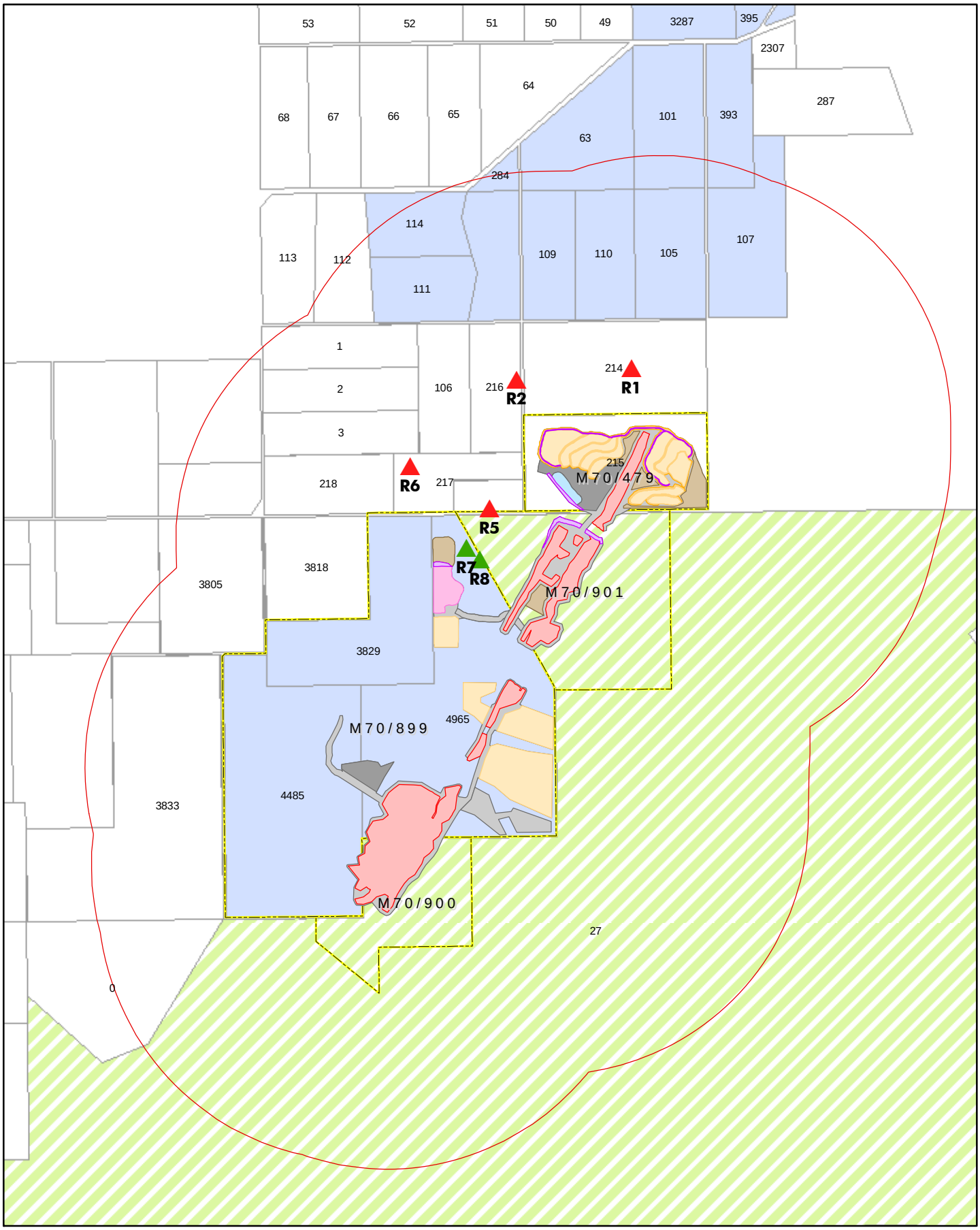

Figure 2-2:
Location of sensitive premises relative to the project.

0 500 1,000 2,000
Meters

Legend

- Bemax owned
- Private
- Bemax Properties
- State Forest
- 2km buffer
- Tenement Boundaries
- Disturbance
- Fines
- Fines (Wall)
- Noise Bund
- OB
- Pit
- Plant Site
- TS
- Water Dam

Datum: GDA 1994 MGA Zone 50
Drawn: DH
Date: 9/4/09

BEMAX INCORPORATING CABLE SANDS

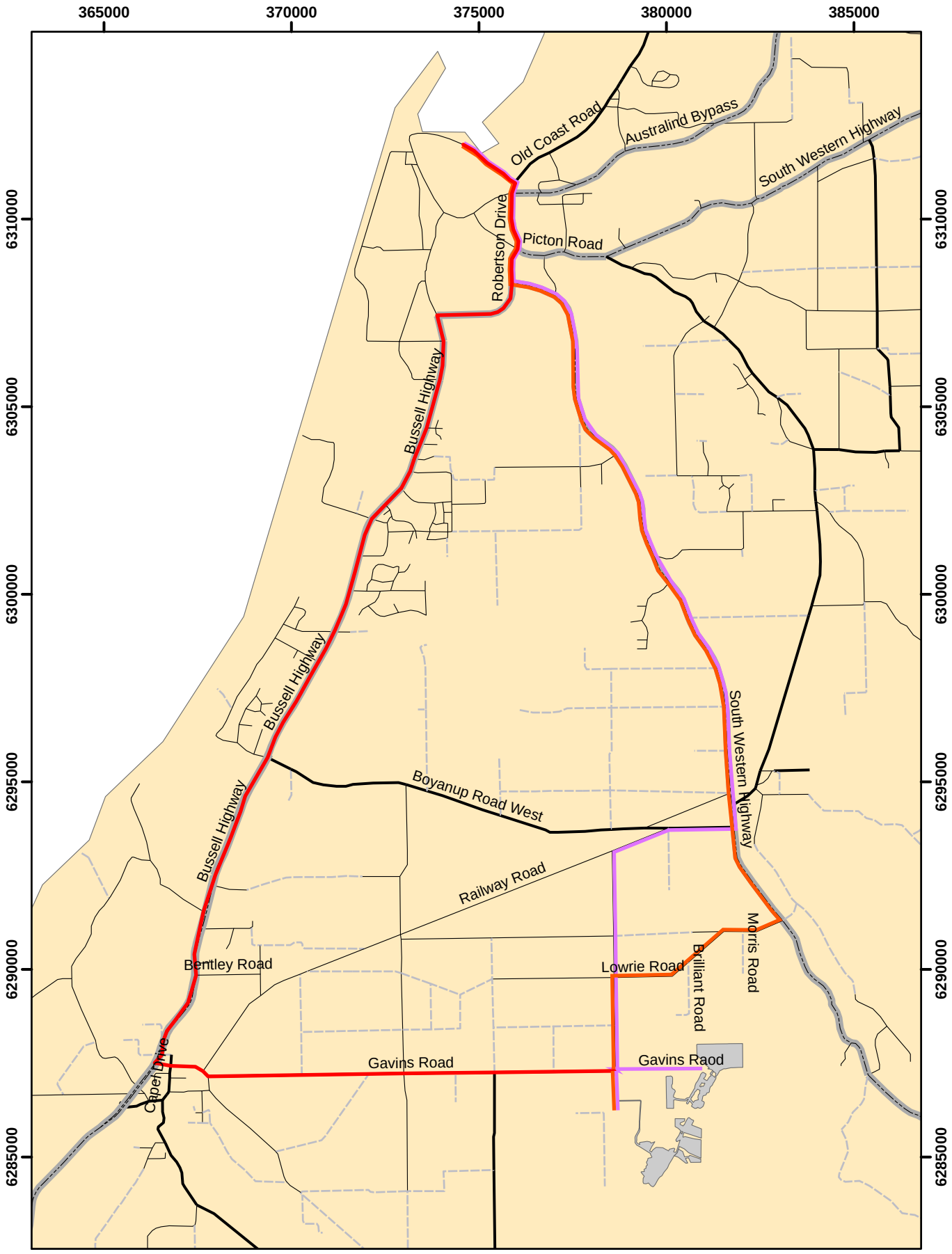

Figure 2-3:
Happy Valley HMC Haulage Route Options

0 1,250 2,500 5,000
Meters

Legend

- Haulage Option 1
- Haulage Option 2
- Haulage Option 3
- Highway
- Sealed Road (Major)
- Sealed Road (Minor)
- Unsealed/Minor Road

Datum: GDA 1994 MGA Zone 50
Drawn: DH
Date: 22/8/08

BEMAX
INCORPORATING CABLE SANDS

3. MANAGEMENT OBJECTIVES AND ACTIONS

3.1 ENVIRONMENTAL OBJECTIVES

The specific objectives for noise emissions from the proposal are:

- To ensure that operations do not adversely affect environmental values or the health, welfare or amenity of people and land uses by meeting statutory requirements and acceptable standards.
- To minimise emissions to levels as low as practicable on an on-going basis (i.e. continuous improvement).
- To respond effectively to complaints.
- To minimise off-site impacts on fauna

3.2 PERFORMANCE INDICATORS / CRITERIA

3.2.1 Environmental Protection (Noise) Regulations 1997

Noise is regulated by the *Environmental Protection (Noise) Regulations 1997*. Regulation 7 provides the assigned levels that must not be exceeded at sensitive receptors (Table 3-1). Further, due to the acknowledgement that specific characteristics of noise may have a greater impact, penalties apply to noise with characteristics that cause annoyance (Table 3-2).

Table 3-1 Prescribed noise limits (from *Environmental Protection (Noise) Regulations 1997*)

Type of premises receiving noise	Time of day	Assigned level (dB)		
		LA 10	LA 1	LA max
Noise sensitive premises at locations within 15 m of a building directly associated with a noise sensitive use	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 at locations further than 15 m from a building directly associated with a noise sensitive use	All hours	60	75	80
Commercial premises	All hours	60	75	80
Industrial and utility premises	All hours	65	80	90

Table 3-2 Prescribed penalties for noise characteristics (from *Environmental Protection (Noise) Regulations 1997*)

Adjustment where noise emission is not music. These adjustments are cumulative to a maximum of 15 dB.			Adjustment where noise emission is music	
Where tonality is present	Where modulation is present	Where impulsiveness is present	Where impulsiveness is not present	Where impulsiveness is present
+5 dB	+5 dB	+10 dB	+10 dB	+15 dB

Bemax has calculated assigned levels for the sensitive premises around the Happy Valley project area as outlined in Table 2-1. It should be noted that construction activities are assessed under different noise limits to those stated above which relate to operational activities. Construction work must be carried out between 7am and 7pm on any day which is not a Sunday or public holiday, must be carried out in accordance with control of noise practices set out in section six of Australian Standard 2436-1981 "Guide to Noise Control on Construction, Maintenance and Demolition Sites" and the equipment used for the construction work must be the quietest reasonably available.

3.2.2 Bemax Environmental policy

Bemax operates a certified ISO 14001:2004 Environmental Management System. The core of the EMS is the company's Environmental Policy, which has been approved and signed by the Managing Director.

The Environmental Policy requires that Bemax operate in compliance with applicable Legislation, Regulations and Codes of Practice. The key regulations applicable to this NMP are the *Environmental Protection (noise) Regulations 1997.* Prescribed noise limits applicable to the project are outlined in section 3.2.1.

Bemax routinely conducts internal audits (SP15 Internal Audits) to assess the compliance with, and effectiveness of various components of its EMS, including Environmental Management Plans. In addition, the entire EMS is audited externally every six months, with a full re-certification audit every three years. Audit findings are fed back into the EMS in order to improve environmental performance.

The Environmental Policy also requires that Bemax monitor and regularly audit its environmental compliance. The noise monitoring program for the Happy Valley project is outlined in Table 4-1. Auditing of performance occurs via a series of compliance, internal and external audits that occur via the Environmental Management System.

The EMS contains procedures for managing internal and external communications of environmental matters. Environmental hazards and incidents are reported using an incident report (CD018). All external complaints automatically generate an incident report that is forwarded to and dealt with by the Environmental Department.

3.3 MANAGEMENT ACTIONS

3.3.1 Planning measures

Noise modelling

Additional modelling will be undertaken if required. Events that could trigger additional modelling include major changes to the mine plan or process.

Equipment placement

One of the primary sources of noise annoyance is the trommels, which are used to provide initial screening of the ore. Placement and orientation of trommels and feed hopper units will occur in such a way as to minimise noise impacts on surrounding neighbours, the aim being to ensure that engine noise from front end loaders is directed away from nearby residences. Ramp gradients to access the hopper units are also kept to a practical minimum to reduce revving of engines traversing the ramp. Placement of stockpiles will, wherever possible, consider the potential mitigating effects stockpiles may have on noise emissions.

Noise modelling also identified that the wet separation plant was a significant source of noise during night-time operations. The plant is enclosed on three sides to reduce noise emissions however the fourth side must remain open to allow access to the plant and machinery for servicing and repair. Given this, care will be taken to orient the wet plant such that the uncladed side of the plant is directed away from sensitive premises (ie towards the south east) in order to minimise noise emissions.

Scheduling

Consideration will be given to location of sensitive premises during mine scheduling. Direction of mining as well as the climatic conditions can have a significant impact on noise emissions i.e. mining towards the receptor will reduce noise at the receptor due to the barrier effect of a relatively vertical pit face. These factors will be incorporated into the mine scheduling.

3.3.2 Operating measures

Acoustic bunds

The use of a 6m bund at the northern end of the pit; also forming the walls of the fines ponds, and the overburden stockpiles will act as an acoustic bund. Construction of the outside walls nearest sensitive residences occurs first, so that these walls (approximately 6m high) will act as an acoustic bund and provide the benefits of sound mitigation during the remaining northern construction phase and mining of the northern pit.

A further barrier will be constructed across the northern end of the southern pits, where the topography slopes steeply down towards a drainage line. This barrier will be up to 8m high across the northern ends of the pits, and tapering back to meet the hillside on the north western corner. Modelling showed this barrier provided substantial benefits to the northern and western residences during mining of the southern pits.

During construction of the southern overburden stockpile a barrier of at least 3 m will be maintained around the northern and north western edges of the stockpile. Construction of the stockpile will then occur within this barrier, providing benefits to the western residences.

These key barriers are shown in Figure 3-1.

Although a short-term activity, the construction of acoustic barriers can be noise generating, and residents will be consulted with before the commencement of any such installation. Regulatory advice is that construction of bund walls is governed by Regulation 13 of the *Environmental Protection (Noise) Regulations 1997*. Bemax will limit construction activities to 7.30am to 5pm between Monday and Saturday. Most barriers are usually completed within a short period of time.

The soil bund walls are usually stabilised with vegetation or coated to minimise dust and erosion.

Equipment supply

Noise-generating potential is considered during the purchase or contracting of heavy equipment for use at all operating sites. Bemax has adopted a "buy quiet policy" which applies benchmarking of noise performance of heavy machinery operating on-site. The process is applied as required whenever heavy machinery is replaced. This includes as standard on mining loaders a noise suppressed exhaust system and noise suppression body kit.

Equipment Operation

Equipment utilised at Bemax sites have 'quackers' instead of the more standard reversing beepers. "Quackers" are a mixed-frequency alarm which does not carry as much as the beeper, but still provides adequate safety warning (standard on all Bemax and earthmoving contract machines).

In addition, equipment operated outside daylight hours have their reversing alarms modified, so that at night time (while headlights are switched on), the audible alarm is switched off and replaced by a flashing light.

Maintenance

Bemax undertakes a scheduled program of preventative maintenance at all operations sites. This is particularly effective for reducing the instances of abnormal noise generation due to faulty equipment such as pumps, screens etc.

Workforce training

All workers and contractors at Bemax sites undergo noise management and awareness training as part of their initial site induction. Under general environmental training and awareness, noise control issues and the responsibilities of individual employees are discussed via monthly minesite staff meetings. A copy of this NMP is to be appended to the site Environmental Management and Monitoring Program, a copy of which is kept at the minesite.

Restricted Operating Times for Heavy Earthmoving Equipment

During after-hours operations (7pm to 7am) in areas that may affect residents, mobile mining equipment will be limited to front-end loaders working in the mine pit. This eliminates any contributions to night time noise levels by bulldozers and other heavy mobile equipment. Front end-

loaders are not permitted to leave the pit and therefore increase noise emissions by operating at surface, unless an emergency arises.

The above limitations will remain in effect until 9.00 am on Sunday and Public Holidays.

The Company reserves the right to utilise any piece of equipment at any time in an appropriate or controlled fashion, including, but not limited to, emergency work. Such a use will still be conducted in accordance with the NMP and Bemax's Environmental Policy.

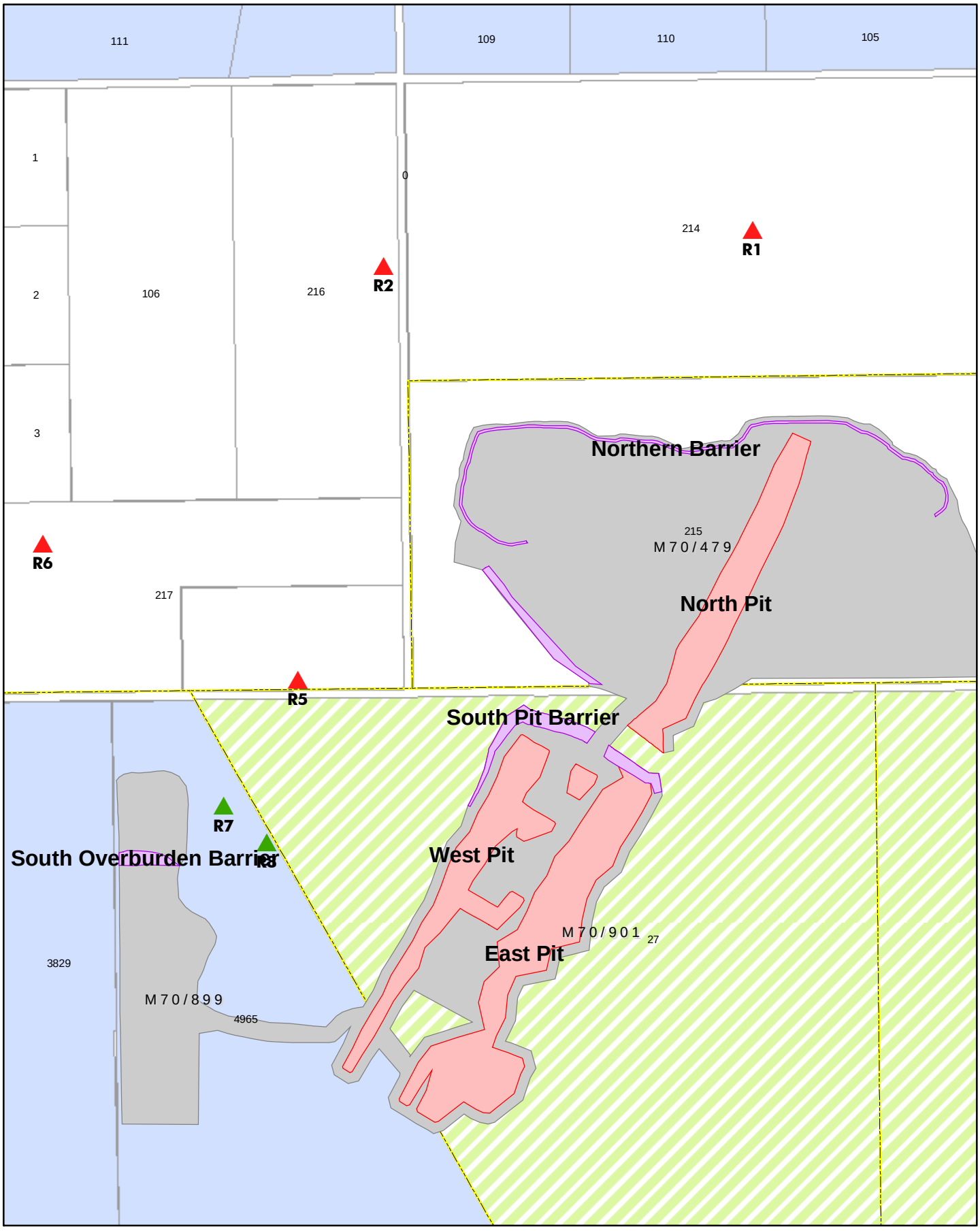

Figure 3-1:
Location of acoustic barriers - Happy Valley North.

0 160 320 640
Meters

Datum: GDA 1994 MGA Zone 50
Drawn: BJ
Date: 07/04/09

Legend

- Bemax owned
- Private
- Bemax Properties
- State Forest
- Tenement Boundaries
- Disturbance
- Noise bund
- Pit

BEMAX INCORPORATING CABLE SANDS

3.3.3 Haulage Noise Measures

Transportation is conducted via road trains hauling between 42 and 59 tonnes. Trucking will generally be carried out in batch runs with trucking rates during these times averaging around 35 return journeys per day.

Transport scheduling

Trucking typically occurs in batch runs, and will be limited to the hours 7 am to 7 pm Monday through to Saturday, however it may need to occur on Sunday and public holidays, in which case trucking will be restricted to the hours of 9 am to 7 pm.

Selection of trucks

When awarding the cartage contract, Bemax will ensure trucks used by transport contractors will comply with Australian Design Standards for noise suppression.

Trucks are also expected to be fitted with rubber mounted truck bodies to prevent vibration noise particularly when trucks are empty. Trailer containers will also be locked down to the trailer chassis during transport to reduce vibration and noise.

Speed Limits

Speed limits on internal roads will be limited to 30 km/h for HMC haulage trucks to prevent excessive vibration and thus noise on the unsealed roads.

Driver education

All contract drivers will undergo environmental and safety training. This will include re-iteration of relevant speed limits both on public and internal mine-site roads. Drivers will be made aware of limitations on haulage hours, and identified noise sensitive premises.

Road maintenance

Bemax is directly responsible for maintaining internal mine roads to a satisfactory standard. Well maintained roads reduce vibration and general road noise of heavy haulage vehicles.

3.4 COMMUNITY CONSULTATION

Bemax has a commitment, under its Environmental Policy, to involve the community in aspects of impact management.

3.4.1 Community Consultation

Bemax will continue to liaise with residents and other interested stakeholders both directly and via the Happy Valley Working Party with the purpose of informing the community about noise issues and to obtain community feedback and attitudes towards its operations and performance.

3.4.2 Complaint Response Procedures

To establish an open line of communication, Bemax will contact neighbouring residents to discuss noise issues and continues to liaise with them on a regular basis. These residents will be informed of the Noise Management Plan for the site and will be made aware of whom to contact in the event of a noise incident occurring. For noise and any operating issues, the Site Supervisors are the first point of contact for neighbours.

In addition to the minesite response, any noise complaints will also be formally processed through Bemax's ISO14001 certified EMS system. Responsibility for long term action resulting from noise issues lies with the Mining Manager. The Environment Department reports complaints and other non-conformances to the Department of Environmental & Conservation (DEC) in the Annual Environmental Report.

3.4.3 Operating Agreements

In the event that noise from the mining operations, despite all other attempts at control, continues to have the potential to impact on any neighbouring resident, Bemax will actively seek to negotiate an agreement with the resident as a means of resolving the issue. Bemax is actively seeking to establish agreements with relevant neighbours prior to commencement of the Happy Valley project.

The form of the agreement will be consistent with other agreements successfully negotiated at other past minesites. The form and content of operating agreements is dependent on a number of factors and will be reviewed on a case by case basis. A third party, such as an independent facilitator may be consulted before an offer of compensation is extended, or if agreement cannot be reached.

4. MONITORING, REVIEW AND REPORTING

4.1 NOISE MONITORING

The noise monitoring program is designed to assess the reliability of risk forecasts, accuracy of modelling and the effectiveness of management measures. Monitoring will be co-ordinated by the Senior Environmental Officer – Operations & Compliance, and will be conducted in accordance with the appropriate procedures.

4.1.1 Noise Monitoring Equipment

Bemax operates various types of noise monitoring equipment, including continuous monitoring/logging and attended hand held monitors. Details of equipment at time of preparation of this plan are as follows:

- Brüel & Kjær Type 2260 Sound Level Meter. This is a Class 1[1], integrating averaging sound level meter, equipped with one third octave filters, and used for attended sound level monitoring by trained environmental staff. This unit is calibrated in the field at each time of use, and sent to a NATA certified facility for full calibration every 2 years.
- B & K Type 4312 Calibrator. Provides a 94dB, 1000Hz signal for field calibration and checks of sound level meters. The calibrator is sent to a NATA certified facility for full calibration every 2 years.
- Acoustic Research Laboratories EL316 Logger. This is a portable Class 1 logging sound level meter, capable of extended unattended sound level measurements, and used as a management and baseline tool. The instrument uses a Fast sound-weighting, as required by AS1055.1[2]. A digital audio tape can be used to record actual sound when user-defined trigger levels are exceeded, to assist in identifying the source of trigger exceedances. A field calibration unit is used to record a reference signal at the beginning of each logging period and the instrument is sent to a NATA certified facility for full calibration every 2 years.
- TPS MC85 Sound level meter. This is a basic sound level meter used as a management tool by minesite personnel for spot checks. Periodic checks of calibration are made by environmental staff.
- Brüel & Kjær Type 2270 Sound level meter. This is a Class 1 integrating averaging sound level meter, with one third octave filters, logging and sound recording capability. It is intended for use as a management tool for continuous sound monitoring with remote access. It will be periodically calibrated in the field, and sent to a NATA certified facility for full calibration every 2 years. It is also suitable as a backup for the B&K 2260 for hand held attended monitoring.

[1] AS IEC 61672.1 – 2004 – Electroacoustics – Sound level meters. Part 1:Specifications

[2] AS 1055.1 – 1997. Acoustics – Description and measurement of environmental noise. Part 1: General Procedures.

The Company reserves the right to substitute any of the above equipment at any time with equivalent instruments. This includes, but is not limited to, replacements and substitution during maintenance, repairs, routine off-site calibration, and use at other company locations.

Equipment is operated according to company work instructions and/or manufacturers operating manuals.

4.1.2 Noise Monitoring Program

Bemax conducts routine monitoring of minesite noise on an ongoing basis and when feedback indicates that noise levels may be increasing or problematic. Major construction and rehabilitation events, such as topsoil & overburden stockpiling and return, and dam construction are monitored more closely as these short term events are recognised as having high noise potential. Noise monitoring locations (to be determined) will be selected on the boundary of the premises, with priority given to points closest to neighbouring residences. Monitoring locations will comply with AS and be verified by DEC staff if required by surrounding neighbours.

Additional or replacement boundary points may be selected as activities progress into different geographic areas of the project area. The requirement for this will be assessed on the basis of proximity of operations to currently occupied noise sensitive premises at that time.

Monitoring is conducted for two purposes: for regulatory compliance assessment, and for gathering information for management purposes. Compliance assessment is restricted to attended, hand held monitoring by appropriately trained environmental staff. Other monitoring is for management purposes only.

Table 4-1. Happy Valley Noise Monitoring Program.

Monitoring activity	Location(s)	Parameters	Frequency
Attended monitoring (B&K 2260)	TBA	L_{10}, L_1, L_{max} (15 minute, A-weighting, Slow (AS)) Wind speed & direction, Audible noise	At least quarterly
Continuous monitoring station (B&K 2270)	TBA	Instantaneous ($L_{Aeq.\ 100ms}$) L_{90}, L_{10}, L_1, L_{max} (15 minute, AS) Audible noise (on level trigger)	Continuous (target >90% availability)
Operational checks (TPS)	Various boundary locations	Average instantaneous levels (L_{AS})	As required (site supervisor judgement)
Noise logger (EL316)	Various boundary locations	L_{90}, L_{10}, L_1, L_{max} (15 minute, A, Fast)	Continuous (target >75% availability)

4.1.3 Benchmarking.

As previously indicated, Bemax assesses the performance of mobile mining equipment in terms of noise generation potential. This occurs as part of the assessment process for purchase of major new equipment. Selected Contractors earthmoving equipment may also be assessed, based on potential risk of causing noise annoyance.

Manufacturers' data is assessed for new equipment. Where such data is unavailable or for older equipment, measurements are conducted based on AS2012.1[3].

4.2 PERFORMANCE MONITORING

The performance monitoring program is described in Table 5-1. All monitoring records will be collected as per any relevant standards or EMS procedures and will be stored at the Bemax North Shore Administration Centre.

4.3 PERFORMANCE REVIEW

Monitoring results will be reviewed by Bemax staff as they are recorded, to enable a response to be implemented if required. The results of the entire monitoring program will be reviewed internally every three months as part of the EMS procedures.

4.4 COMPLIANCE AUDITING

The auditing of conformance with this management plan and any conditions or commitments related to noise management will be conducted on a 12-monthly basis throughout the project's life.

4.5 NON-COMPLIANCES

Non-compliances identified during the auditing process or through the EMS will be brought to the attention of the Operations Manager. Non-compliances will be reported to the DEC in the Annual Environmental Report, along with any measures that will be or have been taken to prevent recurrence of the conditions leading to the non-compliance.

4.6 REPORTING[4]

A report describing the performance of the NMP in working towards its objectives, based on monitoring results and the extent to which it has been complied with, will be submitted to the DEC each twelve months on 31st March each year. The report will be publicly available on request.

[3] AS 2012.1 – 1990. Acoustics – Measurement of airborne noise emitted by earth-moving machinery and agricultural tractors – Stationary test condition. Part 1: Determination of compliance with limits for exterior noise.

[4] SP01 Environmental Reporting.

4.7 DOCUMENT REVIEW AND REVISION

Bemax will review the management plan as part of the performance and compliance monitoring program described above. Revisions will be made as necessary based on this review or in response to any planned changes to the Happy Valley operations likely to impact on the implementation of the NMP.

5. CONTINGENCY MEASURES

In addition to the management measures outlined above, the Company has the ability to implement a number of contingency actions to ensure noise levels remain within compliance limits. These may be applied at certain times, for example when operating in close proximity to an adjoining resident or when unfavourable climatic conditions prevail (see Table 2-3). The decision process for determining when contingencies are required is outlined in Figure 5-1.

Contingency measures may include:

- reducing the number of units of equipment being operated;
- moving operations to alternative mining area sectors until climatic conditions improve or alternative mitigation measures are in place,
- limiting operation of mobile equipment to within the pit.
- substitute for alternative equipment e.g. quieter loader model
- remove identified noisy equipment pending repairs
- restricting areas of operation (Further from residences)
- cease relevant activity until weather conditions improve

Monitoring targets used to trigger contingency actions will be developed on a case by case basis, taking into account the location of active areas, the monitoring location, location of sensitive premises and the relationship between levels measured at the monitoring location and sensitive premises, as established through modelling.

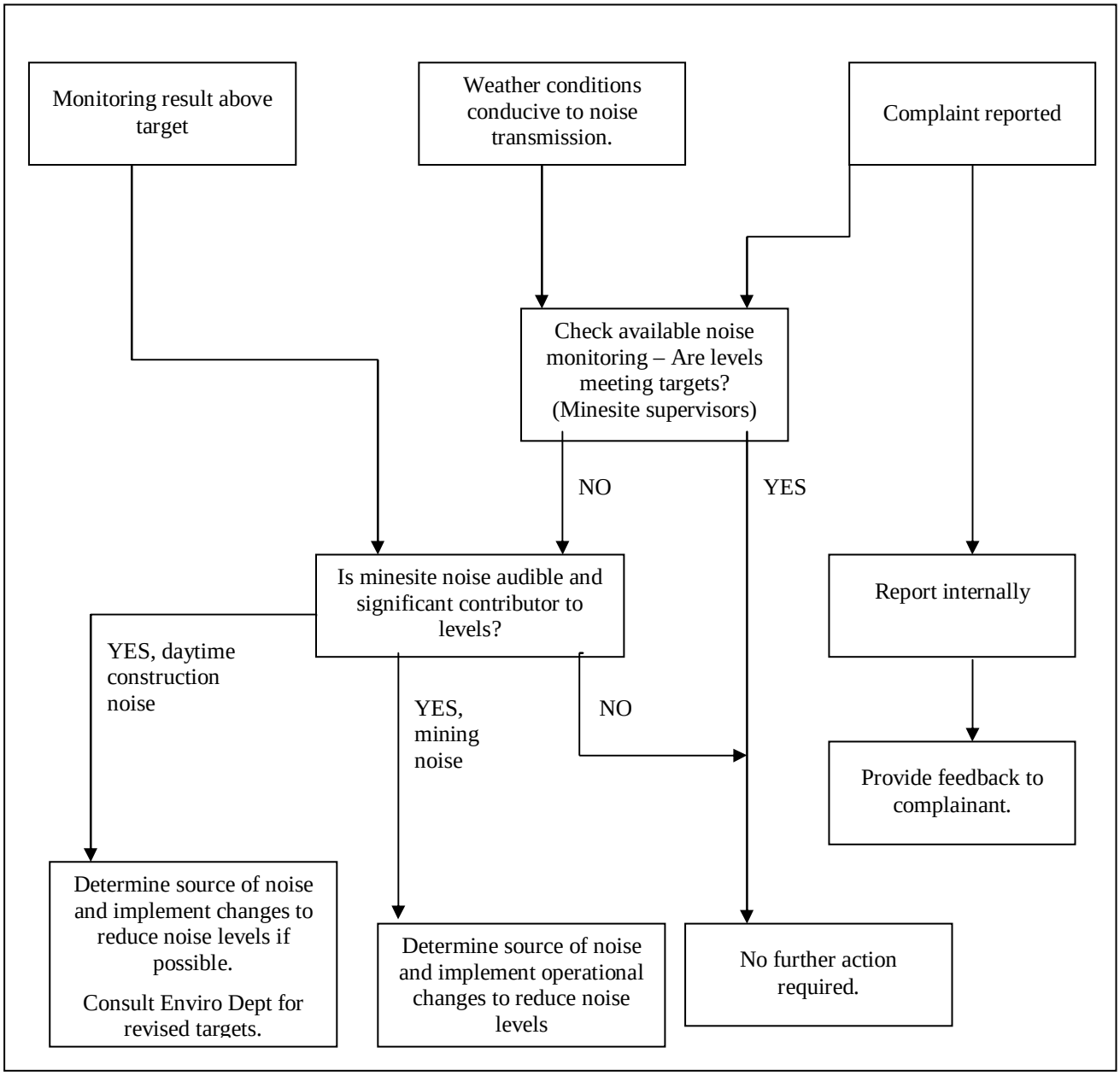

Figure 5-1 Contingency decision tree.

Table 5-1 Summary of management commitments and monitoring measures for noise at Happy Valley.

Environmental Objective	#	Management Commitment	Monitoring Objective	Record / Evidence	KPI
To ensure that operations do not adversely affect environmental values or the health, welfare or amenity of people and land uses by meeting statutory requirements and acceptable standards To minimise off-site impacts on fauna	1.1	Additional noise modelling will be undertaken if required.	To assess potential compliance	Noise modelling report	Non-compliances
	1.2	Placement of trommels and feed hopper units will occur in such a way as to minimise noise impacts on surrounding neighbours	To assess compliance	Retain survey records of trommel placement and orientation	Non-compliances
	1.3	Ramp gradients for access to hopper units to be kept to a practical minimum	To assess compliance	Retain survey records of top/tail of hopper ramps	Non-compliances
	1.4	Placement of stockpiles will, wherever possible consider potential mitigating effects on noise emissions	To assess compliance	Retain survey records	Non-compliances
	1.5	Orientation of wet plant will be such that uncladed side is directed away from sensitive premises	To assess compliance	Retain records of plant orientation (survey, photo)	Non-compliances
	1.6	Mine scheduling will consider noise emissions and climatic factors	To assess compliance	Retain mine schedule	Non-compliances
	1.7	6m acoustic bund will be constructed at the northern end of the project area	To assess compliance	Retain survey records	Non-compliances
	1.8	8m acoustic bund will be constructed across the northern end of the southern pits	To assess compliance	Retain survey records	Non-compliances
	1.9	3m acoustic bund will be constructed and maintained at the northern edge of the southern overburden stockpile	To assess compliance	Retain survey records	Non-compliances
	1.10	Construction of fines dams and overburden stockpiles on Location 215 will occur such that maximum noise mitigation is attained during construction	To assess compliance	Retain records of construction (survey, photo)	Non-compliances
	1.11	Topsoil stockpiles will be located between mining operations and noise sensitive premises wherever possible	To assess compliance	Retain survey records	Non-compliances
	1.12	Construction activities, including acoustic bunds, limited to 7am – 7pm	To assess compliance	Retain machine logs	Non-compliances
	1.13	Noise generating potential will be considered during purchase or contracting of heavy equipment	To assess compliance	Retain AFE records	Non-compliances
	1.14	All equipment will be installed with “quackers” instead of reversing alarms	To assess compliance	Retain equipment purchase and maintenance records	Non-compliances

	1.15	All Bemax equipment will have audible reversing alarms switched off at night and replaced by a flashing light	To assess compliance	Retain incident reports and complaints records	Non-compliances
	1.16	All workers and contractors will undergo noise management and awareness training as part of the initial site induction	To assess compliance	Retain example of induction materials. Retain induction records	Non-compliances
	1.17	A copy of the NMP will be appended to the Site Environmental Management Plan and retained at the minesite	To assess compliance	Control Document distribution records	Non-compliances
	1.18	After hours operations (7pm – 7am) in areas that affect residents, mobile mining equipment will be limited to front-end loaders working in the mine pit. These limitations will remain in effect until 9am on Sunday and Public Holidays. Emergencies excepted.	To assess compliance	Retain incident reports and complaint records	Non-compliances
	1.19	Haulage times will be restricted to 7am – 8pm Monday to Saturday and 9am and 8pm on Sunday and public holidays	To assess compliance	Retain incident reports and complaint records	Non-compliances
	1.20	Transport contractors vehicles will comply with Australian Design Standards for noise suppression	To assess compliance	Retain records of HMC transport contract	Non-compliances
	1.21	Speed limits on internal roads is limited to 30km/h for HMC haulage	To assess compliance	Retain photographic evidence of signage, retain records of incident reports	Non-compliances
	1.22	All contract drivers will undergo environmental and safety training	To assess compliance	Retain induction records	Non-compliances
	1.23	Internal roads will be maintained to a satisfactory standard	To assess compliance	Include as part of daily checklist	Non-compliances
To respond effectively to complaints	2.1	Contact details for the site will be provided to neighbouring residents in case of a noise incident	To assess compliance and monitor effectiveness	Retain copies of community communication	Non-compliances
	2.2	Noise complaints will be formally processed through the EMS system	To assess compliance and monitor effectiveness	Retain incident reports and complaints records	Non-compliances
To minimise emissions to levels as low as practicable on an on-going basis (i.e. continuous improvement)	3.1	Noise monitoring will be conducted as per Table 4-1.	To assess compliance and monitor effectiveness	Retain monitoring records	Non-compliances
	3.2	Compliance with the NMP will be audited annually throughout the projects life and performance reported to DEC by the 31st March annually.	To assess compliance and monitor effectiveness	Annual Environmental Report	Non-compliances

6. REFERENCES

6.1 EXTERNAL DOCUMENTS

DEC 2006, "Compliance Monitoring – Guidelines for Proponents (Draft)", Prepared by Environmental Management Division, Department of Environment, Government of Western Australia, May 2006.

HSA 2009, "Happy Valley North Proposed Mineral Sand Mine – Environmental Noise Assessment", Prepared by Herring Storer Acoustics for Bemax Resources Limited, February 2009.

6.2 INTERNAL DOCUMENTS

Reference	Title	Type
SP15	Internal Audits	System procedure