

CAPE LAMBERT RAIL MARSHALLING YARD PREFERRED ALIGNMENT OPERATIONAL NOISE ASSESSMENT



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EXECUTIVE SUMMARY

SVT was commissioned to undertake an environmental noise impact assessment of the proposed Rio Tinto Cape Lambert rail marshalling yard at Wickham in Western Australia. The objectives of the study were to assess the potential noise impacts from construction and operation of the proposed development according to relevant regulations and guidelines.

This assessment considers the revised location of the marshalling yard (Preferred alignment - along the existing rail line, just to the west of Wickham) layout option shown in Figure 5-1

Methodology

Potential noise impact from the proposed Cape Lambert rail marshalling yard will be generated rail movements, and by various activities associated activities in the marshalling yard such as horn blasts, pressure releases, shunting, etc.

The applicable noise criteria are contained in *State Planning Policy 5.4: Road and Rail Transport Noise and Freight Considerations in Land Use Planning*. This was gazetted in September 2009 and is the current standard by which rail related noise is assessed. Table 2-1 of this document stipulates a night time noise target of $L_{Aeq} = 50\text{dB}$. The maximum noise (L_{Amax}) criterion has been removed. However, the L_{Aeq} criteria are required to be assessed for a minimum of one train movement per hour. The standard explicitly excludes 'freight handling' facilities for which 'all practical noise management and mitigation measures should be considered'. However since the proposed marshalling yards do not involve the handling of freight nor does it now involve workshop or other non rail related noise activities it is our interpretation that the aforementioned target of $L_{Aeq,night} = 50\text{dB}$ is applicable to both the marshalling yards and the existing main through line.

The nearest noise sensitive locations to the proposed Cape Lambert rail marshalling yard are at the township of Wickham. Four locations are considered, three to the north and one to the south of Wickham. Of these the receiver location 'Wickham North 1' (see Figure 5-1) is, at approximately 660 m distance, clearly the closest and, as expected, is predicted to receive the highest noise level from the proposed development.

Predictions

A predictive noise model has been developed for the Cape Lambert rail marshalling yard, incorporating data measured at the 7-Mile rail marshalling yard, where operations are deemed to be equivalent to those proposed at the new facility.

The following table presents a summary of the predicted noise impact at the sensitive locations at Wickham.

Receiver	L_{Aeq}
Wickham North1	48.0
Wickham North2	37.1
Wickham North3	31.6

Receiver	L _{Aeq}
Wickham South	16.4

It should be noted that the noise level predictions are conservative. Verification of these levels, or a more detailed predictive assessment, is not considered necessary at this stage.

The potential impact of cumulative noise levels from both the Cape Lambert rail marshalling yard and the existing rail line operating together has also been considered. This will potentially raise noise levels in Wickham to 49.7 dB(A). However this is still less than the night time noise target level specified in the aforementioned standard.

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1. INTRODUCTION

As part of Rio Tinto's export capacity expansion projects in Western Australia, there are requirements for additional rail facilities at Cape Lambert, including an associated marshalling resources. A new marshalling yard, located along the existing track to the west of the town of Wickham, is proposed to manage trains in transit between Cape Lambert and the Pilbara mines. This location is known as the 'preferred alignment'.

SVT was commissioned to undertake the environmental noise impact assessment of the proposed Rio Tinto Cape Lambert rail marshalling yard. The objectives of the study are to assess the noise impacts of the proposed development according to the relevant noise criteria. The relevant noise criteria for rail development are contained in *State Planning Policy 5.4: Road and Rail Transport Noise and Freight Considerations in Land Use Planning*. This was gazetted in September 2009 and is the current standard by which rail related noise is assessed. Table 1 of this document stipulate a night time noise target of $L_{Aeq}=50\text{dB}$. The maximum noise L_{Amax} criterion has been removed however the L_{Aeq} criteria is required to be assessed for a minimum of one train movement per hour. The standard explicitly excludes 'freight handling' facilities for which 'all practical noise management and mitigation measures should be considered'. However since the proposed marshalling yards do not involve the handling of freight nor does it now involve workshop or other non rail related noise activities it is our interpretation that aforementioned target of $L_{Aeq,night}=50\text{dB}$ is applicable to both the marshalling yards and the main through line. However the expectation would be that reasonable noise mitigation methods are considered and that allowance be made for possible future rail traffic increases. The assessment will also utilise other applicable Australian and international standards where appropriate in order to develop an understanding of precedents or impacts and suitability of recommendations.

As the proposed development is at the preliminary design stage, detailed information on layout and operation of the facility is unavailable. However, using preliminary layout drawings, supplied by Rio Tinto, (*CLB 50_50 PES Addendum Rail CL for Noise Modelling_MGA.dxf*) and considering the existing similarly-sized 7-Mile Rail Marshalling Yard as analogous to the proposed facility; assessment has been completed as appropriate for the WA EPA and planning purposes.

1.1 Background

The current capacity of the Cape Lambert export facility is 85 MT PA. Through phased expansion, the total capacity of the export facility is expected to be increased to 215 MT, with increased rail throughput from new mines and expansion of existing sites. To facilitate efficient rail movements, a new marshalling yard is required on the rail route, with connection to the existing Cape Lambert to Emu rail track.

The overall area of the development is shown in Figure A-1 in Appendix A. The preferred location for the new rail marshalling yard is shown in Figure 5-1 (from Rio Tinto drawing *CLB 50_50 PES Addendum Rail CL for Noise Modelling_MGA.dxf*), is to the west of the town of Wickham. The preliminary layout drawing for this option indicates the new marshalling yard rail route will be approximately 660 m away from residences at the closest point.

1.2 Scope of Work

The major activities undertaken during the course of this study were:

- establishment of appropriate assessment criteria;

- identification of key noise sensitive locations surrounding the project area;
- description of the existing noise environment at noise sensitive locations surrounding the project area;
- identification of sources of noise associated with the project;
- development of an environmental noise model to predict noise propagation from the operational activities of the proposed Cape Lambert rail marshalling yard;
- use of the predicted results to assess the potential noise impact based on comparison with established criteria; and
- identification of opportunities for the attenuation of noise impacts from the rail yard.

The outcomes of these activities are summarised in subsequent sections of this report. The subject of the required environmental assessment is the operation of the marshalling yard alone, and although includes rail movements within the yard, does not consider rail noise generated beyond the extents of the yard. Environmental assessment for the proposed complete rail route operation has been considered separately.

1.3 Consideration of Vibration Impacts and Construction Noise

Environmental Impact Assessment of the Cape Lambert rail marshalling yard also requires some consideration of potential adverse effects due to vibration. Rail movements are, in general, a significant source of vibration. However, for the distances between sensitive receptors and potential rail vibration sources associated with this development (> 0.6 km), transmission of vibration will be negligible assuming rail lines are suitably maintained. As such, vibration is not considered further in this assessment.

Additionally, some treatment of the potential impact of construction noise is required. In WA, management of construction noise will be required by the *Environmental Protection (Noise) Regulations 1997* to be in accordance with *AS 2436-1981 "Guide to Noise Control on Construction, Maintenance and Demolition Sites"*, and the Assigned Noise Levels will not apply if construction is limited to daytime hours. Appropriate construction noise management procedures are included in Appendix D.

With incorporation of these procedures, and considering the sparse population of the area and transient nature of works, no significant noise impacts are predicted for construction of the proposed Cape Lambert rail marshalling yard, and no further assessment is considered necessary.

2. ASSESSMENT CRITERIA AND METHODOLOGY

2.1 Development Definition and Relevant Policy

For assessment purposes, noise emission from the proposed Cape Lambert rail marshalling facility is considered to be noise associated with rail transport (trains into and out of the facility, shunting, horns, pressure releases). Since it is not a freight handling facility nor will there be any non rail/train related noise sources it is our interpretation that the appropriate noise criteria is the same as for general rail noise. Table 2-1 summarises the applicable criteria for new rail developments. We also assume that activities will be on a 24 hour basis therefore we need only consider the more restrictive night time 'target' criterion of $L_{Aeq,night}=50$ dB.

Table 2-1 Summary of Rail Noise Criteria

Time of Day	Noise Target	Noise Limit
Day (6 am-10 pm)	$L_{Aeq(Day)} = 55\text{dB}$	$L_{Aeq(Day)} = 60\text{dB}$
Night (10 pm-6 am)	$L_{Aeq(Night)} = 50\text{dB}$	$L_{Aeq(Night)} = 55\text{dB}$

As noise associated with the marshalling yard represents emissions in addition to those from the existing rail line, this assessment also considers the cumulative effects and potential impacts.

2.2 Sensitive Receptors

Residences in the town of Wickham are the only noise sensitive receptors in the vicinity of the proposed rail marshalling yard. Four locations are considered in this assessment, three to the north and one to the south of Wickham. Of these the receiver locations 'Wickham North 1' (see Figure 5-1) is, at approximately 660 m distance, clearly the closest and as expected is predicted to receive the highest noise level from the proposed development.

2.3 Assessment Methodology

Having established appropriate criteria for evaluating potential for noise impact at sensitive receptors, it is necessary to define the methodology by which rail noise is to be determined or predicted.

2.3.1 Operational Noise Measurement and Modelling

As mentioned in Section 1 above, consideration of the operation of Rio Tinto's 7-Mile rail marshalling facility as analogous to the proposed Rio Tinto Cape Lambert yard provides a significant, and robust, approach to evaluating potential noise impacts in the area of the development. For this purpose, an extensive survey of noise and operations at the 7-Mile yard was undertaken for this study, in July 2008.

The survey incorporated quantification, for prediction purposes, of noise associated with:

- discrete engine tests and movements around the yard;

- regular loaded and unloaded train movements into, across, and out of the yard, and at speed; and
- overall operation of the yard over extended periods at various distances.

The results of the survey, and subsequent predicted levels for Wickham, are discussed in Sections 4 and 5. The measurements provide the basis for development of realistic and descriptive predicted noise metrics comparable with assessment criteria. As mentioned previously, the subject of this required environmental assessment is the operation of the marshalling yard and the resultant cumulative rail noise when operating with the existing rail line.

Survey measurements, and subsequent determination of predicted noise levels, were undertaken according to current industry practices and relevant international standards. Prediction of noise contours was facilitated through use of the proprietary software SoundPlan.

For modelling of noise from rail movements, the *Calculation of Rail Noise* (CRN) procedure, developed by the UK Department of Transport, has been used. This method involves determining the discrete sound energy (Sound Exposure Level – SEL) of each train pass-by event, and averaging the total number of expected train pass-bys over the periods of interest, in this case the day (0600 – 2200) and night (2200-0600). Modelled propagation of noise for the railway, considered as a line-source, is again attenuated by air and ground absorption, screening effects and distance.

Sound energy of the individual train pass-bys is dependent on a range of factors, such as speed, engine and carriage type, length of train, track incline and rail roughness. By considering the operation and condition of trains and rail type at the 7-Mile facility as analogous to the proposed Cape Lambert rail marshalling yard, use of these train samples provides a direct method of characterising the associated noise, and enables a particularly robust assessment.

For predicted propagation of noise from miscellaneous rail sources (horns, pressure releases), the method outlined by *ISO 9613-2 (1996)* has been adopted, as recommended by the WA EPA's *Guidance for the Assessment of Environmental Factors 2007 (draft)*. This method utilises the sound power level and character (frequency spectrum) associated with an operation or plant item, and takes account of attenuation of noise due to air and ground absorption, topography and other screening effects to determine the noise level at a distance from the source. As part of a worst-case assessment, required by the WA Environmental Protection Authority and the Regulations, appropriate meteorological effects are incorporated into predictions. Propagation of noise also depends on the size (eg train horn, pressure releases) and radiating efficiency of the source, and has been incorporated into modelling where the information is available.

Further to direct measurement of noise level, estimation of the effective sound power level associated with equipment or activities for prediction purposes considers the operational 'on-time' over the periods of interest. For sources in the rail yard, this may vary, although a worst-case situation has again been adopted based upon operation of the 7-Mile facility including appropriate averaging of noise events over given periods, in this case the day, evening and night.

Both of these methods, *ISO 9613-2 (1996)* and *CRN*, are widely used and appropriate for Australian industry and conditions.

3. BASELINE NOISE LEVELS

3.1 Description of the Area

As shown on Figure A-1, the area around the proposed Cape Lambert Rail Marshalling Yard is primarily undeveloped or rural and, with the exception of the township of Wickham to the south-east, sparsely populated. The facility is proposed to be located alongside the existing rail line to the west of the township of Wickham. The township of Wickham is not considered to include any significant (noise producing) industry or commercial area. The nearest industry, the Rio Tinto Cape Lambert iron ore export facility, is located approximately 7 km to the north of residences on Wilson Way. It is expected that completion of the Cape Lambert expansion will extend the industrial area southwards towards Wickham, although the major fixed plant noise sources will still be a considerable distance away.

The existing Cape Lambert-to-Emu rail line passes Wickham to the west, at a distance of approximately 660 m at the closest point. Trains on this line are currently the most significant contributors to ambient noise in Wickham, which is discussed below. The Roebourne-Pt Samson Road passes to the east of Wickham, but does not carry enough traffic (< 10000 vehicles/day) to be considered a major road and does contribute significantly to noise levels.

As indicated by the wind rose of Figure 3-1, prevailing winds around Wickham are from the west-south-west (with W and WNW components). This wind rose is based upon daily data for 2005 – 2008. The highest wind speed in the direction of Wickham from the marshalling yard is 10 m/s, expected on about 2 days of the year. This can be considered an abnormal condition, and is not subject to evaluation in this assessment. However, for a number of days (88), wind speeds around 7-8 m/s can be expected. This will act to increase transmission of noise to Wickham and has been considered in modelling.

3.2 Noise Levels

Further measurements of noise levels at the township of Wickham were undertaken for this particular assessment. These are shown in Appendix D. In addition, a previous assessment (*Noise & Vibration Impacts of Pilbara Iron's Rail Activities on Surrounding Communities*, SVT) of the impact of noise from the Cape Lambert-to-Emu rail line on residences in Wickham, reported in June 2007, included relevant rail noise samples and estimation of overall levels. The railway dominates ambient noise in Wickham, and the results of the June 2007 assessment included the summary as shown in Table 3-1, including categorisation of exposure as per the then WA Planning Commission rail noise guidance.

Table 3-1 Current Rail Noise Levels in Wickham

Period	Number of Trains	Estimated (Rail) Noise Level		Exposure Level
		L _{Aeq} (dB)	L _{Amax} (dB)	
Day (0600 – 2200)	6	40	62	1
Night (2200 – 0600)	3	40	62	1

This previous assessment determined a noise Exposure Level of 1 for Wickham, which is the category desirable for noise sensitive premises. The estimated level is above the 35 dBA Assigned Noise Level for receptors in Wickham, although this has no influence on emission assessment criteria as it is not considered an exceedance due to industrial sources according to the Regulations. The effect of the current railway on ambient noise levels may act to mask the intrusiveness of any new noise sources in the area.

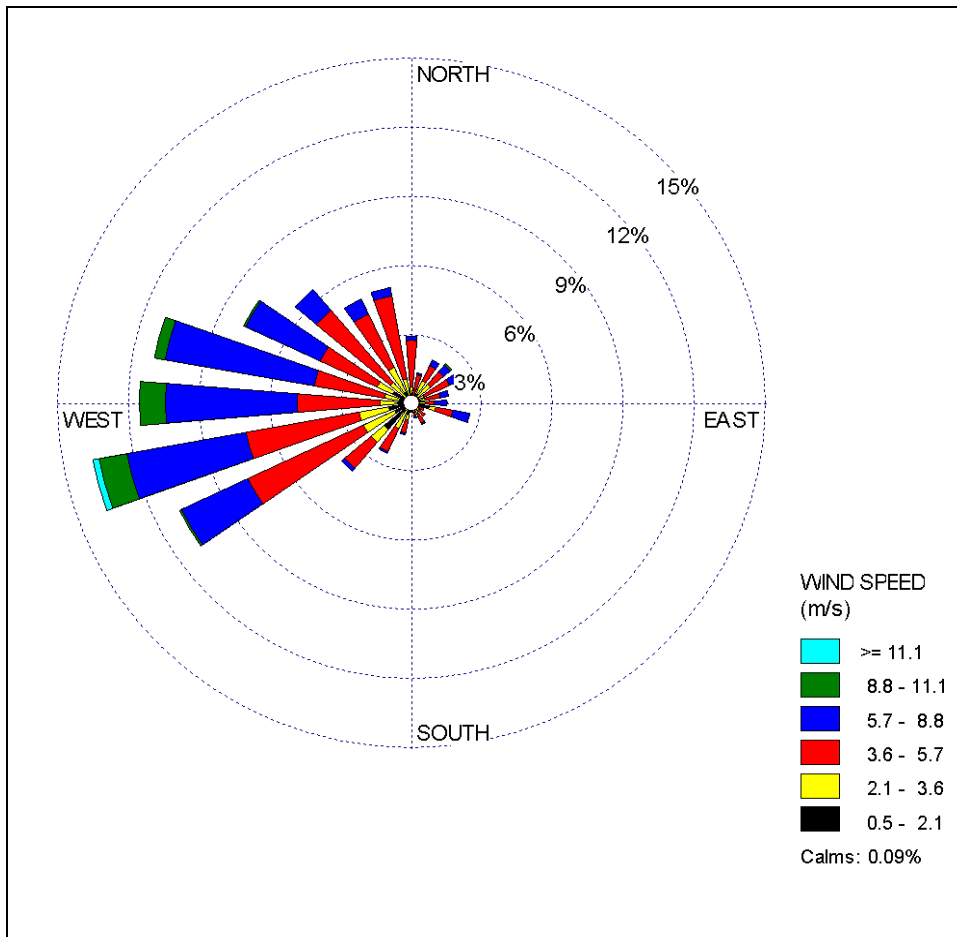


Figure 3-1 Wind Rose for Wickham

Further measurements taken in November are presented in Appendix D. They show that night time L_{Aeq} values typically reduce to just under 40 dB at position 1 (the nearest location to the existing train line). Since noise sources other than trains contribute to these levels, this represents an upper level for noise due only to current train activity.

4. OPERATIONAL NOISE LEVELS

4.1 Survey Details

As described previously, a comprehensive survey of operations and noise emissions at Rio Tinto's 7-Mile rail marshalling yard was undertaken in July 2008. As mentioned, the survey incorporated quantification for prediction purposes, of noise associated with:

- regular loaded and unloaded train movements into, across, and out of the yard, and at speed;
- individual work activities typical in the workshop and surrounds;
- cumulative levels inside and outside of the workshop;
- discrete engine tests and movements around the yard; and
- overall operation of the yard over extended periods at various distances.

Of these activities, the rail movements provide the greatest contribution to environmental noise levels, and as such were the focus of the survey and assessment. The separate parts of the survey are discussed in proceeding sections of this chapter.

The site visit and noise survey at the 7-Mile facility was undertaken between July 28th – August 1st 2008. Noise level measurements (1/3rd Octave band) of rail pass-bys and workshop activities were made using a Brüel & Kjær 2250 Class 1 meter, and a 2260 Class 1 meter, both calibrated before and after survey periods. Appropriate laboratory calibration certifications can be supplied if required. Weather conditions were warm, calm and dry during noise measurements, and representative of conditions at the proposed Cape Lambert rail marshalling facility.

4.2 Noise from Rail Movements

Noise from rail pass-bys was measured at a number of locations around 7-Mile, in order to gain a broad understanding of the variation in noise generated. Subsequently, rail noise samples from the yard can be divided into two categories:

- regular train movements (loaded and unloaded, moderate speed, on straight or curved track); and
- shunting or slow transit across the yard (including coupling noise, brakes, horns and pressure release).

Results from these measurements enabled determination of SELs and subsequent development of day and night-time source levels for trains entering and leaving the yard, estimation of sound power levels for point noise sources such as horns and pressure releases, and evaluation of intrusive characteristics such as tonality, modulation or impulsiveness as required by the Regulations.

4.2.1 Regular Train Movements

As this assessment considers only the potential noise impact of the rail movements within the yard, measurement of regular train pass-bys was focused at the yard extents, where speeds will be the highest within the yard and noise emission will be most significant.

Additionally, the proposed track route to be included in the bounds of the Cape Lambert Marshalling Yard indicates some curvature at the entry and exits. Such curvature is expected to cause generation of 'wheel-squeal', together with normal engine and rolling noise. Generation of high-pitched wheel-squeal will increase the SEL associated with the train pass-by, and is a common source of annoyance at noise sensitive receptors. Rail noise measurements were thus also carried out at curves in the track close to 7-Mile, of trains travelling appropriate speeds, for inclusion in determination of SELs for trains at the Cape Lambert rail marshalling yard.

For comparison, two typical noise time-histories for Pilbara Iron Rail pass-bys are shown in Figures B-1 and B-2 of Appendix B. The first sample was of a train on straight track, with an average speed of 38 kph. The second sample, during which wheel-squeal was noted, was taken at a curve, with the train having an average speed of 47 kph. Both measurements clearly show the noise of the engines. Typical 1/3rd octave band spectra for these two samples are shown in Figures B-3 and B-4 respectively. In Figure B-4, the presence of wheel-squeal can be seen in the 4 kHz octave centre band. The dominant contribution to noise, however, is found in frequencies between 315 – 400 Hz, corresponding to rolling noise of the wagons. This indicates that although wheel-squeal is present, it will not be a major contributor to noise levels on curves of a similar radius. Greater generation of wheel-squeal could be expected on tighter track radii.

Using the train pass-by noise samples measured, together with an estimation of average speed, an approximate relationship between train speed and noise emission has been developed, as shown by the graph in Figure 4-1. This information is useful for indicative purposes, but should not be relied on too heavily because the exact influence of other factors, such as wagon load and track radius, which require further quantification.

For use in noise modelling, a train noise emission level based upon the noisiest measured sample (from the fastest measured train and including wheel-squeal) has been applied to the furthest extents of the preferred track route associated with the yard. This is to account for trains potentially reaching speeds of up to 60 kph leaving the yard, and increased noise emission on the curved track on these sections. Using the upper bound sample is conservative, allowing a worst-case assessment, but considered reasonable as the measured variation in noise emission of these regular train movements with speed (and curvature) is relatively small, being about 9 dB between speeds of 15 – 60 kph (see Figure 4-1). This small variation also supports the reliability of rail noise predictions for the range of speeds of train movements through the marshalling yard and upon exit.

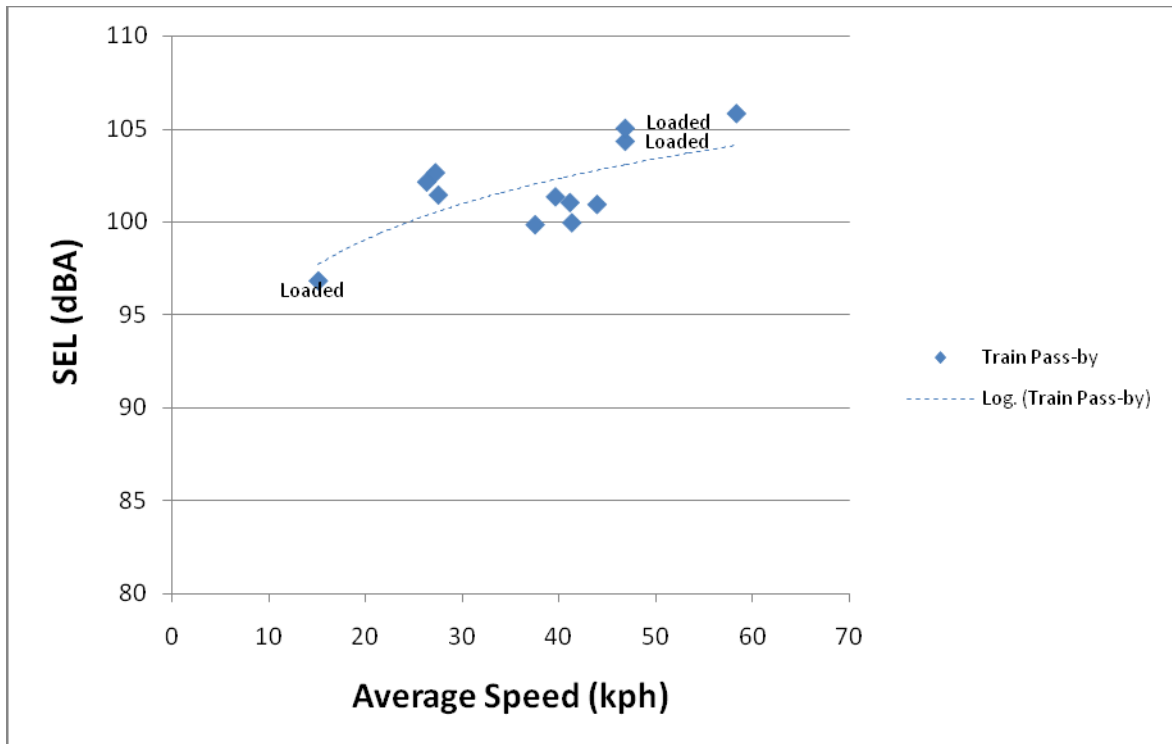


Figure 4-1 Approximate Noise Emission/Speed Relationship for Pilbara Iron Trains Based Upon July Survey

The small variation of noise with speed is due in part to the consistency and dominance of engine noise in the rail pass-by SELs. Measurement of engine noise during the survey, carried out under controlled conditions within the marshalling yard, revealed a maximum variation of around 17 dB between the 'notch 1' load setting and highest 'notch 8' setting, and a maximum variation of around 5 dB between the 'notch 4' and 'notch 8' settings. For regular train movements around the yard, over level ground, the engine settings could be expected to be within this latter range, and thus produce consistent noise emissions.

For modelling train noise emission along the straight track through the main section of the marshalling yard, an average of the measured samples (SELs) of regular train movements has been used. Information obtained from the operators of 7-Mile rail yard indicates that on average, around 18 regular train movements can be expected per day. That is, 9 unloaded and 9 loaded trains entering and leaving the yard per day. However owing to the requirement of the new criteria for the L_{Aeq} numbers to be averaged over a minimum of 1 train per hour ie 24 regular train movements per day (12 unloaded and 12 loaded). Further to this, it is assumed that the movements are distributed evenly over the day and night-time periods. Although this has yet to be confirmed as an operating condition for the Cape Lambert Rail Marshalling yard, this assumption of train movements is considered a conservative representative for the current EIA.

A summary of train movements, applied SELs and developed day and night-time source levels for the modelled sections of the preferred route carrying regular rail movements is shown in Table 4-1 below. Note that the train numbers given here are approximately double those that are estimated to actually occur. These higher numbers were modelled to fulfil the relevant requirement that calculated L_{Aeq} values are based on a minimum of one train movement per hour (i.e. 24 trains per day rather than 12 - see section 1)

Table 4-1 Summary of Regular Rail Movements and Subsequent Noise Source Levels

Track Section	Movements (total)		Pass-by SEL ¹ (dBA)	L _{Aeq} , period (dB)	
	Day (0600-2200)	Night (2200-0600)		Day	Night
Yard Entry and Exit	16	8	107	70	70
Main Track Through Yard			104	67	67

¹ Normalised to 25m from closest track rail

4.2.2 Irregular Movements and Other Rail Noise Sources

Irregular rail movements and related sources across the yard include shunting, coupling, engine idling and transfer, horns, and air pressure release from engine compressors. These have been treated separately in the predictive noise model, due to slightly different source characteristics (eg horn as point source) and averaging of noise events over assessment periods.

Together with sampling of pass-by noise for slower moving trains and shunted wagons, in order to determine event SELs as per the method for regular movements, quantification of noise from irregular rail sources required some additional analysis. Measurement of engine noise under controlled conditions was undertaken, firstly to appreciate the contribution of engines to rail pass-by noise, and secondly to gain an understanding of emissions during load testing. Additionally, engines in the marshalling yard remain idling for long periods, and as such may contribute significantly to overall noise levels.

Also, logging of rail activity was carried out in order to capture impulsive noise events, including coupling, horns and air-pressure release, and estimate their source characteristics and sound power level. Typical noise levels from the idling and embarkation of a loaded train, at a distance of 30m, are shown as a time-history in Figure B-5. This sample includes measurement of the horn and air pressure release, as indicated on the graph.

Determination of day and night-time noise source levels for irregular rail movements has again been based on the highest measured SEL, and also the average, to ensure consideration of worst-case noise levels. For modelling purposes the number of movements, incorporating shunting and engine transfer, has been assumed to be 36, although this is subject to confirmation. Also, these noise sources are assumed to be located amongst the sidings of the rail yard.

A summary of applied SELs, assumed movements, and subsequently developed day and night-time source levels for the modelled sidings is shown in Table 4-2 below. Table 4-3 displays a summary of sound power levels, derived from measured data, and assumed number of events for modelling engine idling, horns and air pressure release.

Table 4-2 Summary of Irregular Rail Movements and Subsequent Noise Source Levels

Data Used	SEL ¹ (dBA)	Assumed Movements		L _{Aeq, period} (dB)	
		Day (0600-2200)	Night (2200-0600)	Day	Night
Engine Transfer	99	16	8	62	62
Average of Measurements	95	16	8	58	58
¹ Normalised to 25m from closest track rail					

Table 4-3 Sound Power Levels and Assumed Number of Events for Irregular Rail Noise Sources

Noise Source	Estimated Sound Power Level (dBA)	Assumed Operation ¹		Effective Sound Power Level ²
		% On-time	No. of Events	
Engine Idling	105	50%	-	102
Horn	132	-	36	95
Air Pressure Release	130	-	36	89
¹ Evenly distributed over 24 hours				
² The increased discrepancy between the Effective Sound Power Levels of the Horn and Air Pressure Release is due to the duration of the event; the air pressure release being shorter than a horn blast				

4.3 Logged Noise Levels

Noise logging at several locations around 7-Mile was undertaken in order to determine overall cumulative noise levels from activities in the marshalling yard, and identify any patterns in noise emission over the assessment periods. Due to the variety of sources within the yard, noise logging at different distances was useful for an understanding of the reasonably complex propagation. Logged noise results were also used to verify the modelled predictions for individual sources, such as rail movements and the workshop.

Noise logging equipment was installed at 5 locations around the 7-Mile marshalling yard, as indicated on figure in Appendix C. Noise was measured over 15 minute intervals for between 18 - 25 hours at each location. Two Brüel & Kjær 2236 Class 1 noise level meters were used for logging, calibrated prior to and following installation at each location.

Results of noise logging for the 5 locations are shown in Figures E-1 to E-5 in Appendix E. The peaks in the graphs clearly indicate the influence of rail pass-bys in noise levels, which correspond

to predicted noise emission from measured rail noise samples. Table 4-4 below displays a summary of noise logging results for the 7-Mile rail yard. While the L_{A10} metric is used in the table below for comparison with the Assigned Noise Levels, the L_{Aeq} metric is used in the graphs (together with L_{A90} – background noise) of logged noise levels, as this is deemed to better represent rail pass-by events.

Table 4-4 Summary of Logged Noise Levels

Noise Logger Location	Logging Duration (h)	Approximate Distance (m)		Day time Noise Levels (dB)			Night-time Noise Levels ¹ (dB)		
		From Track	From WS	$L_{A10, T}$	$L_{A1, T}$	L_{Amax}	$L_{A10, T}$	$L_{A1, T}$	L_{Amax}
1	20	520	630	47	52	75	48	53	74
2	18	20	-	67	75	92	66	74	89
3	25	200	320	54	60	81	53	60	85
4	21	100	220	64	70	96	64	70	100
5	21	30	780	60	66	102	54	60	85

¹ For simplicity, evening noise levels have been omitted from this table, as measured results were found to be consistent over the 24 hour periods

The results of noise logging indicate consistency across the day and night-time periods, supporting this assumption for predicted emissions. As expected, the highest L_{A10} and L_{A1} levels were measured at location 2, 20m from the track at the far extent of the yard and not far from a curve. It is noted that, with the exception of L_{Amax} , noise levels at logger location 4, 100m from the track, are generally higher than those measured at location 5, at 30m from the track. This is due firstly to the proximity of logger 4 to the workshop and activity on the adjacent sidings; the graph in Figure D-4 indicates overall noise levels are dominated by numerous events. Secondly, train speeds around logger location 4 are reasonably slow, and there are less sidings, suggesting less irregular rail movements in this area. However, the highest L_{Amax} level was measured here, which corresponds to use of the horn, as this is near the northern exit of the yard.

Measured L_{Amax} levels at locations 3 and 4 should be treated with caution, as none of the noise sources surveyed within the marshalling yard generate noise of this level (at 100m). It is likely that these effects were caused by events in close proximity to the logging microphone, such as impacts by birds or insects. This is reasonable considering the grassed area in which these measurements were taken. As such, these L_{Amax} levels have not been used or considered further in the assessment.

5. PREDICTED NOISE LEVELS

5.1 Development of Predictive Noise Model

As discussed previously, the software package SoundPlan was used to model noise levels from the proposed Cape Lambert Rail Marshalling Yard. This model required input of all relevant noise sources, as discussed in Section 4, together with buildings, topographical and ground absorption data, location of noise sensitive receptors and meteorological information. Topographical data, in the form of spot-heights, was obtained from Landgate (WA Government dept.), and filtered to achieve vertical steps of 0.5m. Figure 5-1 below shows a graphical representation of the modelled marshalling yard, displaying locations of noise sources and terrain contours.

The revised location of the marshalling yard has been based upon Rio Tinto drawing *CLB 50_50 PES Addendum Rail CL for Noise Modelling_MGA.dxf*. Noise from shunting and engine transfers has been positioned arbitrarily along the sidings. Locations of point noise sources, including horns, air pressure releases, and engines idling, have been made appropriately near the yard exit, and connections to the main line.

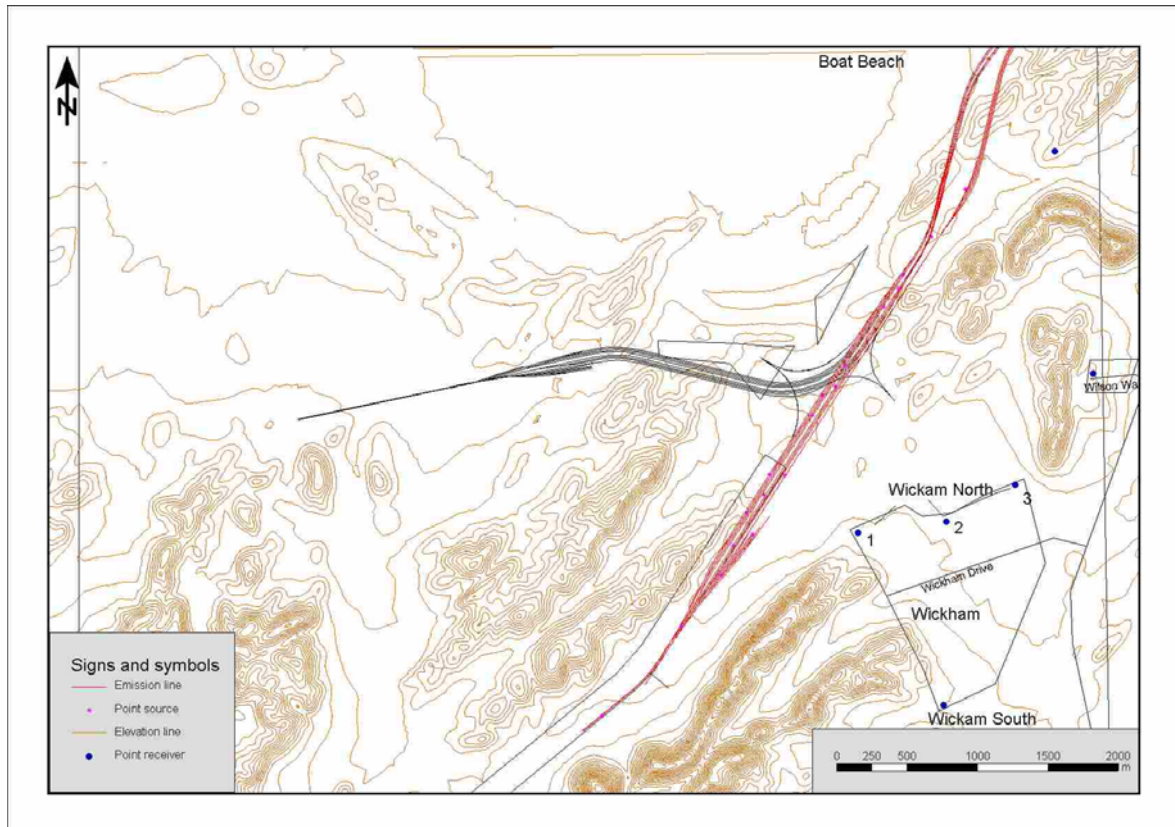


Figure 5-1 Graphical Representation of Cape Lambert Rail Marshalling Yard Noise Model

5.2 Predicted Noise Levels at Receptors

Single point noise predictions have been made at the four receptors around Wickham (Wickham North 1, 2 & 3 and Wickham South) shown in Figure 5-1, together with development of noise contours.

Predicted operational noise contours for the revised Cape Lambert Rail Marshalling Yard (preferred route) are displayed in Figure 5-2. These contours illustrate the overall noise levels (L_{Aeq}) for both the day and night-time periods, as noise emissions will be consistent over 24 hours. Single point predictions for the four representative receptors around Wickham are summarised in Table 5-1.

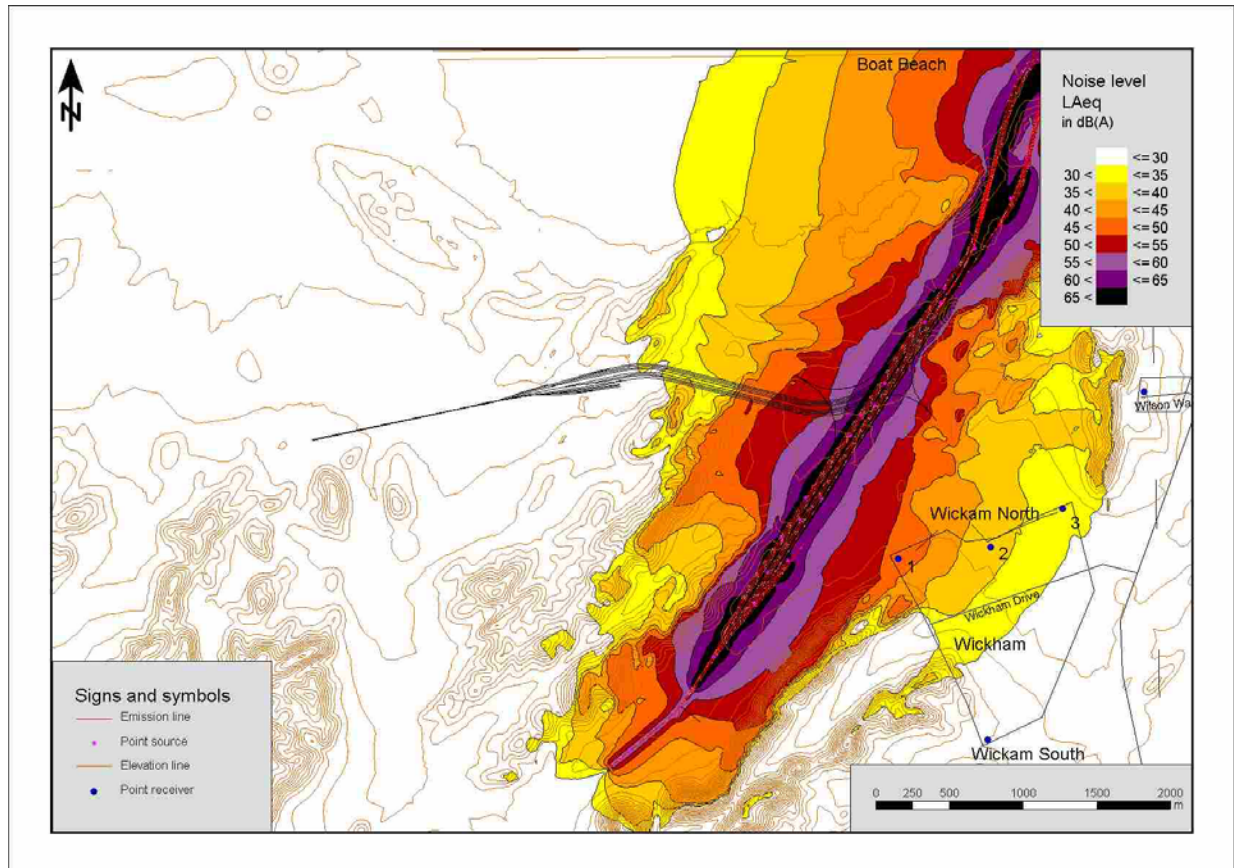


Figure 5-2 Predicted Noise Contours for Operation of the revised Cape Lambert Rail Marshalling Yard

Table 5-1 Predicted Noise Levels at Receptors from proposed marshalling yard

Receiver	L_{Aeq}
Wickham North1	48.0
Wickham North2	37.1
Wickham North3	31.6
Wickham South	16.4

Predictions were also made for the current rail traffic. These were also made on the assumption of 1 train movement per hour in order to fulfil the requirements of the relevant criteria in the rail noise assessment guidelines for L_{Aeq} , and again this represents a considerable increase of rail traffic compared to current operations. These are illustrated graphically in Figure 5-3. Corresponding single point predictions for the four representative receptors around Wickham are summarised in Table 5-1.

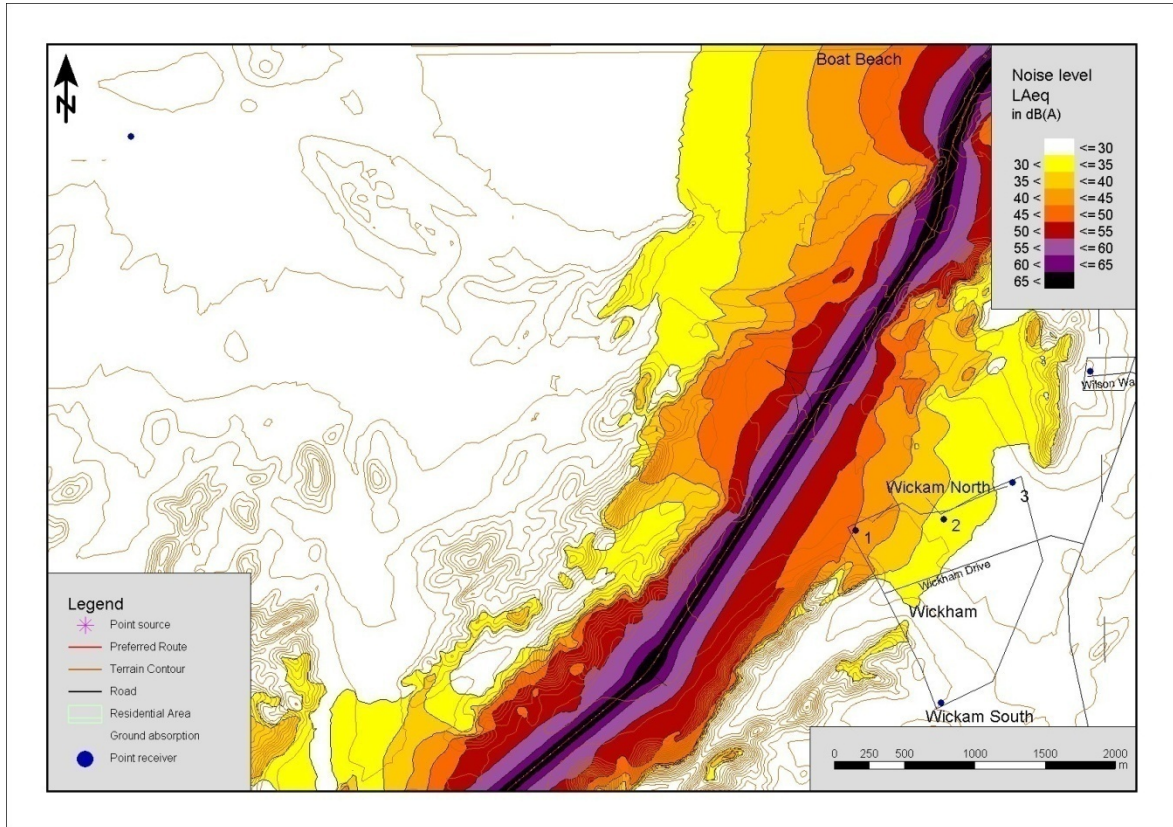


Figure 5-3 Predicted noise contours for the existing rail line based on 1 train movement per hour

Table 5-2 Predicted noise levels at receptors based on existing rail line

Receiver	L_{Aeq}
Wickham North1	44.7
Wickham North2	33.6
Wickham North3	28.2
Wickham South	13.8

Adding Table 5-1 to Table 5-2 gives the total estimated noise levels from both the proposed marshalling yard and the existing rail line (based on the increased rail traffic of 1 train movement per hour for each). This is shown in Table 5-3

Table 5-3 Predicted noise levels at receptors for all planned rail activity in the vicinity

Receiver	L _{Aeq}
Wickham North1	49.7
Wickham North2	38.7
Wickham North3	33.2
Wickham South	18.3

These results indicate that, no exceedance of the assessment criteria (L_{Aeq,night} = 50dB) is expected at Wickham.

Table 5-4 shows a hierarchy of the top five source contributions to overall noise levels at North Wickham (receiver North Wickham 1).

Table 5-4 Hierarchy of Noise Source Contributions at receiver North Wickham 1

Rank	Noise Source	Contribution to Overall Level (L _{Aeq} dB)
1	Existing rail line	45
2	Main Track (through yard)	44
3	Shunting on Siding	45
4	Engine Idling (near northern exit)	26

5.3 Comparison with Current Ambient Noise Levels

As outlined in Section 3, night time noise levels at the western edge of Wickham are dominated by train movements on the existing Cape Lambert – Emu track. Logged data at Receiver 1 gives average night time L_{Aeq} values shown in Table 5-5.

Table 5-5 Average L_{Aeq,night} Values

Day	L _{Aeq,night}
1	43.3

Day	L _{Aeq,night}
2	45.9
3	44.3
4	43.7
5	42.5
6	45.8
7	46.3
8	46.7
Average	45.1

Comparing Table 5-4 with Table 5-5. Indicate that the predicted train noise is similar to the measured L_{Aeq} values averaged over the night time period (10:00 to 06:00). This represents an upper ceiling for the current train noise as the recorded data will inevitably be influenced to some extent by other noise sources (particularly nearer the beginning and end of the night time periods).

6. CONCLUSIONS

The assessment criteria adopted for evaluation of the potential noise impacts from operation of the proposed Rio Tinto Cape Lambert Rail Marshalling Yard are based upon the 'Noise Target' levels contained in the *State Planning Policy 5.4: Road and Rail Transport Noise and Freight Considerations in Land Use Planning*. This was gazetted in September 2009. As discussed in Section 1 this is appropriate since the proposed marshalling yards do not involve the handling of freight nor does it now involve workshop or other non rail/train related noise activities it is our interpretation therefore that target level of $L_{Aeq,night} = 50\text{dB}$ contained in this document is appropriate to both the marshalling yards and the existing line.

Prediction and analysis of noise from the proposed rail yard has been comprehensively undertaken according to industry standards, primarily based upon equivalent operations at Rio Tinto's 7-Mile facility.

Noise from the marshalling yard was predicted at four locations, representative of noise sensitive receptors around Wickham. No exceedance of the assessment criteria is predicted at any receptor, and as such noise from the proposed Cape Lambert Rail marshalling yard is deemed acceptable.

Noise from the proposed marshalling yard may however be audible above background noise levels in Wickham, and will in fact be at a similar level to noise from the existing rail line.

APPENDIX A : DEVELOPMENT AREA

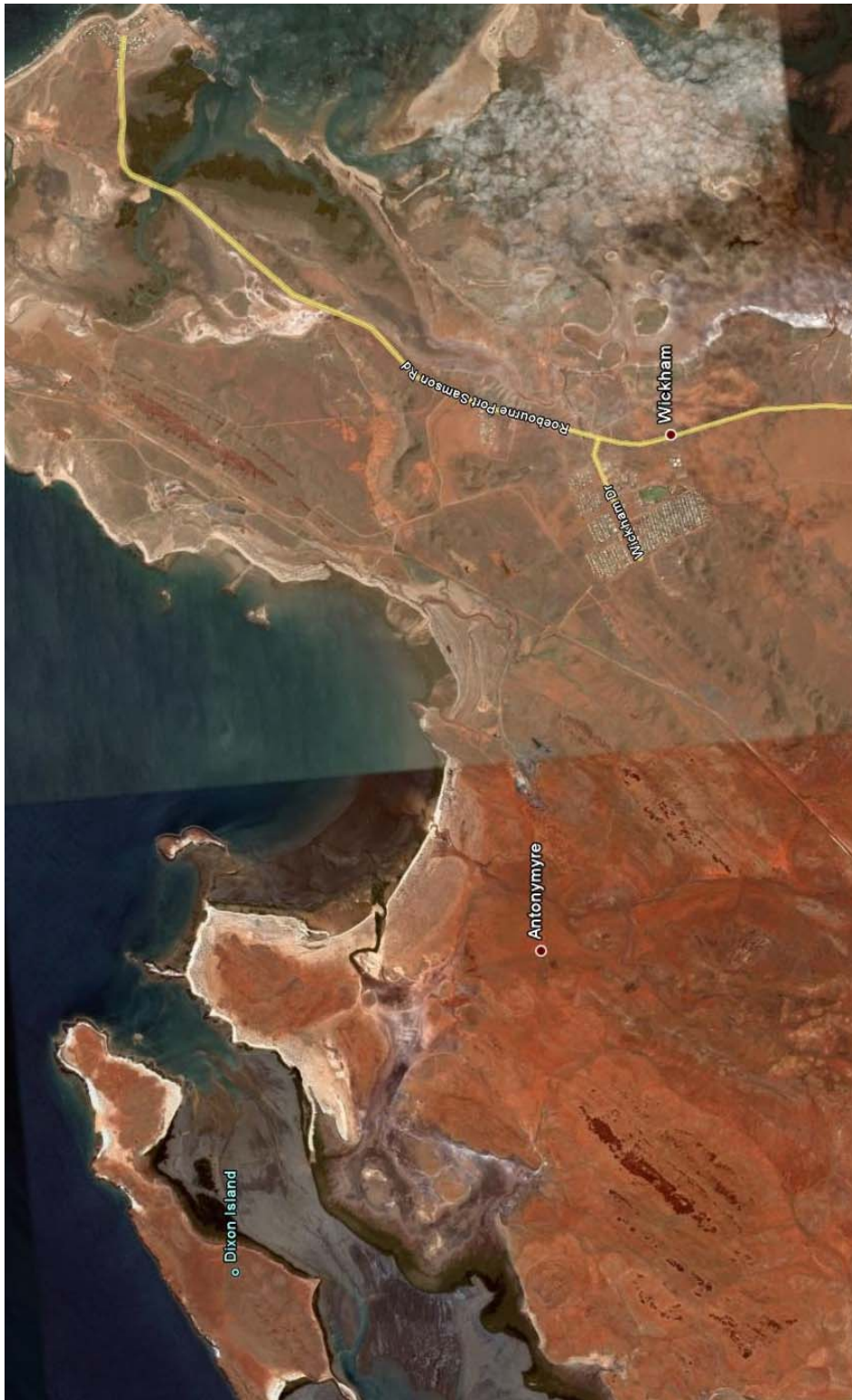


Figure A-1 Development Area of Proposed Cape Lambert Rail Marshalling Yard (courtesy of Google)

APPENDIX B : MEASURED NOISE SOURCE DATA

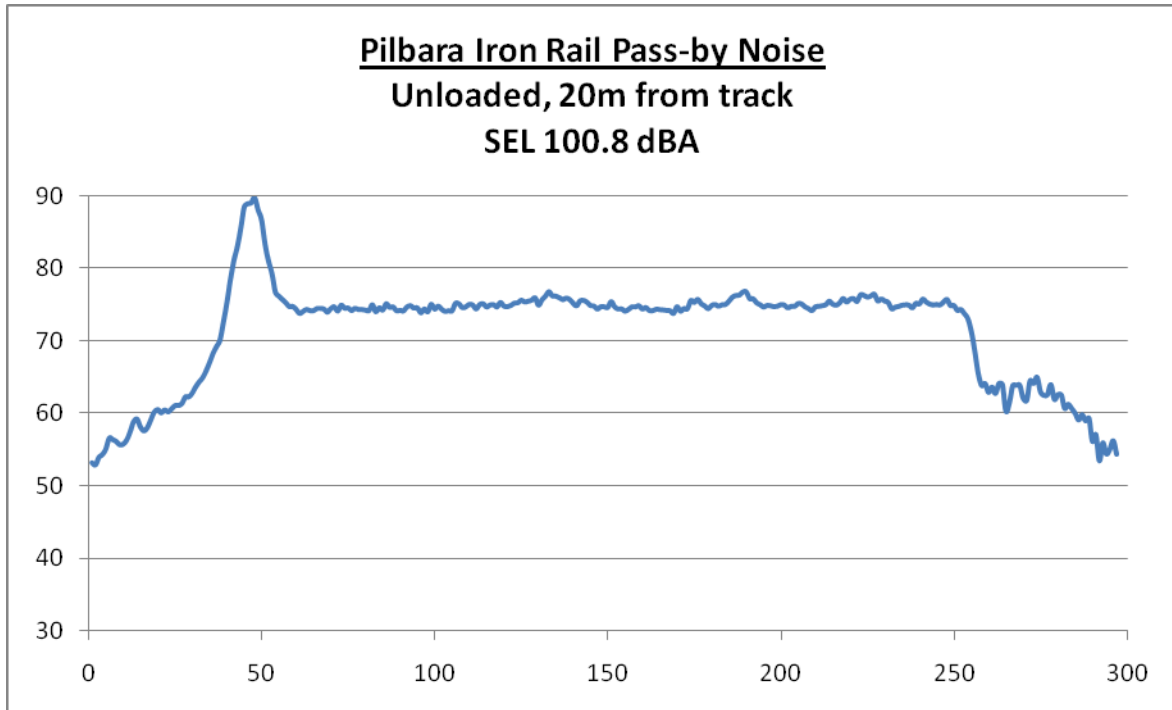


Figure B-1

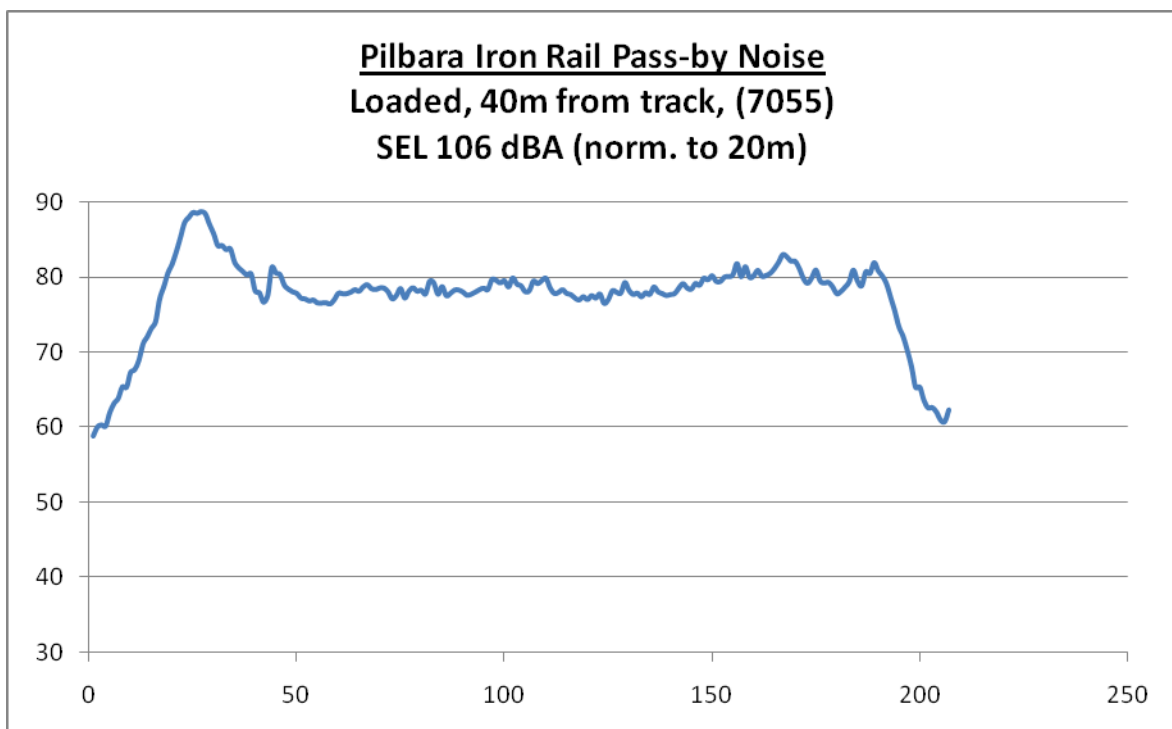


Figure B-2

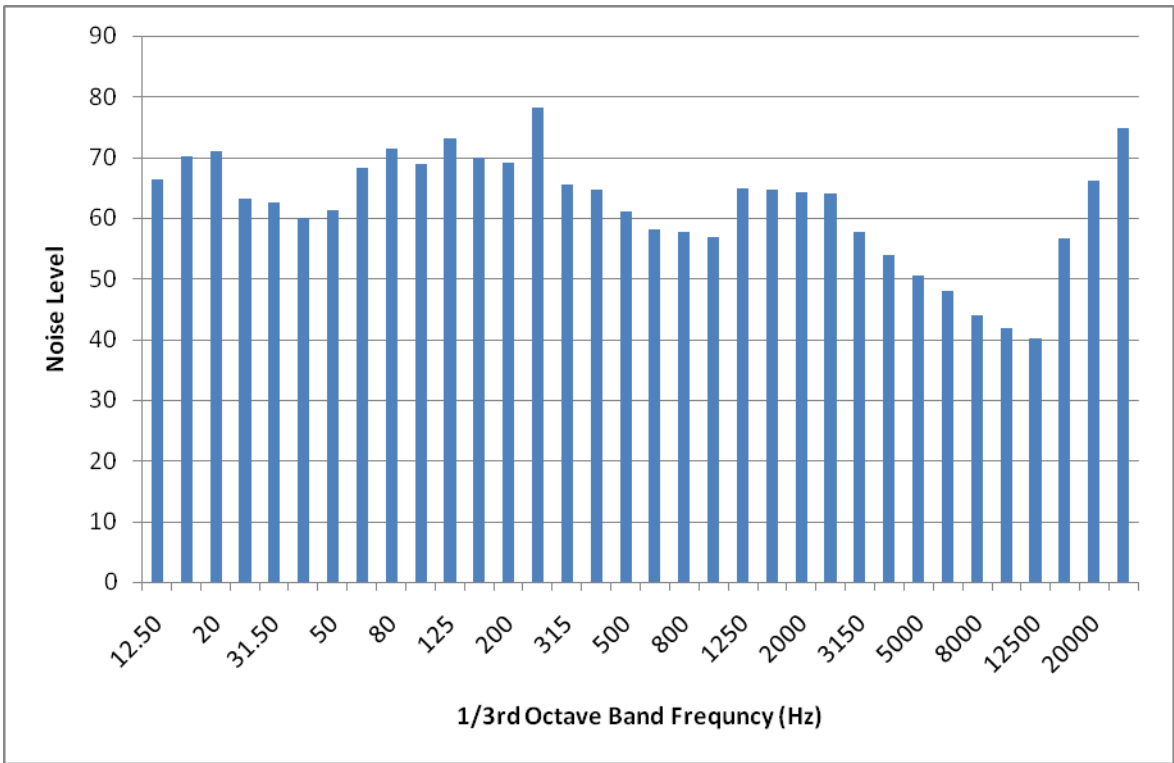


Figure B-3 Typical Rolling Noise Emission from PI Wagons on Straight Track

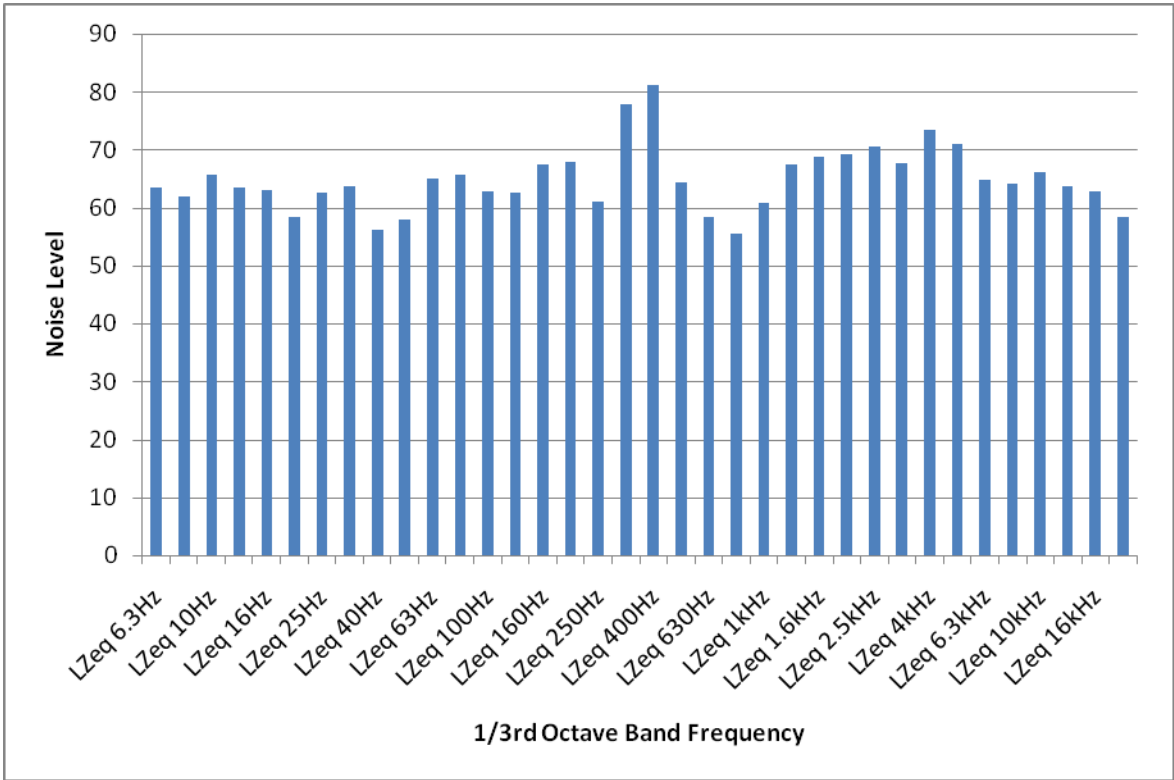


Figure B-4 Typical Rolling Noise Emission from PI Wagons on Curved Track

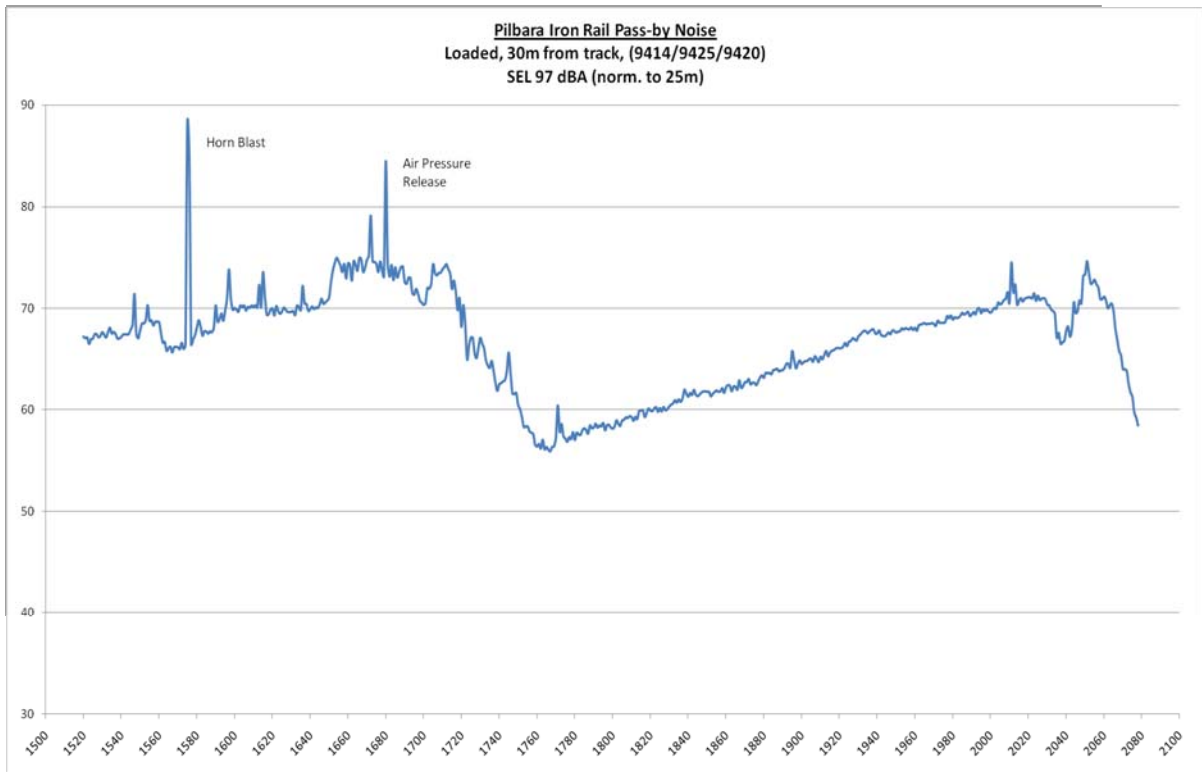


Figure B-5

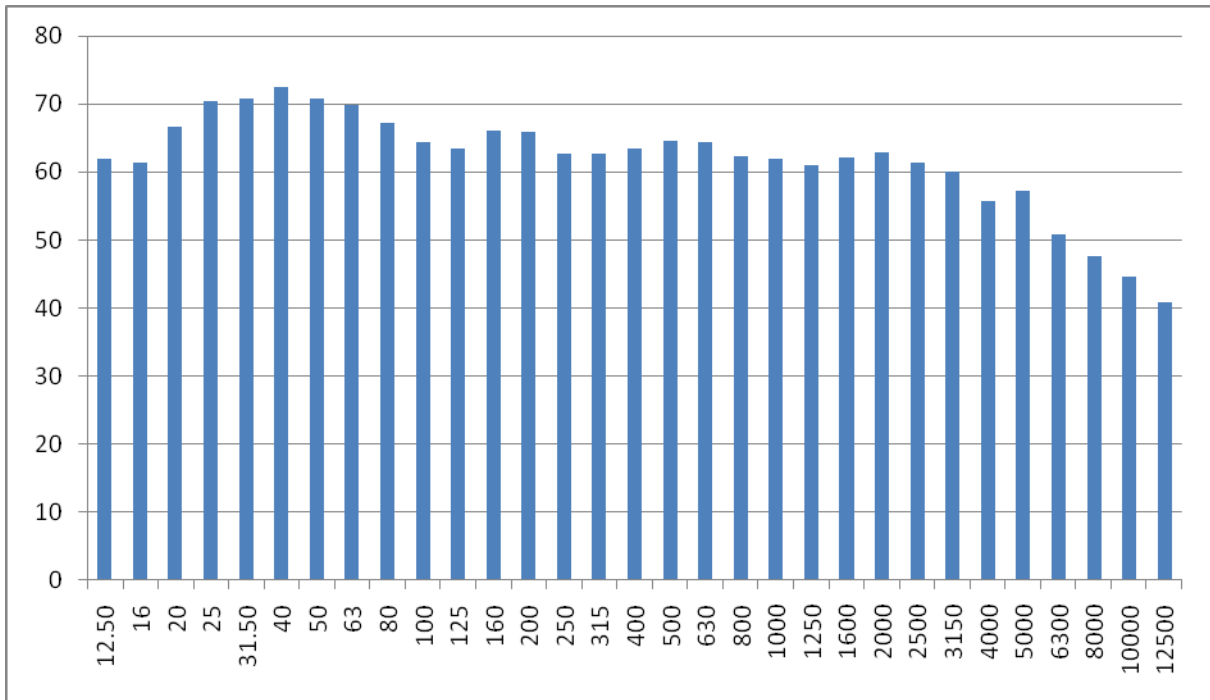


Figure B-6

APPENDIX C : NOISE LOGGER LOCATIONS

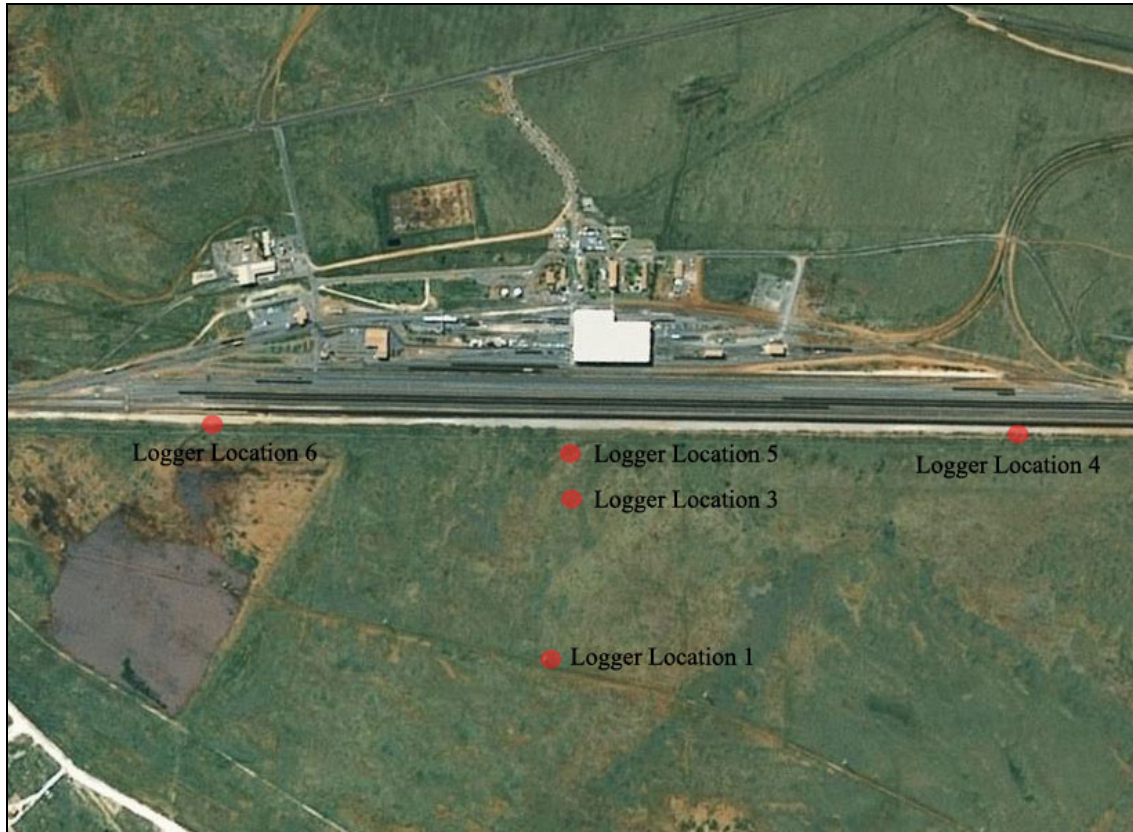


Figure C-6-2 Location of 7-Mile Noise Loggers 1, 3, 4 and 5

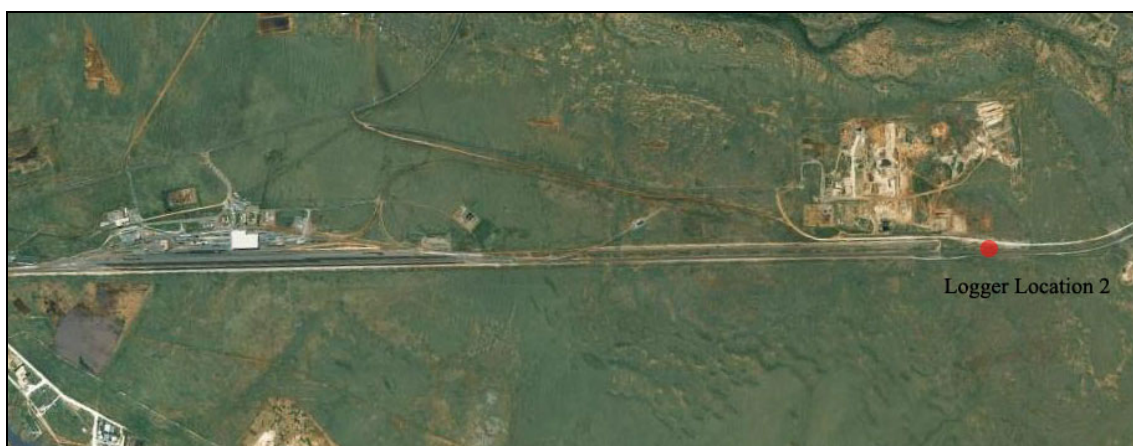
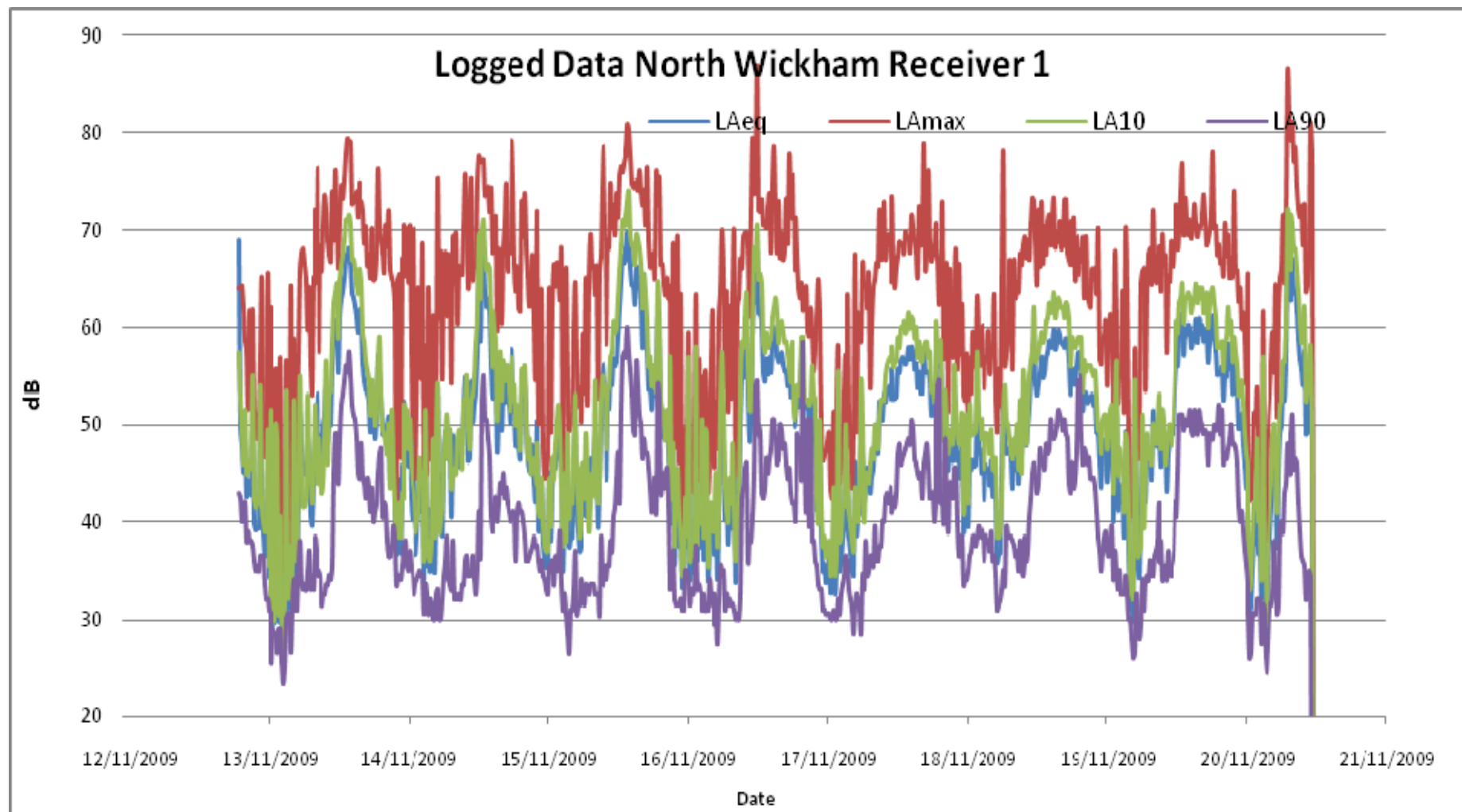
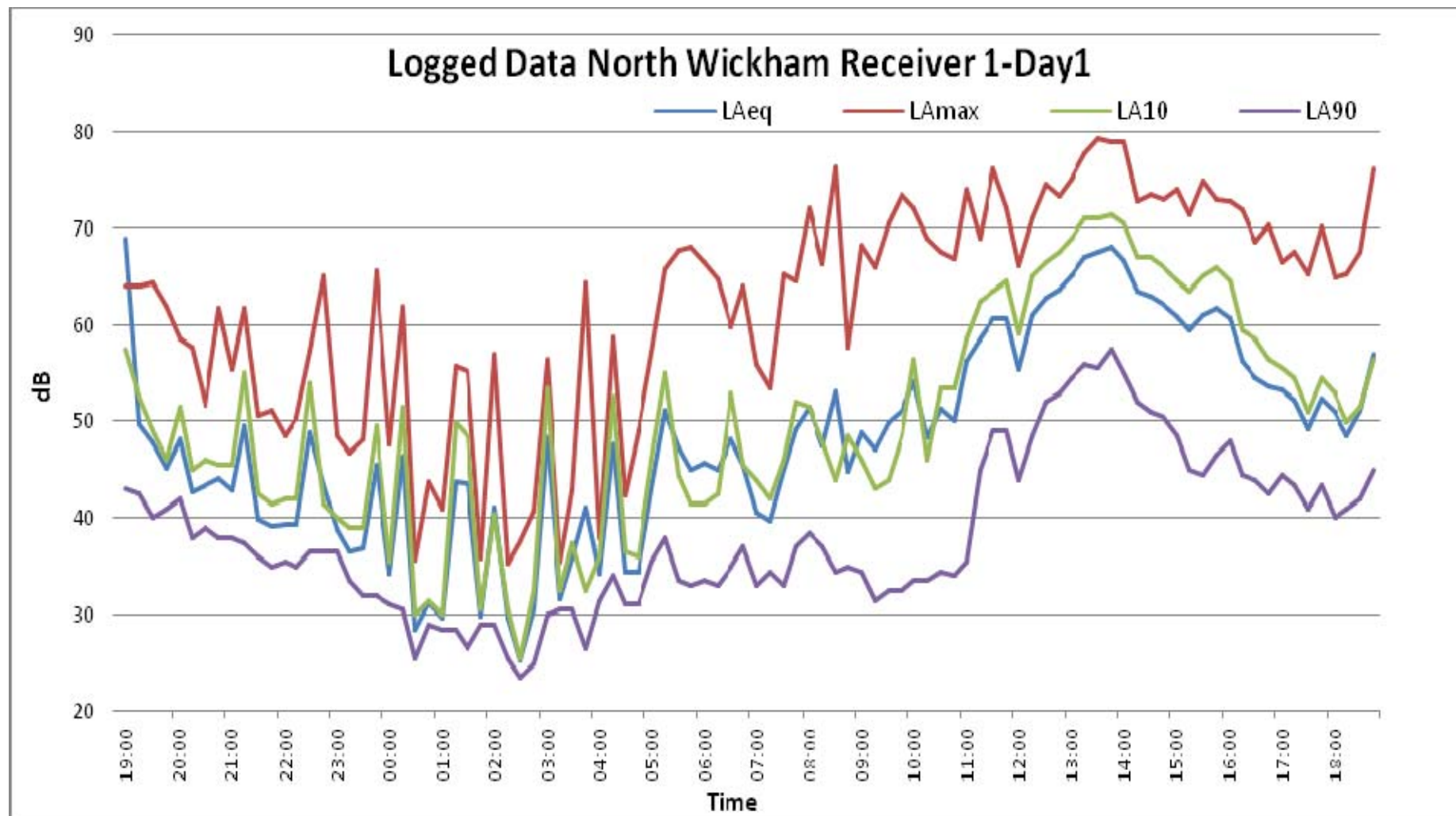
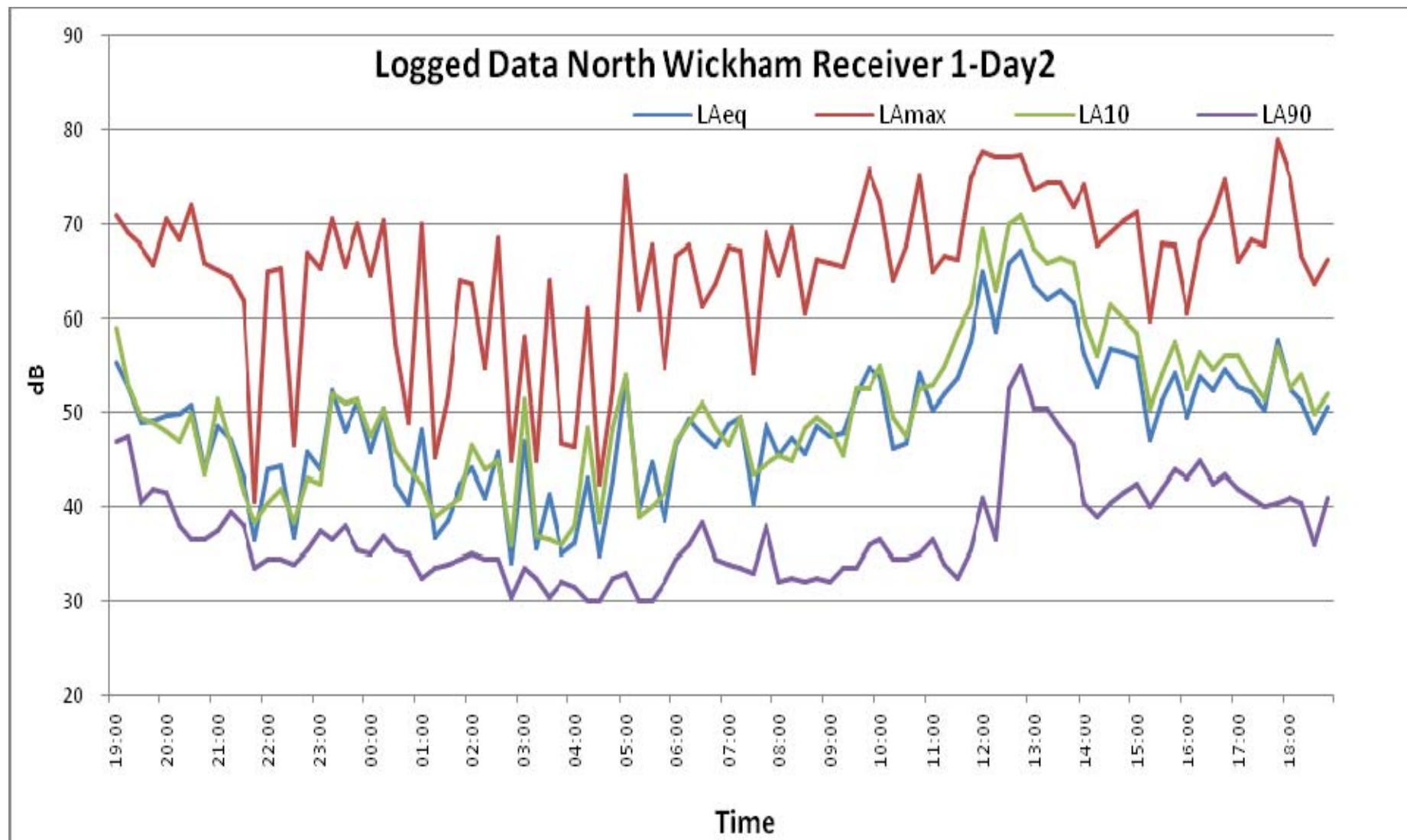


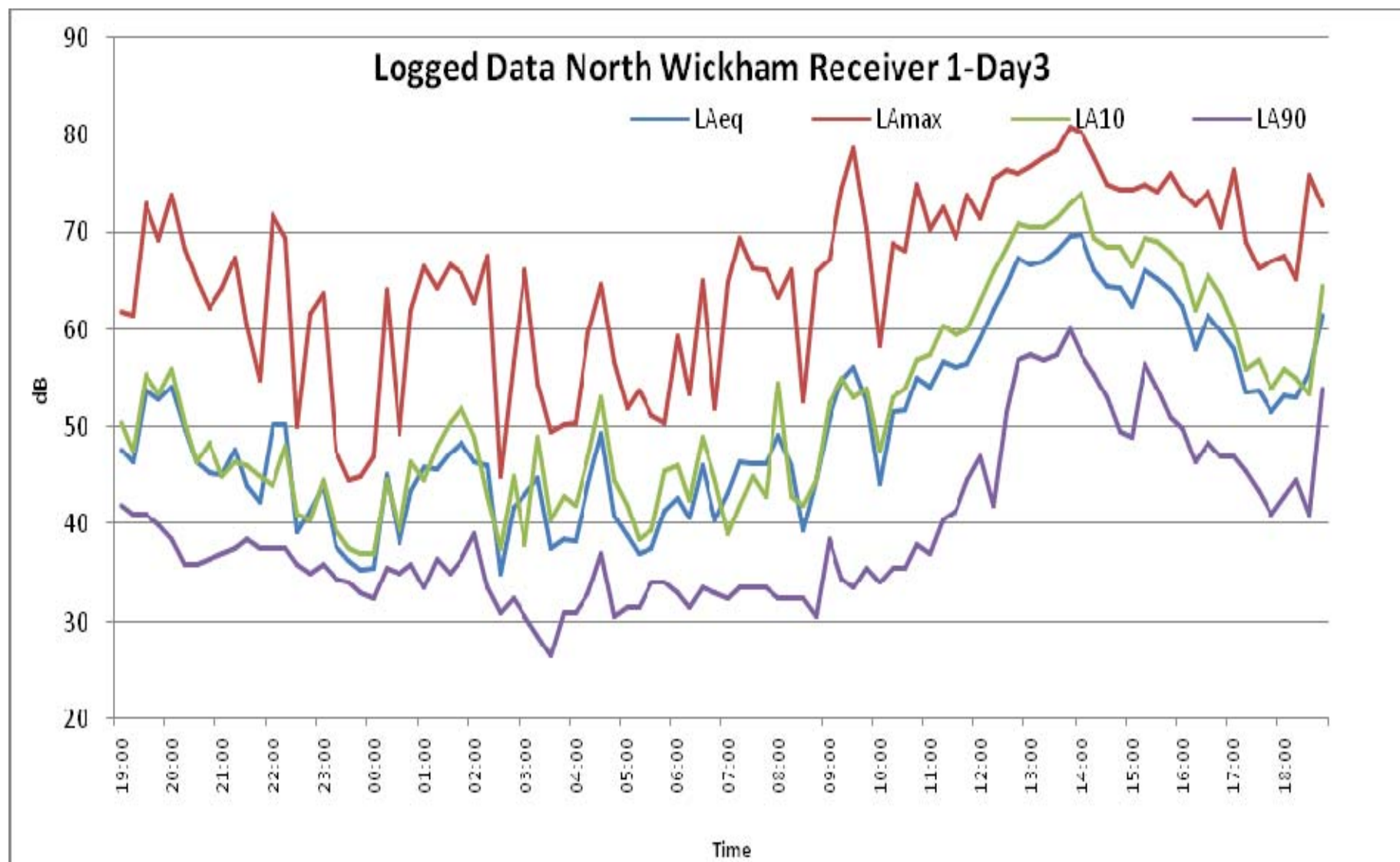
Figure C-6-3 Location of 7-Mile Noise Logger 2

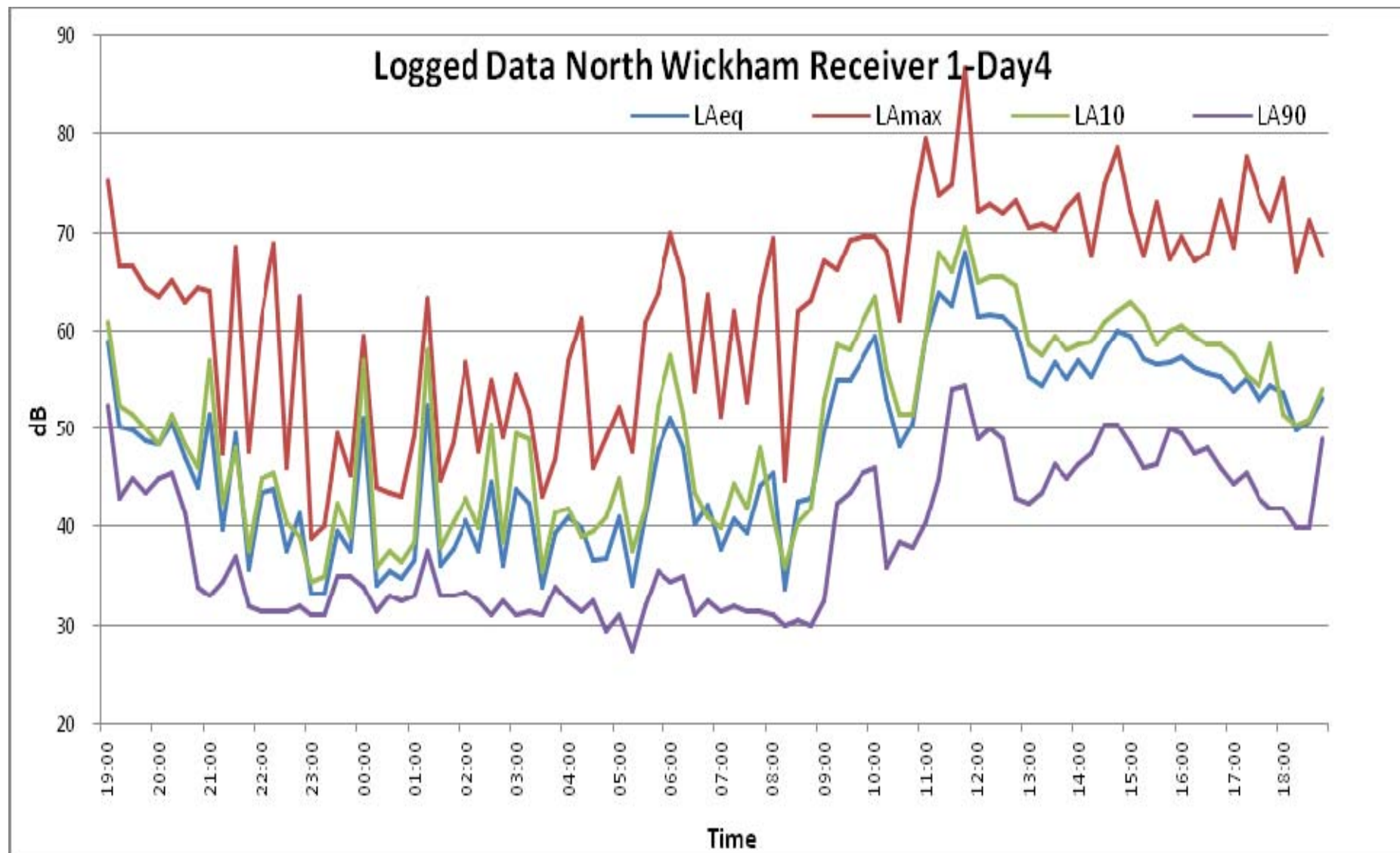
APPENDIX D : LOGGED NOISE LEVELS AT WICKHAM – NOVEMBER 2009

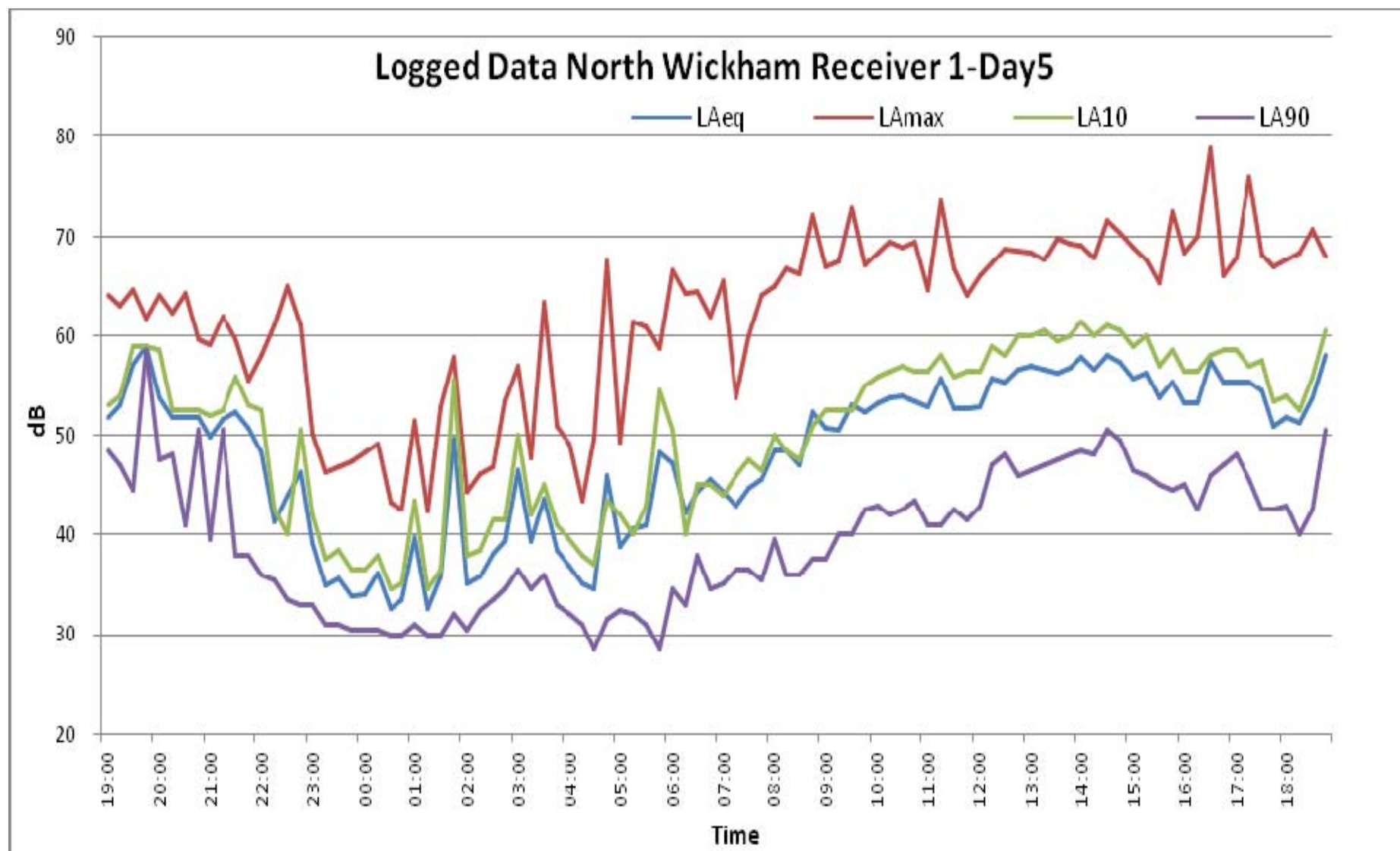


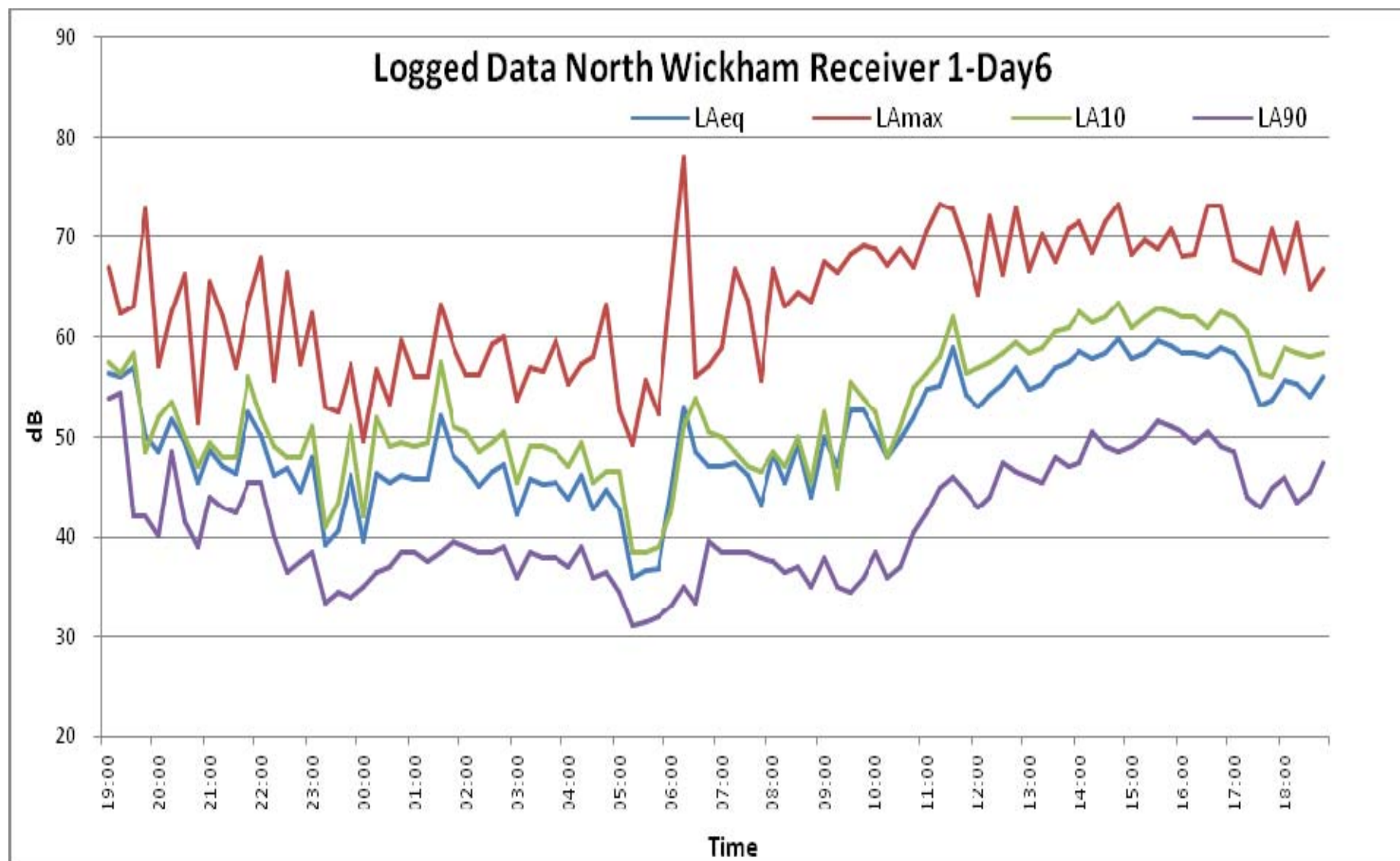


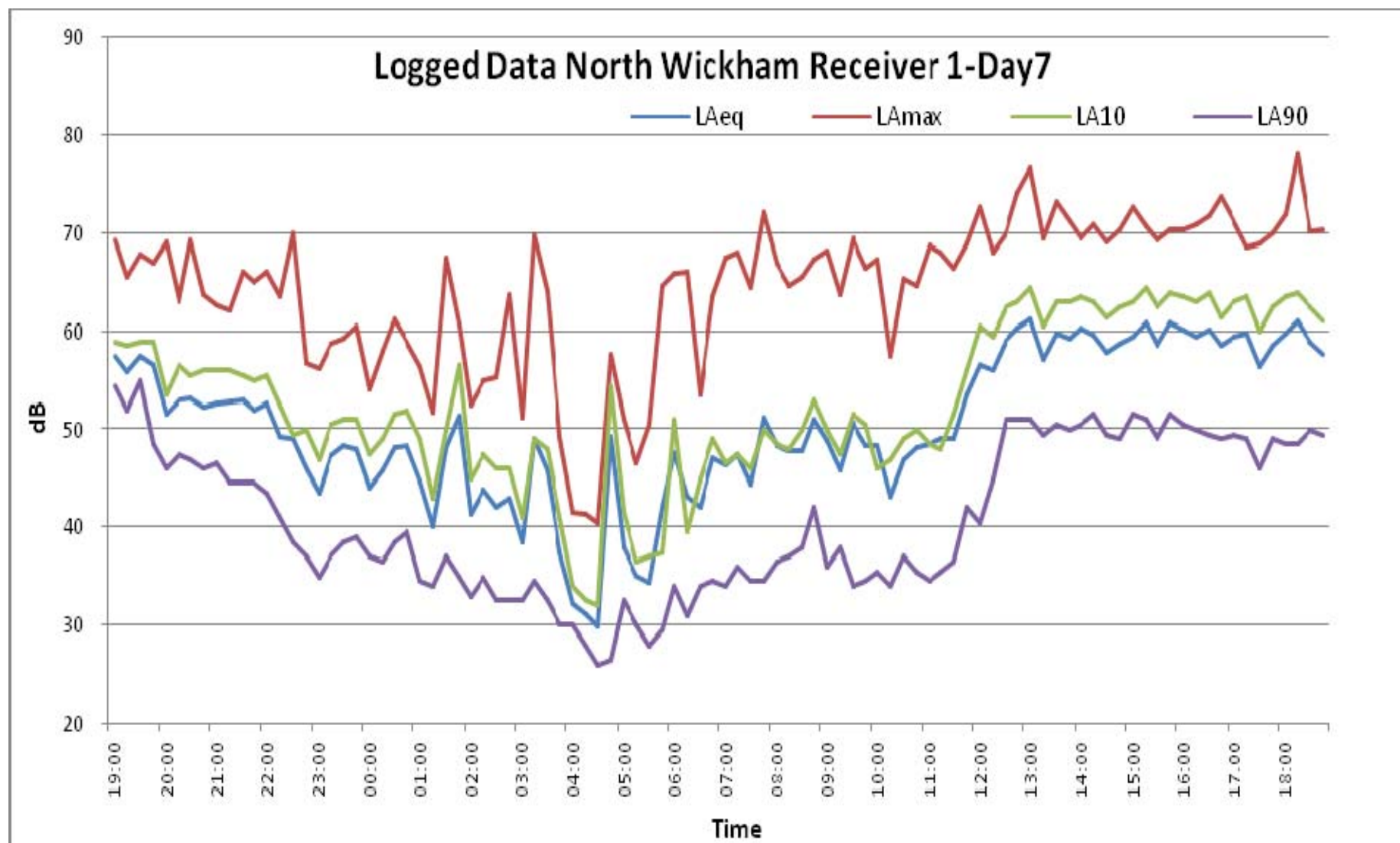












APPENDIX E : LOGGED NOISE LEVELS

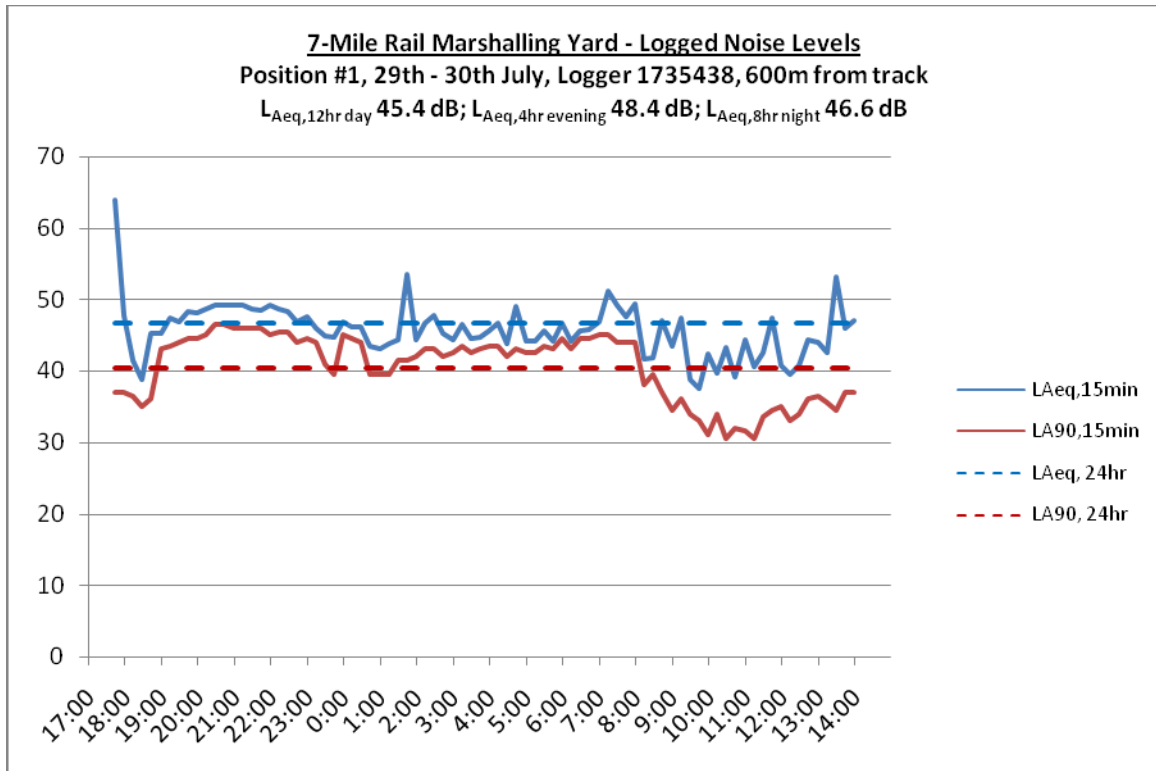


Figure D-1

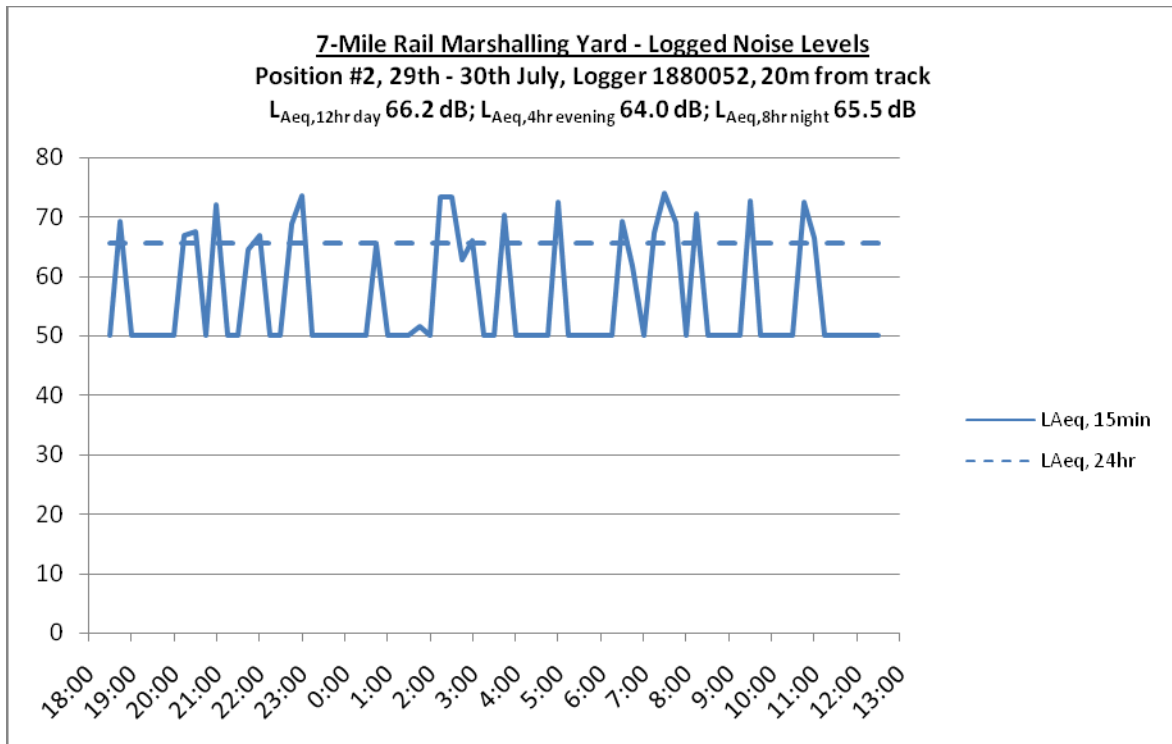


Figure D-2

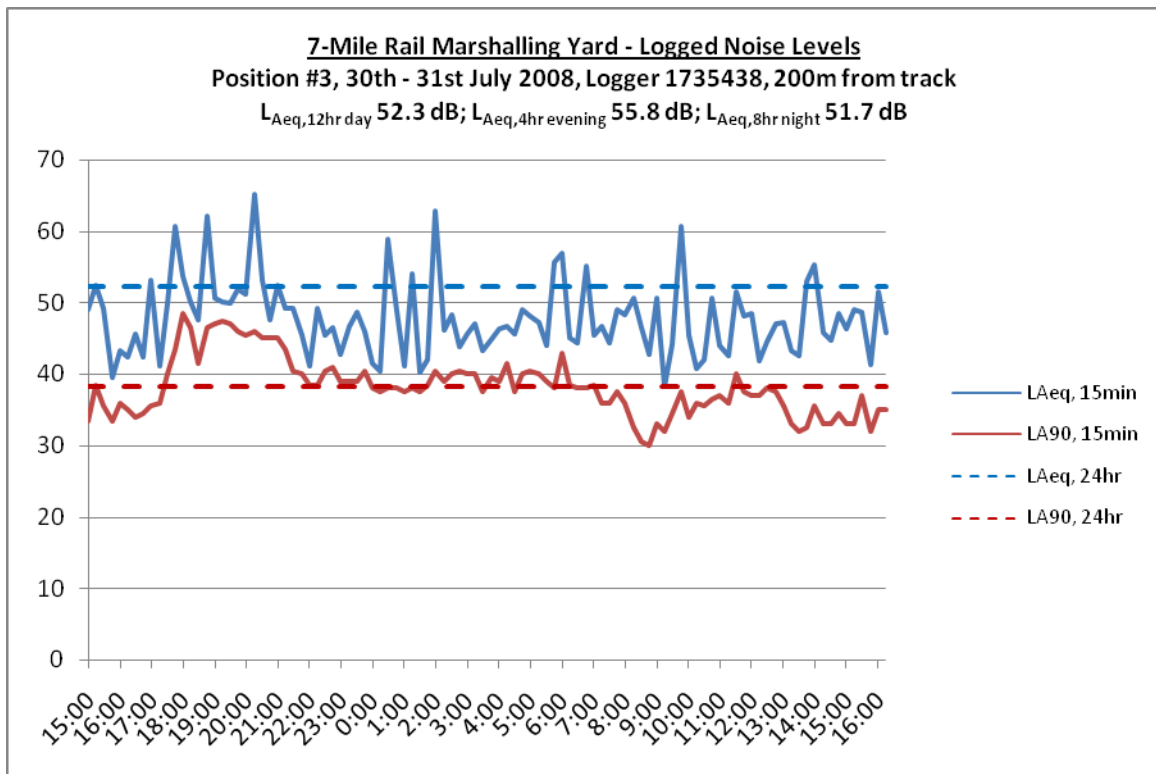


Figure D-3

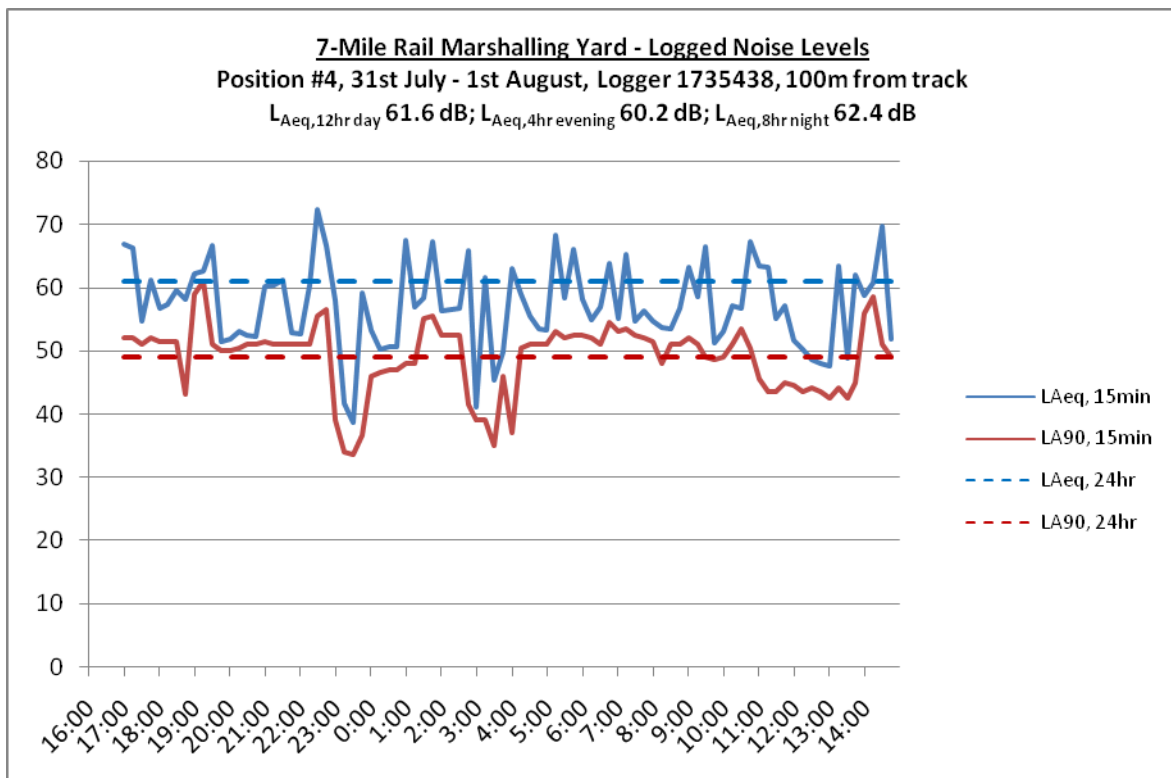


Figure D-4

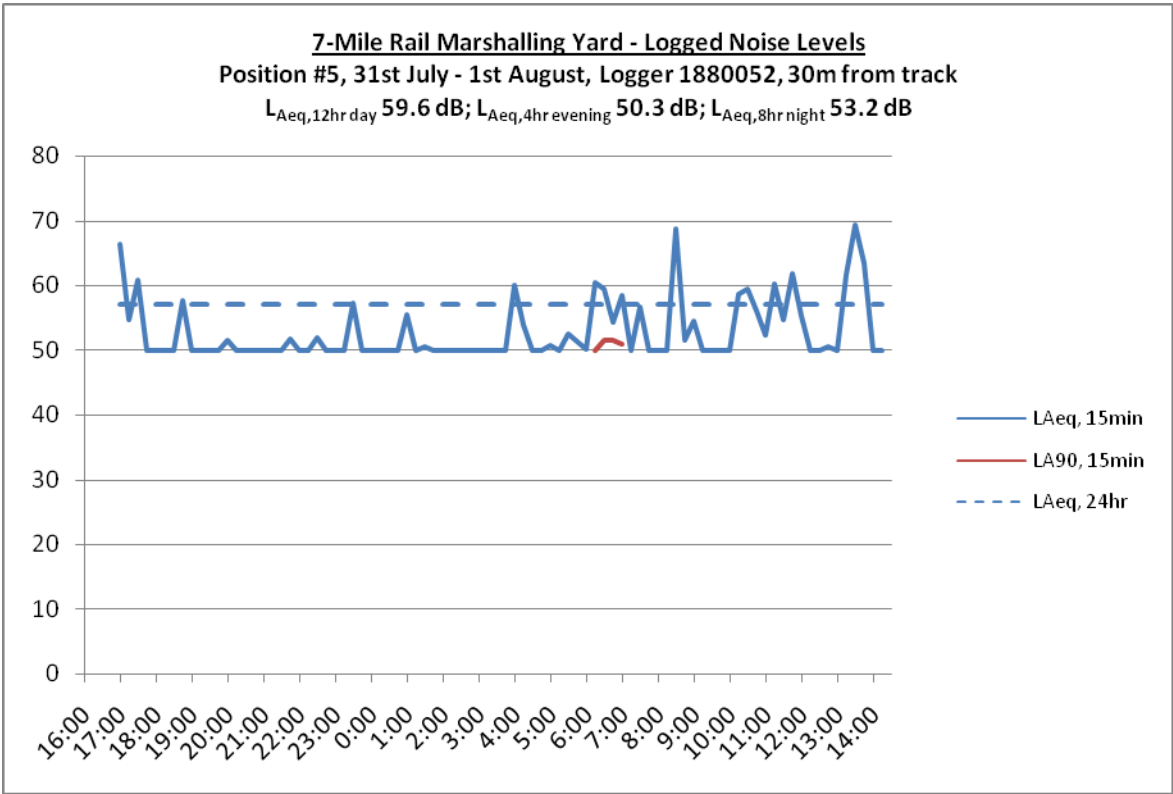


Figure D-4

APPENDIX F : GUIDELINES FOR CONSTRUCTION NOISE

As part of the construction of the plant Rio Tinto needs to comply with clause 13 of the Environmental Protection Noise Regulations 1997 which addresses the requirements for construction noise control and emission.

The Environmental Protection Noise Regulations 1997 (as amended) stipulates requirements for construction noise. These Regulations state that:

For construction work carried out between 7am and 7pm on any day, which is not a Sunday or public holiday:

- The construction work must be carried out in accordance with control of noise practices set out in Section 6 of Australian Standard 2436-1981 "Guide to Noise Control on Construction, Maintenance and Demolition Sites";
- The equipment used for the construction must be the quietest reasonably available; and
- The Chief Executive Officer (CEO) may request that a noise management plan be submitted for the construction work at any time.

For construction work done outside these hours:

- The construction work must be carried out in accordance with control of noise practices set out in Section 6 of Australian Standard 2436-1981 "Guide to Noise Control on Construction, Maintenance and Demolition Sites";
- The equipment used for the construction must be the quietest reasonably available;
- The contractor must advise all nearby occupants or other sensitive receptors who are likely to receive noise levels which fail to comply with the standard under Regulation 7, of the work to be done at least 24 hours before it commences;
- The contractor must show that it was reasonably necessary for the work to be done out of hours; and
- The contractor must submit to the CEO a Noise Management Plan at least seven days before the work starts, and the plan must be approved by the CEO. The plan must include details of:
 - Need for the work to be done out of hours;
 - Types of activities which could be noisy;
 - Predictions of the noise levels;
 - Control measures for noise and vibration;
 - Procedures to be adopted for monitoring noise emissions; and
 - Complaint response procedures to be adopted.

Appendix F-1 : Noise control measures

To control noise emission from the construction activities the following measures should be undertaken.

The construction work will be carried out in accordance with control of environmental noise practices set out in section 6 of AS 2436-1981 Guide to Noise Control on Construction, Maintenance and Demolition Sites.

The following lists particular details that should be considered:

- When sufficient details on the list of equipment to be used is available, a noise model of the likely noise emission should be undertaken to assess noise impacting noise sensitive premises.
- An induction program covering noise management should be given to all site personnel.
- Where practicable, particularly noisy activities should be scheduled for times that will cause least annoyance i.e. during daylight hours.
- Plant items should be correctly maintained to manufacturer's specifications.
- Equipment should be subject to regular maintenance. This should include ensuring all noise control equipment is correctly fitted and operating at design performance.
- All noisy areas should be clearly identified as such.
- Noise checks should be undertaken on all machinery where practicable prior to mobilisation.
- Powered machines and combustion engines should be switched off and/or their speed reduced wherever possible.
- Noise screen walls should be set up around stationary workplaces for grinding and adjusting work, where practicable.
- Ensure existing noise protection hoods should not be removed from machines and vehicles.
- Silencers and exhaust mufflers should be used on all equipment, so that noise levels are less than 85 dB(A) at 1 metre from the item.
- Acoustic enclosures should be located over compressors and generators so that noise levels are less than 80 dB(A) at 1 metre from the enclosure.
- Equipment used for the construction works should be the quietest reasonably available.
- Any unduly noisy item should be repaired, modified or replaced with a quieter item.
- All vehicles will follow approved haul routes off-site and on-site to minimise noise impacts.

Appendix F-2 : Noise monitoring and complaints

It is not anticipated that monitoring of the construction noise levels would be required.

Provision should be made for the project's environmental officer review and log all complaints lodged with the company. Where a complaint is made then all complaints should be logged and responded to in a manner satisfactory to the regulatory bodies.

Repeated complaints would be investigated through noise monitoring, and a report should be prepared to address the extent of any impacts and a range of practical and feasible mitigation measures that should be adopted.