



Noise sentinel – a proactive approach to noise management in mining operations at BHP Billiton Worsley Alumina Pty Ltd

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ABSTRACT

BHP Billiton Worsley Alumina Pty Ltd (BWAPL) consists of mining operations located near the town of Boddington, a 51km conveyor linking to an alumina refinery located in Worsley and a port load out facility located in Bunbury. BWAPL mining operations expanded in 2012, resulting in mining operations taking place much closer to a number of residential properties in the community and closer to the township of Boddington. Given the proximity of the mining operation to these sensitive receptors, noise was identified early on as a high risk to the operations that needed to be proactively managed to ensure that BWAPL's environmental and social licences to operate were maintained. BWAPL adapted Brüel & Kjær's Noise Sentinel monitoring system to monitor noise generated by mining operations and ensure that the impact on near neighbours was minimised. This was achieved by incorporating alert systems that allowed for proactive management. This paper will cover the compliance parameters required to be measured; the adaptations applied to the software and the key project challenges that were overcome. On the basis of the experiences gained and the positive outcomes achieved through implementing the Noise Sentinel system, BWAPL received a Highly Commended award at the 2013 BHP Billiton Health, Safety, Environment and Community Awards in the Environment category.

Keywords: Mining, Environmental Noise

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1. INTRODUCTION

BHP Billiton Worsley Alumina Pty Ltd (BWAPL) consists of mining operations located near the town of Boddington, a 51km conveyor linking to an alumina refinery located in Worsley and a port load out facility located in Bunbury (Figure 1). BWAPL mining operations expanded in 2012 entering the Marradong Timber Reserve. This expansion resulted in mining operations taking place much closer to a number of residential properties in the community and closer to the township of Boddington (Figure 2). Given the proximity of the mining operation to these sensitive receptors noise was identified early on as a high risk to the operations that needed to be proactively managed to ensure that BWAPL's environmental and social licences to operate were maintained.

BWAPL worked in collaboration with Brüel & Kjær to customise the Brüel & Kjær Noise Sentinel monitoring system (4), originally designed for monitoring and management of urban environments, in such a way that it could monitor noise generated by mining operations and ensure that the impact on near neighbours was minimised by incorporating alert systems to allow for proactive management.

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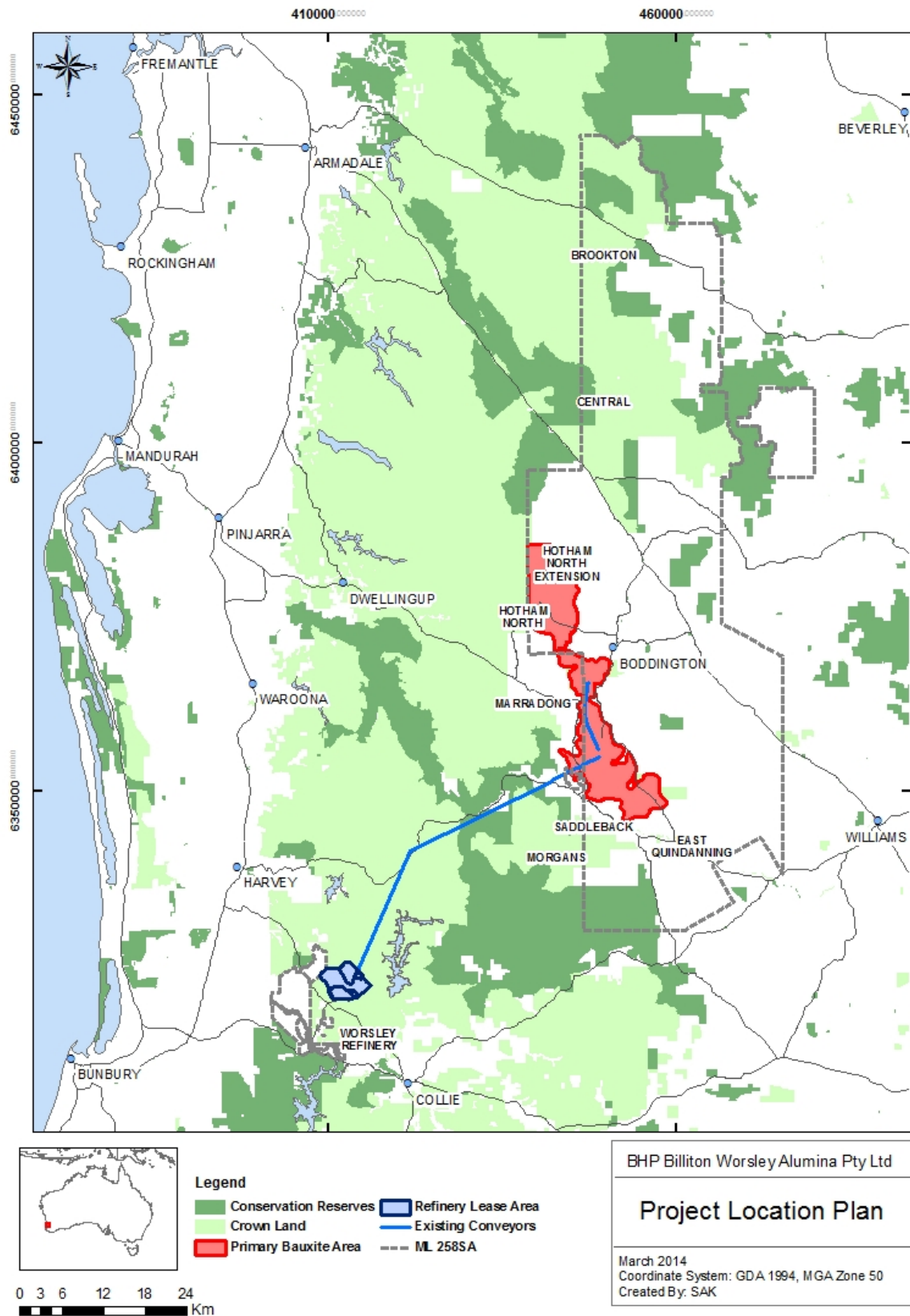


Figure 1 – BWAPL project regional location

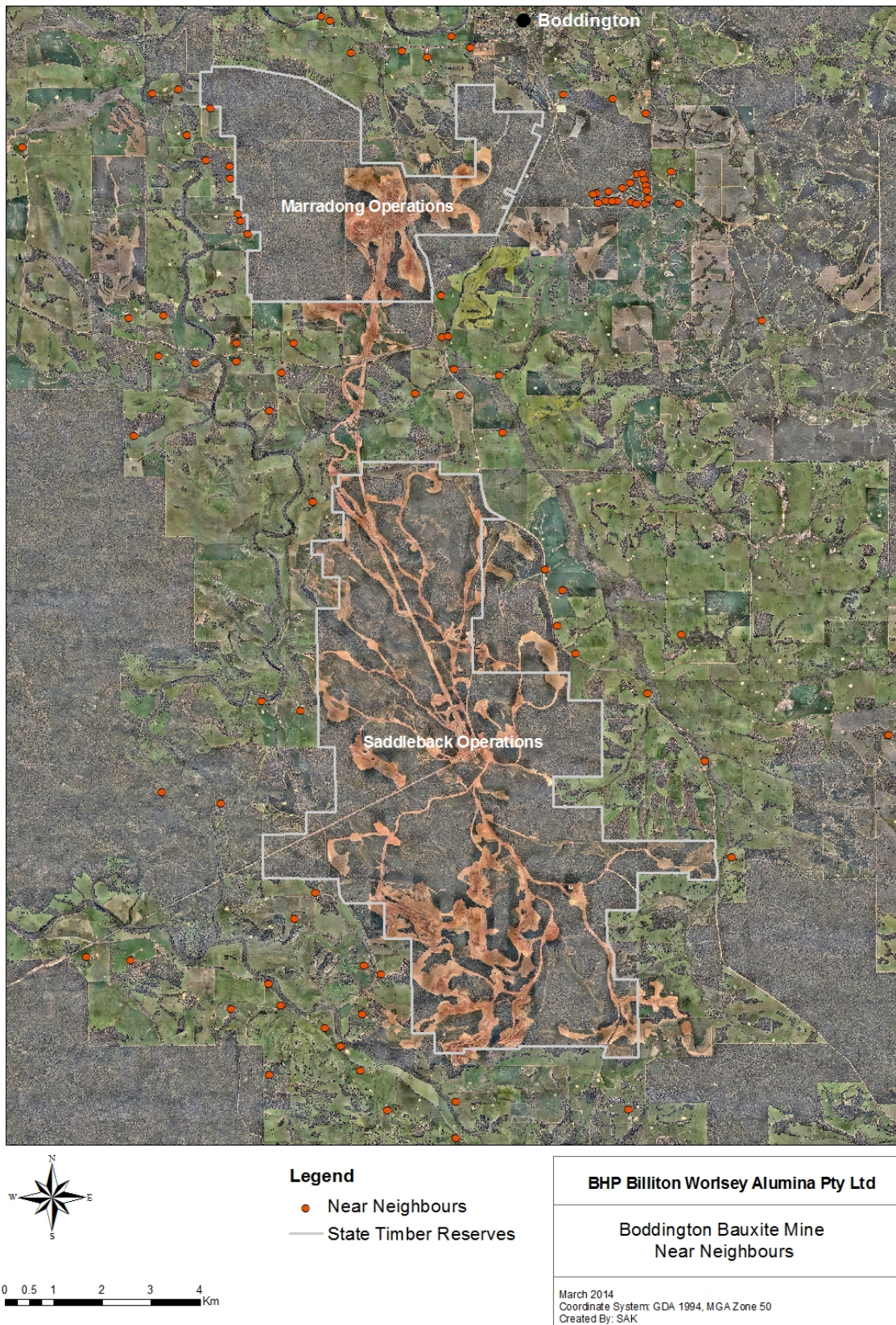


Figure 2 – BWAPL mining operations showing proximity of near neighbours and the town of Boddington.

2. COMPLIANCE PARAMETERS

The *Environmental Protection (Noise) Regulations 1997* specify noise limits for mining activities in Western Australia (WA). Legal limits are defined for noise sensitive premises requiring noise levels to be within certain limits. In BWAPL’s context sensitive premises are predominantly residences. The limits applicable to mining operations in WA are listed in Table 1.

Table 1 – Regulatory limits for mining noise at sensitive receptors (5)

Time Period	Limit
	L _{A 10} dB(A)*
07:00 to 19:00 hrs Monday to Saturday	45
09:00 to 19:00 hrs Sunday and Public Holidays	40
19:00 to 22:00 hrs All days	40
22:00 hrs any day to 07:00 hrs Monday to Saturday and 09:00 Sunday and Public Holidays	35

*L_{A 10} assigned level means an assigned level which, measured as an L_{A Slow} value, is not to be exceeded for more than 10% of the representative assessment period (5).

3. BACKGROUND

Prior to the implementation of Noise Sentinel, BWAPL mining operations relied on hand held noise monitoring to manage operations to ensure compliance with the *Environmental Protection (Noise) Regulations 1997*. This process was considered ineffective for a number of reasons. Namely, data was easily contaminated by human influences, only one reading could be taken at any location at any time, operators were required to leave their regular duties to complete handheld monitoring and there were safety concerns with operators performing handheld measurements offsite, especially on nightshift.

Expansion into the Murradong mining area lead to a dramatic increase in the number of community complaints received and a proportionate increase in the amount of operational downtime (Figure 3). Handheld monitoring was required to determine whether mining operations were in compliance with the prescribed limits leading to extensive operational delays during complaint investigation.

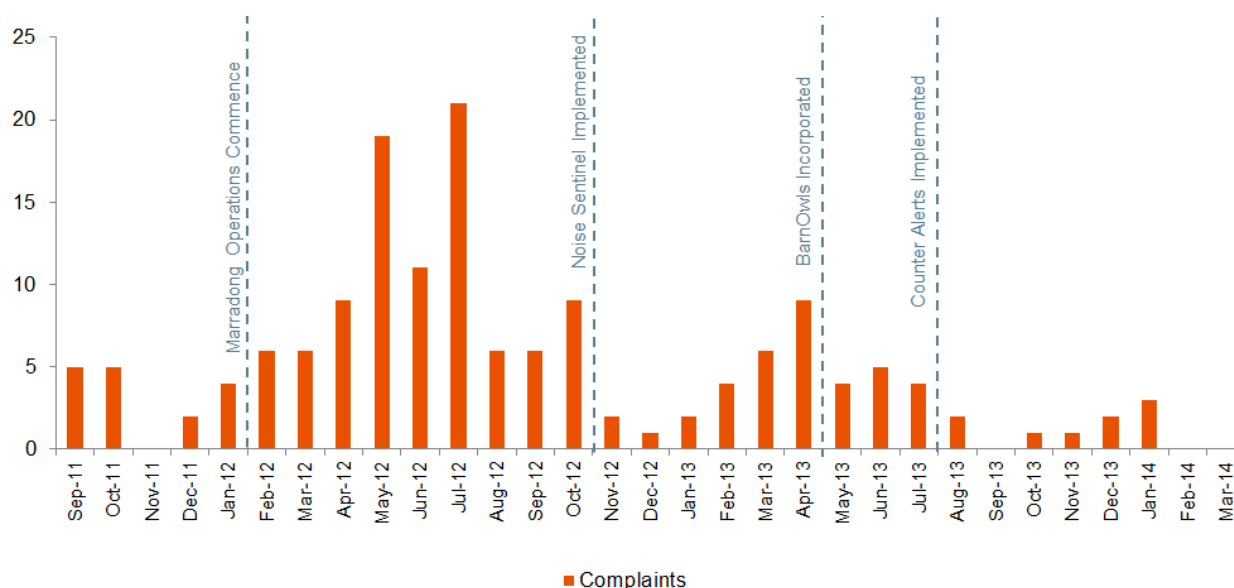


Figure 3 – Mining noise complaints received by BWAPL

4. KEY PROJECT CHALLENGES

4.1 Background Noise

Given the relatively low limits applied to noise in Western Australia there were a number of difficulties that had to be overcome during the implementation of Noise Sentinel. The most difficult of these was the presence of many background noise sources other than mining. Other noise sources common in the area include traffic, bird song, livestock and farming equipment. The range of frequencies covered by these external sources makes filtering by frequency quite difficult. To combat this issue a number of alterations were made to the alert rules in the Noise Sentinel system. Where passing traffic was a key contributing source threshold levels for alerts were increased to 60dB(A) during the day to cover the peak traffic hours. Given that this time period was the lowest risk (highest prescribed limits) this approach was considered acceptable. In addition to this filtering of frequencies greater than 2kHz was incorporated to remove the majority of bird song and reduce the number of alerts received that were not related to mining activities.

Weather also contributes significantly to measured noise levels. In order to minimise the impacts of weather related noise (e.g. wind, rain, thunder) a second filter was applied to fixed noise monitors which have a six-parameter weather station attached. This filter minimises the generation of weather related alerts by preventing alert generation when wind levels are greater than 5m/s and when rain is present at levels greater than 0.25mm/15 min.

4.2 Alert Development

Creating a proactive alerting system was a very challenging factor associated with this project. The *Environmental Protection (Noise) Regulations 1997* specify measurement periods for L_{A10} stating that measurements should be between 15 minutes and 4 hours in length. Given this requirement a lead indicator alert was developed for each noise monitor using a 15 minute rolling L_{A10} measurement. The alerts were designed to have an associated 30 second sound recording enabling the determination of the source of the exceedance. In conjunction with this 15 minute alert a counter alert was developed for longer time periods. The counter alert allows for proactive management by tallying time used above the allowable limit within a fixed time period. Each time 60 seconds of excessive noise is accumulated a minute will be removed from the total available time on the counter (10 per cent of the fixed time period). For example, in a four hour period there are 24 minutes of time available where the noise level is allowed to exceed the defined noise threshold, if one minute of accumulated excessive noise were to be recorded this would drop to 23 minutes and so on with accumulation of each such excessive minute. Operations are managed to ensure that the counter never reaches zero due to mining noise in any fixed period.

4.3 Community Engagement

Given that community concern regarding BWAPL's mining noise was a major identified risk that drove the implementation of the Noise Sentinel system, engaging our local landowners and community members was key to getting the project off the ground. The implementation of Noise Sentinel required the participation and acceptance of the system by many community members with a number of noise monitors being deployed onto private property. Where monitors were placed on private property Landholder Agreements were put in place and residents were provided with access to a stakeholder webpage. This webpage provided a traffic light system for all noise monitors that reflected the counter alert status as shown on BWAPLs monitoring screen (see Figure 4). This increased transparency to mine operations allowing the community to see when noise monitors were active and when noise levels were below (green), close to (yellow) or over (red) prescribed limits. Prior and during implementation of the system, the purpose and value of the monitoring network was communicated through private sessions with individual landowners, Community Liaison Committee meetings and at community forums. Community engagement throughout the project assisted to ensure support for the system and understanding during initial implementation as new systems were tweaked to get the best possible results for both the community and BWAPL operations.

Complaints received where noise levels are above the prescribed statutory limit are recorded by BWAPL as Level 2 and are considered to be a failure of site systems. Since the installation of Noise Sentinel the number of Level 2 complaints has dropped from 18 in FY2013 to 6 in FY2014. This drop demonstrates the increased capacity to monitor and manage noise by implementing this

comprehensive proactive management system. The total number of complaints has also dropped significantly from 77 in FY2013 to 20 in FY2014. This drop indicates that the local community has developed trust in the business and system - noise is being managed proactively to minimise impacts on community amenity.

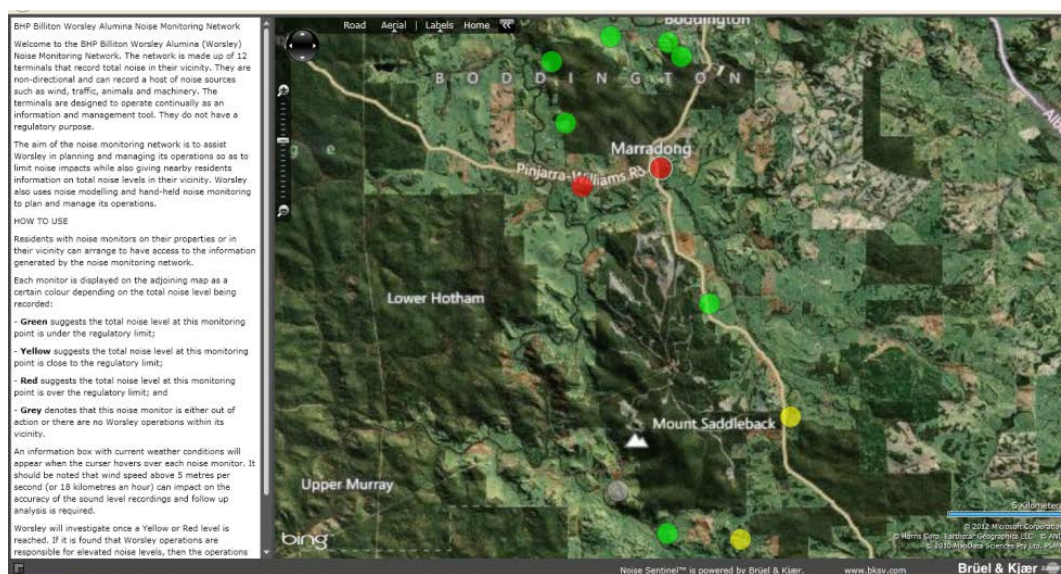


Figure 4 – Noise Sentinel Stakeholder Web Page display.

5. PROCEDURES AND SYSTEMS

5.1 Noise Modelling

Noise modelling is also incorporated into BWAPL's noise management processes. The Predictor noise modelling software package (3) was used to develop models for each active mining area (Saddleback and Marradong). This allowed BWAPL to model the impacts of different mining scenarios on all nearby noise sensitive premises. Where such premises are found to be within 3 dB(A) of the prescribed noise limit the locations are flagged as high risk and where possible alternate mining locations are sought. This process provides greatest value in long and medium term planning processes allowing for the planning of pits in line with seasonal weather patterns (i.e. dominant wind direction) to maximise operational time and minimise noise impacts on the community. Daily modelling is also used to determine whether additional monitoring is required at locations considered to be outside the coverage of the Noise Sentinel monitoring network.

5.2 Noise Sentinel

The Noise Sentinel monitoring network at BWAPL consists of 12 fixed real time noise monitors (1.) and five mobile directional noise monitors (BarnOwls) (2.) (Figure 5). Fixed noise monitors include a six-parameter weather station and allow live audio streaming on demand to assist in determining the source of noise. These monitors feed information to a live internet based system which is monitored on a 24 hour basis by BWAPL personnel. All noise monitors are programmed to generate alerts based on set thresholds and rules for defined periods during the day and each alert has an associated 30 second sound recording to allow for determination of what caused the alert. BWAPL staff review each alert and its associated sound recordings and close out alerts with relevant comments to allow for later analysis. Where mining noise is the cause of the alert actions are taken to ensure that operations are modified to be below prescribed limits prior to a counter alert reaching zero. Where operations are modified or cease due to high noise emissions it will remain so until the end of the current fixed period to ensure that the prescribed limits are not breached due to mining activities. The counter alert is designed to give a warning alert when 70 per cent of available time over the prescribed noise limit is consumed. This allows sufficient time to modify operations and make areas safe without exceeding prescribed limits.

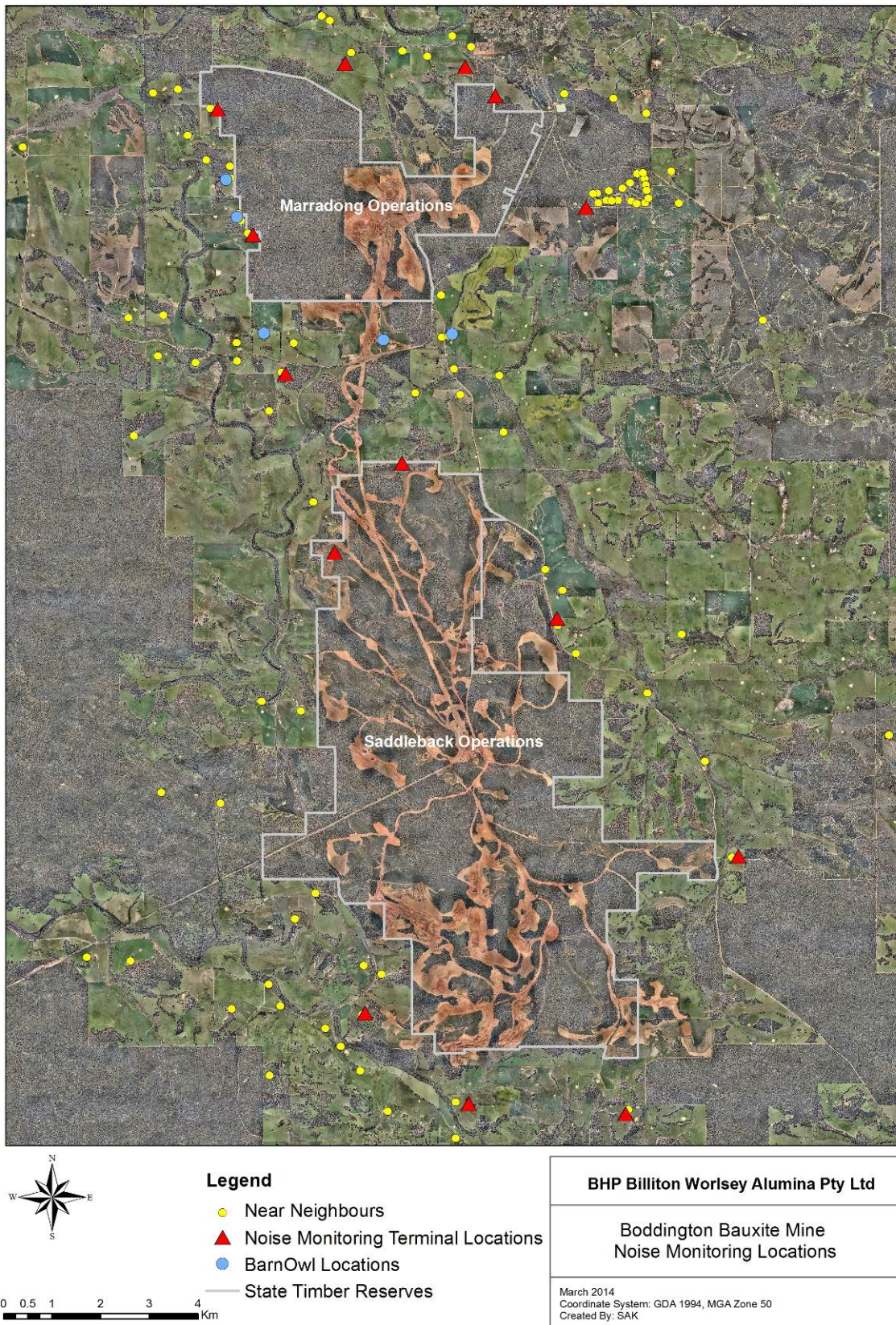


Figure 5 – BWAPL mining operations showing locations of noise monitors and near neighbours.

5.3 Complaint Investigation

Complaint investigation processes have changed significantly with the implementation of Noise Sentinel. Historic monitoring data is maintained external to BWAPL and is easily extracted for the purpose of investigating noise levels and alerts during a given period. When a complaint is received it is initially rated based on the current noise levels and active alerts by operational personnel. Further investigation is completed at a later time by the Community Relations team who extract the historic noise information and alerts from the relevant monitoring terminals. This report also extracts recorded sound files associated with alerts and alert close out comments recorded by operational personnel. A review of this report allows verification of noise levels at the time of the complaints as well as a review of history prior to the complaint to determine if any alerts were generated and if so what had caused the higher levels at that time. This increase in available information makes investigations much simpler and more transparent.

5.4 Project Recognition

On the basis of the experiences gained and the positive outcomes achieved through implementing the Noise Sentinel system, BWAPL received a Highly Commended award at the 2013 BHP Billiton HSEC Awards under the Environment category. This was a welcome recognition, on top of the improvements in community interaction, of the recent work done to improve environmental noise management.

6. SUMMARY

The noise management processes implemented by BWAPL has established a proactive system for the management of mining noise which is arguably best practice in the mining industry. The real time noise monitoring system has allowed BWAPL to accurately monitor and manage its noise emissions to ensure that levels are maintained within the limits prescribed by the *Environmental Protection (Noise) Regulation 1997* and protect the amenity of near neighbours. Recent reductions in noise complaints have demonstrated the effectiveness of this noise management program and enhanced BWAPL's social licence to operate.

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