EC Data Centre

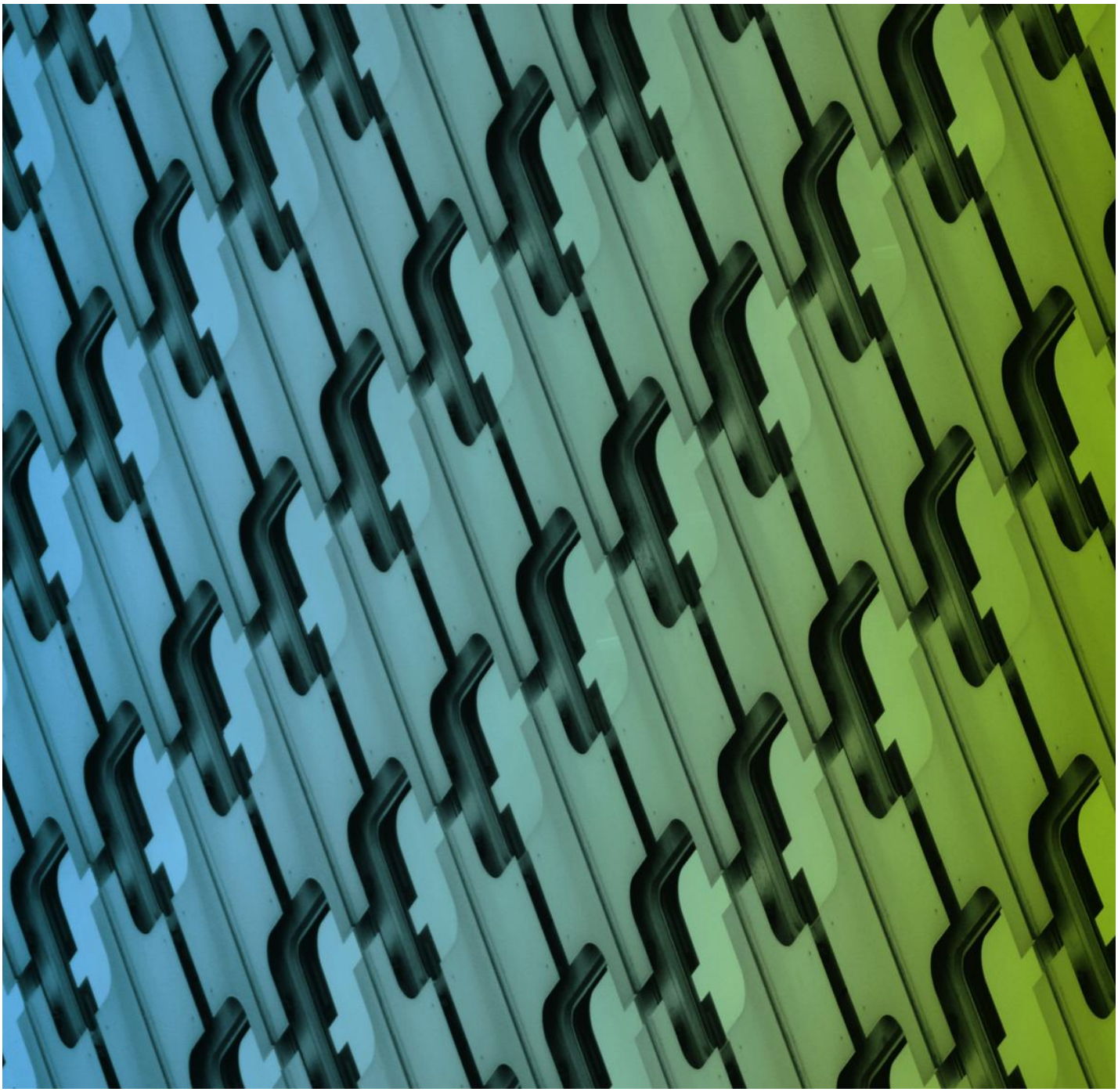
CB Richard Ellis Pty Ltd

20 September 2010

Document No. 60161037.RPT02.03.doc

Eastern Creek Data Centre

Noise and Vibration Impact Assessment



Eastern Creek Data Centre

Noise and Vibration Impact Assessment

Prepared for

CB Richard Ellis Pty Ltd

Prepared by

AECOM Australia Pty Ltd
Level 11, 44 Market Street, Sydney NSW 2000, PO Box Q410, QVB Post Office NSW 1230, Australia
T +61 2 8295 3600 F +61 2 9262 5060 www.aecom.com
ABN 20 093 846 925

20 September 2010

60161037

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Quality Information

Document Eastern Creek Data Centre

Ref 60161037

Date 20 September 2010

Prepared by Angus Leslie

Reviewed by Patrick Martinez

Revision History

Revision	Revision Date	Details	Authorised	
			Name/Position	Signature
1	2-Sept-2010	For client information	Michael Slinn Project Manager	
2	20-Sep-2010	Updated to Client Requirements	Michael Slinn Project Manager	
3	20-Sep-2010	Updated to Client Requirements	Michael Slinn Project Manager	

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Executive Summary

AECOM Australia Pty Ltd (AECOM) was engaged by CB Richard Ellis (CBRE) to undertake a Construction and Operational Environmental Noise Impact Assessment for the proposed Eastern Creek Data Centre Stage 1 development, located between Roberts Road and Capicure Drive, Eastern Creek (the Site). The construction and operational noise impact assessment was undertaken to predict the impact of noise from the proposed development on the closest residential receivers located at Erskine Park, Minchinbury and Horsley Park and commercial receivers within the M7 Business Hub.

Two typical construction scenarios were modelled to predict and assess noise emission levels from the Site that the nearest residential and commercial receivers will experience. The two important construction phases that have been modelled are the site preparation and the erection of the buildings structure.

The construction noise assessment indicates compliance with NSW Department of Environment, Climate Change and Water (DECCW) '*Interim Construction Noise Guidelines'* acoustic requirements at all assessment locations during the daytime (i.e. during DECCW's standard construction hours).

Operational noise levels from the proposed Stage 1 development were predicted using SoundPlan 7.0. In the modelling it was assumed that up to 80 Twin City Model 36D4 TCVA Axial Fan Units, as part of the Indirect Air-Side Economizer (IASE) Cooling System which is proposed to cool the proposed Stage 1 development, will be in operation at full load as the worst case operating scenario for normal operating conditions. In the case of emergency operations (e.g. blackouts) 10 off 3 MW Generators housed in acoustic enclosures will also be in operation. The governing operational acoustic criterion was established to be the night-time period. The assessment was undertaking assuming neutral and prevailing weather conditions for the area.

The environmental noise impact assessment concluded that for the worst case night-time operating condition, for normal operations, the noise emissions will comply with the Blacktown City Council SEPP59 and the NSW DECCW's Industrial Noise Policy acoustic amenity and intrusiveness requirements at all residential and commercial locations.

During emergency operations the assessment concluded that the noise emissions from the Site comply with the established intrusiveness criterion requirements at all residential and commercial receivers.

1.0 Introduction

AECOM Australia Pty Ltd (AECOM) was engaged by CB Richard Ellis (CBRE) to undertake a Construction and Operational Environmental Noise Impact Assessment for the proposed Eastern Creek Data Centre Stage 1 development site, located between Roberts Road and Capicure Drive, Eastern Creek (the Site). The Site is located within a broader area referred to as the M7 Business Hub at the corner of Old Wallgrove Road and Wallgrove Road, Eastern Creek, within Blacktown City Council Local Government Area (LGA). The location of the Site is shown in Figure 1.

AECOM understands that CBRE have been engaged by a potential purchaser of the Site to assist in the preparation of a Part 3A Environmental Assessment (EA) for the proposed development of the Site. This report was prepared to accompany the Part 3A EA submission to the NSW Department of Planning (DoP) and in accordance with the requirements of *State Environmental Planning Policy No 59* (SEPP 59). It is understood that the proposed future land use for the Site is industrial, as a Tier III Data Centre.

As part of the operational phase, it is proposed that the development will contain up to 10 3 MW Generators and up to 80 Twin City Model 36D4 TCVA Roof Top Fan Units during Stage 1 of the development. A dedicated sub-station servicing the Site will also be located on the south-east corner of the Site. A site plan of the locality is shown in Figure 1 and a general development site layout is presented in Figure 2. In Figure 1, the Site plan identifies the locations of the closest noise sensitive receivers.

The generators are for emergency backup only, and will only be used in emergency situations. The planned normal operation of the Data Centre is for all roof top fan units to be operating at the required capacity to satisfy the demand on the Data Centre. The demand will vary but the worst case operating scenario is with the fans operating at full load at all hours of the day and night-time.

The worst case operating scenario is for all Indirect Air-Side Economizer (IASE) Cooling Systems to be operating at full capacity. AECOM has been engaged to undertake an acoustic assessment of the construction and future operations of the proposed Eastern Creek Data Centre, M7 Business Park, Eastern Creek.

Acoustic terminologies used in this assessment are explained in Appendix A.

1.1 Site description

The proposed Data Centre is to be located at the M7 Business Hub, Capicure Drive, Eastern Creek. The Site location, noise monitoring locations and key sensitive receivers are shown in Figure 1.

The nearest residential receivers are located to the south and south-west in Horsley Park, with additional nearby residential receivers located in Erskine Park, and Minchinbury. The closest residential receivers are located at 138-140 Burley Rd, Horsley Park, approximately 690 metres away from the proposed nearest boundary of the Site, refer to Figure 1.

The nearest commercial receivers are located within the M7 Business Hub to the north-west (Coles), north (Toll), and east (Coca-Cola) of the proposed development site.

For this assessment the proposed layout of the Data Centre site has been identified with reference to Drawing W1001 Issue K, for Project Number 10212102 AR, Dated 16 September 2010 prepared by Woodhead Architects, refer to Figure 2.

Figure 1 Site location, attended and unattended noise monitoring locations and noise sensitive receivers

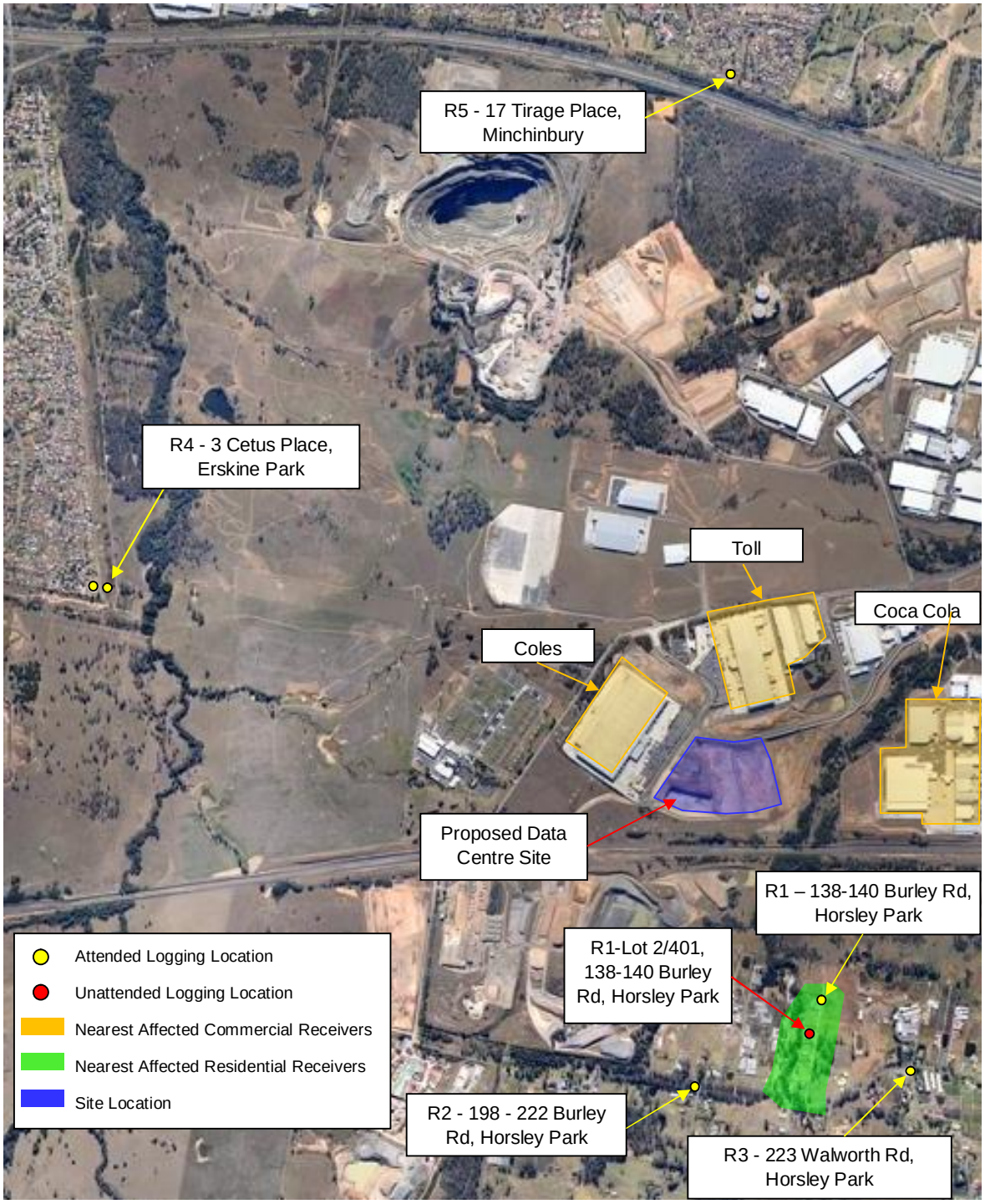
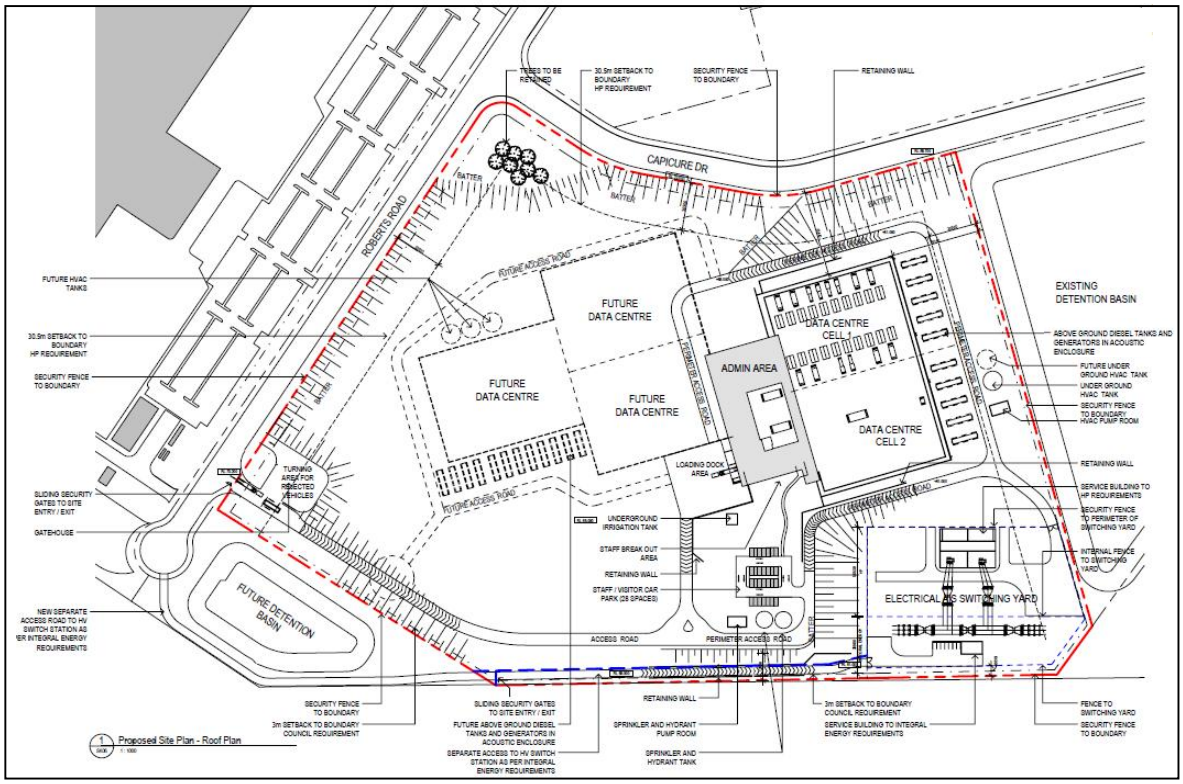


Figure 2 General development site layout



Existing Noise Environment

2.1 Noise monitoring locations

In order to establish the existing noise environment adjacent to the project area, ambient noise monitoring was conducted at a location (refer to Figure 1). The chosen monitoring location is representative of other assessment locations within the area, this was determine from the site inspection, attended noise measurements and from aerial photographs depicting land use surrounding the site.

The noise monitoring was conducted in accordance with the NSW Department of Environment, Climate Change and Water (DECCW) Industrial Noise Policy (INP) requirements. These locations were selected after a detailed inspection of the project area taking into consideration sensitive locations and other noise sources which may influence the measurements.

Table 1 presents the selected monitoring location, whilst Figure 1 shows these noise monitoring locations.

Table 1 Ambient noise monitoring location

Location Noise Monitoring Survey Duration	Description / Address Land Use Zoning	Instrumentation	Comments
Lot 2/401 138-140 Burley Road, Horsley Park Start: 6:45am 26/8/10 Finish: 6:30am 2/9/10	Suburban	SVAN 948 Serial Number:8800	• Noise sensitive residential receiver. • Chosen to determine operational and construction noise emissions criteria. • Assessment location to determine noise levels impacting on residential receivers. • Noise logger located approximately 1.5 m above ground level and approximately 1 m from a facade.

2.2 Unattended ambient noise logging

Unattended noise monitoring of the existing ambient noise levels was undertaken at a location representative of the residential receiver most likely to be adversely affected. An unattended noise logger was installed at Lot 2/401, 138-140 Burley Road, Horsley Park for a period of seven days between Thursday 26 August 2010 and Thursday 2 September 2010. The location of the noise logging location is shown in Figure 1 and described in Table 1. Graphical representation of the logging results are shown in Appendix B.

A noise logger measures the noise level over the sample period and then determines L_{A1}, L_{A10}, L_{A90}, L_{Amax} and L_{Aeq} levels of the noise environment. The L_{A1}, L_{A10} and L_{A90} levels are the levels exceeded for 1%, 10% and 90% of the sample period respectively. The L_{Amax} is indicative of maximum noise levels due to individual noise events. The L_{A90} is taken as the background noise level. The L_{Aeq} level is the equivalent continuous sound level and has the same sound energy over the sample period as the actual noise environment with its fluctuating sound levels.

The background noise level is defined by the DECCW as "the underlying level of noise present in ambient noise when all unusual extraneous noise is removed". It can include sounds that are normal features of a location and may include birds, traffic, insects etc. The background noise level is represented by the $L_{A90,15\,min}$ descriptor. The noise levels measured at the noise logger location were analysed to determine a single assessment background level (ABL) for each day, evening and night period, in accordance with the DECCW's NSW INP.

The ABL is established by determining the lowest tenth-percentile level of the L_{A90} noise data acquired over each period of interest. Table 2 presents the individual ABL's for each day's assessment periods. The background noise level or rating background level (RBL) representing the day, evening and night-time assessment periods is based on the median of individual ABLs determined over the entire monitoring duration. Table 2 also presents the

existing L_{Aeq} ambient noise level, for each day, evening and night-time period, in accordance with the INP. An overall representative L_{Aeq} noise level is determined by logarithmically averaging each assessment period for the entire monitoring duration.

The results are presented in Table 2 with all data affected by adverse weather conditions being excluded from the results.

Table 2 Unattended noise logging results summary

Logger Location	L_{A90}			L_{Aeq}		
Lot 2/401 138-140 Burley Road, Horsley Park	Day	Evening	Night	Day	Evening	Night
Thursday 26 August, 2010	-	-	33	-	-	42
Friday 27 August, 2010	-	-	31	-	-	52
Saturday 28 August, 2010	35	35	31	59	46	50
Sunday 29 August, 2010		32	28	-	48	43
Monday 30 August, 2010	34	35	32	54	47	44
Tuesday 31 August, 2010	32	38	39	48	47	44
Wednesday 1 September, 2010	-	29	32	-	45	38
RBL	34	35	32	-	-	-
Log Average L_{Aeq}	-	-	-	56	47	47

Notes:

1. Day is defined as 7:00am to 6:00pm, Monday to Saturday and 8:00am to 6:00pm Sundays & Public Holidays.
2. Evening is defined as 6:00pm to 10:00pm, Monday to Sunday & Public Holidays.
3. Night is defined as 10:00pm to 7:00am, Monday to Saturday and 10:00pm to 8:00am Sundays & Public Holidays.
4. Where the RBL is calculated to be less than 30 dB(A), then the RBL is set to 30 dB(A) in accordance with DECCW's INP recommendations.

2.3 Attended noise monitoring

Attended noise monitoring was undertaken at a number relevant locations on 13 August 2010 between 1:15am and 4:15am the result of which are shown in Table 3. The attended noise monitoring locations are shown on Figure 1. The attended measurements were made to assist in quantifying the contributing noise sources at the different monitoring locations and validation of the monitoring data.

Table 3 Attended noise monitoring results summary

Monitoring Location	Date of Measurement	Time of Measurement	$L_{Aeq, 15min}$	$L_{A90, 15 min}$ (Background Noise Level)	Existing Noise Environment
R1 - 138-140 Burley Rd, Horsley Park	13 August 2010	03:15	39	37	Distant traffic noise (M7 to SSE), environmental noise (e.g. crickets, dogs), industrial noise to NNE (e.g. fan noise, reversing alarms)
R2 - 198-222 Burley Rd, Horsley Park	13 August 2010	03:45	38	36	Distant traffic noise (M4 to N, and M7 to SSE), environmental noise (e.g. crickets, frogs), industrial noise to NNE (e.g. fan noise, reversing alarms)
R3 - 223 Walworth Rd, Horsley Park	13 August 2010	04:05	39	37	Distant traffic noise (M7 to SE), environmental noise (e.g. crickets, frogs, dogs), industrial noise to W (e.g. fan noise)
R4 - 3 Cetus Place, Erskine Park –East of houses	13 August 2010	02:10	39	36	Distant industrial noise (trucks, reverse alarms, engine noise) from SW, environmental noise (e.g. crickets)
R4 - 3 Cetus Place, Erskine Park –In Cul-de-sac	13 August 2010	02:30	36	33	Distant industrial noise (trucks, reverse alarms, engine noise, fan noise) from SW, trucks to N (airbrakes and engines), environmental noise (e.g. crickets)
R5 - 17 Tirage Place, Minchinbury	13 August 2010	01:30	53	46	M4 vehicle traffic noise, environmental noise (e.g. frogs)

3.0 Construction Noise and Vibration Criteria

3.1 Construction noise criteria

In July 2009 the NSW Department of Environment, Climate Change and Water (DECCW) published the *Interim Construction Noise Guidelines (ICNG)* for use in construction noise assessment. This document replaces the previous publication the *Environmental Noise Control Manual (ENCM)* and is used as the basis for establishing construction noise criteria for the proposed development.

Under the existing DECCW policy a construction noise management plan is required to be compiled by the Contractor, prior to construction commencing. Noise level objectives must be set for the daytime evening and night-time periods, and must be complied with where reasonably practicable. Work that is proposed outside of standard working hours, as defined in the *ICNG*, generally requires strong justification.

The noise management plan should detail the '*best practice*' construction methods to be used, presenting a reasonable and feasible approach. The plan should identify the extent of the residential area affected and assess the impact on residents. The plan should detail any community relation programs that are planned e.g. prior notification for particularly noisy activities, letter box drop regarding out of hours construction work to be undertaken and a 24 hour contact phone number for residents to call should they have any complaints or questions.

The *ICNG* defines what is considered to be feasible and reasonable as follows:

> *"Feasible*
>
> *A work practice or abatement measure is feasible if it is capable of being put into practice or of being engineered and is practical to build given project constraints such as safety and maintenance requirements.*
>
> *Reasonable*
>
> *Selecting reasonable measures from those that are feasible involves making a judgment to determine whether the overall noise benefits outweigh the overall adverse social, economic and environmental effects, including the cost of the measure."*

The *ICNG* recommends that a quantitative assessment is carried out for all *'major construction projects that are typically subject to the EIA process'*. A quantitative assessment, based on a likely '*worst case*' construction scenario, has been carried out for the Eastern Creek Data Centre.

Predicted noise levels at nearby sensitive receivers (residential, commercial and industrial premises) are compared to the levels provided in Section 4 of the *ICNG*. Where an exceedance of the criteria is predicted the *ICNG* advises that the proponent should apply all feasible and reasonable work practises to minimise the noise impact.

Construction noise management levels (NMLs) for residential receivers are set using the information in Table 4.

Table 4 Noise management levels at residences using quantitative assessment

Time of Day	Management Level $L_{Aeq\ (15min)}$[1]	How to Apply
Recommended standard hours: Monday to Friday 7 am to 6 pm Saturday 8 am to 1 pm No work on Sundays or public holidays	Noise affected RBL + 10 dB	The noise affected level represents the point above which there may be some community reaction to noise. • Where the predicted or measured $L_{Aeq\ (15\ min)}$ is greater than the noise affected level, the proponent should apply all feasible and reasonable work practices to meet the noise affected level. • The proponent should also inform all potentially impacted residents of the nature of works to be carried out, the expected noise levels and duration, as well as contact details.
	Highly noise affected 75 dB(A)	The highly noise affected level represents the point above which there may be strong community reaction to noise. • Where noise is above this level, the relevant authority (consent, determining or regulatory) may require respite periods by restricting the hours that the very noisy activities can occur, taking into account: • times identified by the community when they are less sensitive to noise (such as before and after school for works near schools, or mid-morning or mid-afternoon for works near residences. • If the community is prepared to accept a longer period of construction in exchange for restrictions on construction times.
Outside recommended standard hours	Noise affected RBL + 5 dB	• A strong justification would typically be required for works outside the recommended standard hours. • The proponent should apply all feasible and reasonable work practices to meet the noise affected level. • Where all feasible and reasonable practices have been applied and noise is more than 5 dB(A) above the noise affected level, the proponent should negotiate with the community. • For guidance on negotiating agreements see section 7.2.2 of the ICNG.

Notes:

1. Noise levels apply at the property boundary that is most exposed to construction noise, and at a height of 1.5 m above ground level. If the property boundary is more than 30 m from the residence, the location for measuring or predicting noise levels is at the most noise-affected point within 30 m of the residence. Noise levels may be higher at upper floors of the noise affected residence.

3.1.1 Construction noise management levels

It is assumed that the construction activities will take place predominantly during recommended standard working hours (7.00 am – 6.00 pm Monday to Friday and 8.00 am – 1.00 pm Saturday). However, oversized loads and emergency work may need to be conducted outside recommended standard working hours.

Construction noise management levels for the nearest affected residential receivers are shown in Table 5.

Table 5 Construction noise management levels – Residential receivers

Residential Receivers	Daytime RBL L_{A90} dB(A)	Daytime Noise Management Levels L_{Aeq} dB(A)	Evening RBL L_{A90} dB(A)	Evening Noise Management Levels L_{Aeq} dB(A)	Night-time RBL L_{A90} dB(A)	Night-time Noise Management Limit L_{Aeq} dB(A)
R1 – R5	34	44	34[1]	39	32	37

Notes:

1. The DECCW's INP application notes recommends that when higher background noise levels (RBL) occur in the evening assessment period, that the criteria are generally set to the lower daytime criteria in accordance with community expectations.

Noise management levels for other sensitive land uses around Eastern Creek, such as schools, places of worship are shown in Table 6. However, it is noted that there are no sensitive receivers in close proximity to the proposed development site.

Table 6 Construction noise management levels – Sensitive land uses other than residential

Land Use	Management Level, $L_{Aeq\ (15\ min)}$ (applies when properties are in use)
Classrooms at schools and other educational institutions	Internal noise level 45 dB(A)
Places of worship	Internal noise level 45 dB(A)
Active recreation areas (characterised by sporting activities and activities which generate their own noise or focus for participants, making them less sensitive to external noise intrusion)	External noise level 65 dB(A)
Passive recreation areas(characterised by contemplative activities that generate little noise and where benefits are compromised by external noise intrusion, for example, reading, meditation)	External noise level 60 dB(A)
Community centres	Depends on the intended use of the centre. Refer to the recommended 'maximum' internal levels in AS2107 for specific uses.

Criteria for industrial (e.g. Distribution Centres) and commercial premises (e.g. general retail), are shown below:

- Industrial premises: external $L_{Aeq\ (15min)}$ 75 dB(A), and
- Offices, retail outlets: external $L_{Aeq\ (15min)}$ 70 dB(A).

3.2 Construction vibration criteria

Unlike the criteria applicable to noise emissions, vibration criteria are the same for both the construction and operational phases of this project. DECCW's '*Assessing Vibration: a technical guideline*', (DECCW, 2006) has been designed to be used in evaluating and assessing the effects on amenity of vibration emissions from industry, transportation and machinery. The guideline is used in assessments of vibration impacts caused by the construction and operation of new developments.

Vibration criteria are set primarily according to whether the particular activities of interest are continuous in nature or intermittent, whether they occur during the daytime or night-time and the type of receiver to be assessed e.g. commercial or residential.

The effects of vibration in buildings can be divided into three main categories:

- Those in which the occupants or users of the building are inconvenienced or possibly disturbed, i.e. human disturbance or discomfort;
- Those in which the integrity of the building or the structure itself may be prejudiced; and
- Those where the building contents may be affected.

Therefore, vibration levels at sensitive receiver locations must be controlled so as to prevent discomfort and regenerated noise, and in some extreme cases, structural damage.

For the proposed Eastern Creek Data Centre, the nearest residential receivers (vibration sensitive) are located more than 600m from the proposed development site. The existing nearby distribution centres and industrial developments are located approximately 115m from the proposed Eastern Creek Data Centre site. This facility is neither noise nor vibration sensitive. At such distances, the risk of discomfort, regenerated noise and structural damage impacting receivers is extremely low and needs not to be considered further.

Vibration levels on residential receivers due to additional traffic generated by the proposed development during the construction phase are considered insignificant. This is due to the small number of additional heavy vehicles forecast during the construction phase of the project, refer to Section 6.0 for predicted construction traffic numbers. Therefore, from a vibration perspective, the issue of impacts caused by the construction of the Eastern Creek Data Centre need not be considered further.

4.0 Operational Noise and Vibration Criteria

4.1 Operational noise criteria

The following documents have been used to established site specific criteria for the operation of the proposed Data Centre:

- State Environmental Planning Policy No 59 (SEPP59) – Central Western Sydney Economic and Employment Area – Eastern Creek Precinct; and
- NSW Department of Environment, Climate Change and Water's Industrial Noise Policy (INP).

4.1.1 State Environmental Planning Policy No 59 (SEPP59) – Central Western Sydney Economic and Employment Area – Eastern Creek Precinct

The acoustic criteria have been determined directly from the SEPP 59 and are presented in Table 7. The optimum noise level goals presented in Table 7 represent the optimal noise contribution from each zone to protect the acoustic amenity of residential areas surrounding the Precinct.

Table 7 Optimum noise level goals as specified in the SEPP 59 – Eastern Creek Precinct Plan (Stage 3)

Period	Zone 1	Zone 2	Zone 3	Zone4	Zone 5	Zone 6
Day	57 dBA	54 dBA	56 dBA	54 dBA	49 dBA	52 dBA
Evening	47 dBA	44 dBA	46 dBA	44 dBA	39 dBA	42 dBA
Night	42 dBA	40 dBA	40 dBA	39 dBA	34 dBA	37 dBA

The proposed development site is located within Zone 6 of the noise emission zones specified in the SEPP 59.

It is understood that the noise emission criteria presented in the report was derived from predicted noise contributions from a number of noise zones within the M7 Business Hub, and the limiting noise goals that have been adopted within the SEPP59 have been derived to be assessed at the nearest affected residential location.

The zone noise level goals specified in the SEPP 59 are for the total contribution of a zone to the nearest residential receiver. As a result, it is necessary to take into consideration the other operational sources within Zone 6, so that the proposed development (Data Centre Phase 1) does not contribute an uneven share and takes up the entire allowable noise quota allocate to Zone 6.

The proposed Data Centre is one of four industrial sites within the designated Zone 6 under the SEPP59. Accordingly, it is reasonable to assume that the site should contribute a quarter of the noise quota from the Zone, and as such should contribute 6 dB below the zone limit for the most stringent period, refer to Table 7 for these noise level goals.

In addition, it should be noted that the current development is Stage 1 of 2. It is proposed that a similar facility is to be constructed at a future point in time with three (3) data halls for Stage 2 in addition to the two (2) data halls proposed for the current stage (Stage 1). The additional data halls are to be constructed adjacent to the Stage 1 development. As a result it is important to take into consideration the total contribution that the site may make on the nearest affected receiver when the site is fully developed. To take this into consideration the noise emissions from Stage 1 should be designed to be 4dB below the required total noise contribution from the site when Stages 1 and 2 are completed. This is based upon the assumption that Stage 2 will have three (3) data halls, each of similar noise levels to that of two (2) constructed in Stage 1. The final noise goals for the proposed Eastern Creek Data Centre Stage 1 development to comply with SEPP59 requirements are specified in Table 8.

Table 8 Environmental noise emission criterion under the SEPP59– Normal operations

Period	Zone 6 Criterion, dB(A)	Quarter contribution of Zone 6 Criterion
Day	52	42
Evening	42	32
Night	37	27

4.1.2 Department of Environment, Climate Change and Water's criteria - General considerations

The NSW DECCW's Industrial Noise Policy's (INP) objectives are to preserve the amenity of the environment and to protect against noise intrusion. The amenity of the environment is protected by assessing the absolute noise levels against acceptable levels for a particular land use. Noise intrusion is prevented by restricting the level by which a noise source may intrude above the prevailing background noise levels. In most cases either the intrusive criterion or the amenity criterion is more stringent and sets the allowable noise levels for the proposed development.

In order to satisfy the above requirements at noise-sensitive receptors such as residences, amenity and intrusive noise criteria are recommended for daytime (7am to 6pm), evening (6pm to 10pm) and night-time assessment periods (10pm to 7am).

4.2 Intrusive noise impacts

The INP states that the noise from any single source should not intrude greatly above the prevailing background noise level. Industrial noise sources are generally considered to be acceptable if the equivalent continuous (energy-averaged) A-weighted level of noise from the source (L_{Aeq}), measured over a 15 minute period, does not exceed the background noise level measured in the absence of the source by more than 5 dB(A). This is often termed the Intrusiveness Criterion.

The 'Rating Background Level' (RBL) is the background noise level to be used for assessment purposes and is determined by the methods given in the INP. Using the rating background noise level approach results in the intrusiveness criterion being met for 90% of the time. Adjustments are to be applied to the level of noise produced by the source that is received at the assessment point where the noise source contains annoying characteristics such as tonality or impulsiveness. These adjustments are not required for this investigation.

Table 9 Environmental noise emission intrusiveness criterion – Normal operations

Period	RBL (L_{A90}), dB(A)	Intrusiveness Criterion (RBL + 5), dB(A)
Nearby residential receivers		
Day	34	39
Evening	35[1]	39
Night	32	37

Notes:

1. The DECCW's INP application notes recommends that when higher background noise levels (RBL) occur in the evening assessment period, that the criteria are generally set to the lower daytime criteria in accordance with community expectations.

4.3 Protecting noise amenity

To limit continuing increases in noise levels, the maximum ambient noise level within an area from industrial noise sources should not normally exceed the acceptable noise levels specified in the INP. That is, the background noise level should not exceed the level appropriate for the particular locality and land use. This is often termed the Background Creep or Amenity Criterion.

When the existing noise level from *industrial noise sources* is close to the "Acceptable Noise Level" (ANL) given above, noise from the new source must be controlled to preserve the amenity of the area in line with the requirements of the INP. However, industrial noise is not significant at this site. The dominant source of noise is that of road traffic.

For both the commercial properties adjacent to the subject site and the potential affected nearby residential receivers, such as Horsley Park, which can be classified a suburban area, the recommended amenity criteria are shown in Table 10.

Table 10 Recommnded L_{Aeq} noise levels from industrial noise sources

Type of Receiver	Noise Amenity Area	Time of Day	Recommended L_{Aeq} Noise Level, dB(A)	
			Acceptable	Recommended Maximum
Residential	Suburban	Day	55	60
		Evening	45	50
		Night	40	45
Commercial	-	When in use	65	70

4.4 Tonality

The DECCW Industrial Noise Policy provides additional guidance and criteria for assessing noise emission from sources defined (by procedures contained within the Policy) as 'tonal' in nature. Of significance to substation noise is that penalties of up to 5 dB(A) may be applied where the subject noise emission is tonal or with significant low frequency content at the receiver.

A penalty is applied when the level of a one-third octave band exceeds the level of each adjacent band by:

- 5 dB(A) or more if the frequency band containing the tone is above 400 Hz;
- 8 dB(A) or more if the frequency band containing the tone is below 400 Hz and above 160 Hz inclusive; and
- 15 dB(A) or more if the frequency band containing the tone is below 160 Hz.

4.5 Emergency plant and equipment

It is understood that brown-outs and black-outs are extremely rare for the area and in addition redundancy has been built into the incoming power supply, and as result of this the use of the emergency generators will be extremely rare.

For this reason and in the absence of any relevant NSW guideline for emergency generators and equipment, it is therefore recommended that noise limits for emergency plant equipment be relaxed. It is recommended that the noise emission from emergency plant and equipment be set to 10 dB(A) above the background (RBL).

It is also recommended that all emergency plant and equipment be tested during the day (7am to 6pm).

Table 11 Environmental noise emission intrusiveness criterion – Emergency operations

Period	RBL (L_{A90}), dB(A)	Intrusiveness Criterion (RBL + 10), dB(A)[2]
138-140 Burley Rd, Horsley Park		
Day	34	44
Evening	35[1]	44
Night	32	42

Notes:

1. The DECCW's INP application notes recommends that when higher background noise levels (RBL) occur in the evening assessment period, that the criteria are generally set to the lower daytime criteria in accordance with community expectations.
2. Relaxation of criterion to BG+10 dB(A) as the equipment being used is emergency plant.

4.6 Project specific noise criteria

A summary of the environmental noise criteria that applies to the subject Site is given in Table 12, and has been compiled with reference to the SEPP 59, and the DECCW INP intrusive and amenity criteria. As the noise emissions from the Data Centre would be dominated by a relatively steady-state mechanical services noise, the L_{Aeq} period has been assumed to be equal to the assessed $L_{Aeq,15min}$ for the worst case operational scenario. This represents a conservative assumption.

In summary, the project specific noise emission criterion established by the SEPP 59 for this site is **27 dB(A)** during the night-time period. Since operation of plant and equipment is the same during the day as it is at night a conservative approach of using the night-time limit for other periods (day-time and evening) will be used. Compliance with night-time criteria will ensure compliance with the day and evening period.

Table 12 presents the noise limits for the proposed site. Noise emission from the site should not exceed these levels at the boundary of any residential receptor and commercial premises.

Table 12 Summary of environmental noise criteria, L_{Aeq} - dB(A)

Receiver	Time of Day	Operational noise limit, L_{Aeq}, dB(A)	Emergency plant and equipment noise limit, L_{Aeq} dB(A)
Residences	Day	39	44
	Evening	32	44
	Night	27	42
Commercial premises	When in use	65	70

4.7 Meteorological effects

In accordance with the DECCW INP adverse meteorological conditions must be considered for the subject Site.

4.7.1 Meteorological data

Long term weather data for the area was sourced from the Bureau of Meteorology for Station 067119 – Horsley Park for the period of 2007 to 2010 to determine the direction of dominant wind conditions, and prevalence of temperature inversions and wind speed and directions in the area.

4.7.1.1 Temperature inversion

The occurrence of F and G class inversions was determined and assessed individually and together for the total night-time period during the winter months (June, July and August) of these years. It was concluded that class F and G inversions occurred less that 30% of the total winter night-time period for each year, with an overall average of 23% occurrence of both F and G class inversions.

As a result and in accordance with the INP guidelines, F and G class inversions have not been included in the assessment as they do not occur often enough to be considered significant and warrant assessment.

4.7.1.2 Prevailing wind conditions

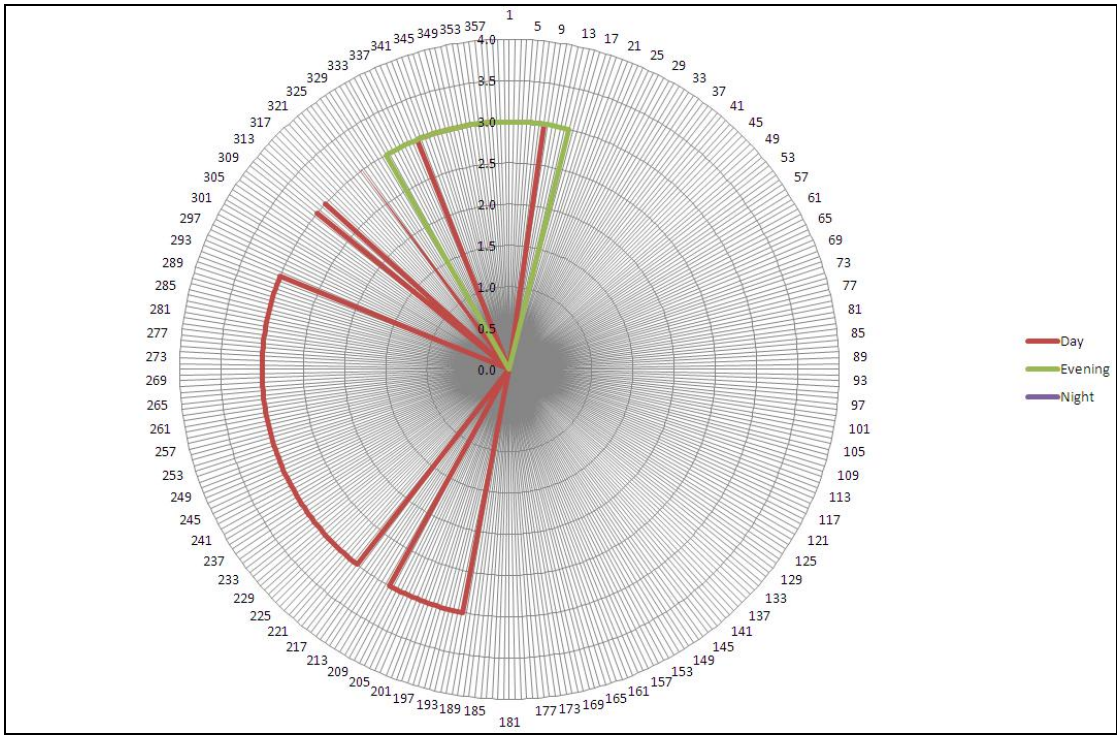
The INP considers wind effects to be assessed when source-to-receiver wind speeds of 3 m/s or below occur for at least 30% of the assessment period in any season. The occurrences of wind speeds of up to 3 m/s for each season are provided in Appendix E. A summary of affected residential receivers is provided in Table 13.

Table 13 Wind affected residential receivers

Receiver	Approximate Angle (Degrees)	Wind Affected		
		Day	Evening	Night
R1	**163**	Yes	Yes	No
R2	**192**	No	No	No
R3	**152**	No	No	No
R4	**285**	No	No	No
R5	**359**	No	No	No

The INP requires wind effects to be modelled at the highest measured wind speed. For all locations receivers that are wind affected they will be modelled at 3 m/s, this represents a conservative approach. A summary of the modelling requirements is provided graphically in Figure 3.

Figure 3 Wind speed modelling



When there is at least a 30% occurrence of wind speed below 3 m/s, the INP requires the highest wind speed to be modelled rather than the default wind speed of 3 m/s. The wind assessment has found only a small number of angles with wind speeds below 3 m/s; all of which, the discrepancies are only marginal. As such all receivers that have an occurrence of at least 30% have been modelled at 3 m/s. This will result in a slightly conservative assessment.

4.8 Sleep disturbance criteria

DECCW's INP has recently been updated with application notes which discuss sleep disturbance and its objective assessment.

To minimise the risk of sleep disturbance as a result of industrial type operations during the night-time period, the DECCW's INP application notes recommends that, the $L_{A1(1\ minute)}$ noise level outside a bedroom window should not exceed the L_{A90} background noise level by more than 15 dB(A) during the night-time period (10.00 pm to 7.00 am). DECCW considers it is appropriate to use this metric as a screening criterion to assess the likelihood of sleep disturbance. If this screening criterion is found to be exceeded then a more detailed analysis must be undertaken and include the extent that the maximum noise level exceeds the background noise level and the number of times this is likely to happen during the night-time period.

Based on the measured background noise levels during the night, the sleep disturbance criteria for the nearest noise sensitive residential receivers are presented in Table 14.

Table 14 Night-time sleep disturbance criteria

Location	Measured RBL $L_{A90,\ 15\ mins}$ dB(A)	Sleep Disturbance Criteria $L_{A1\ (1\ minute)}$ dB(A)
138-140 Burley Rd, Horsley Park	32	47
198-222 Burley Rd, Horsley Park	32	47
223 Walworth Rd, Horsley Park	32	47

4.9 Operational vibration criteria

Unlike the criteria applicable to noise emissions, vibration criteria are the same for both the construction and operational phases of this project. The DECCW's '*Assessing Vibration: a technical guideline*', (DECCW, 2006) has been designed to be used in evaluating and assessing the effects on amenity of vibration emissions from industry, transportation and machinery. The guideline is used in assessments of vibration impacts caused by the construction and operation of new developments.

Vibration criteria are set primarily according to whether the particular activities of interest are continuous in nature or intermittent, whether they occur during the daytime or night-time and the type of receiver to be assessed e.g. commercial or residential.

The effects of vibration in buildings can be divided into three main categories:

- Those in which the occupants or users of the building are inconvenienced or possibly disturbed, i.e. human disturbance or discomfort;
- Those in which the integrity of the building or the structure itself may be prejudiced; and
- Those where the building contents may be affected.

Therefore, vibration levels at sensitive receiver locations must be controlled so as to prevent discomfort and regenerated noise, and in some extreme cases, structural damage.

For the proposed Eastern Creek Data Centre, the nearest residential receivers (vibration sensitive) are located more than 600m from the proposed development site. The existing nearby distribution centres and industrial developments are located approximately 115m from the proposed Eastern Creek Data Centre site. This facility is neither noise nor vibration sensitive. At such distances, the risk of discomfort, regenerated noise and structural damage impacting receivers is extremely low and needs not to be considered further.

Vibration levels on residential receivers due to additional traffic generated by the proposed development during the operational phase are considered insignificant. This is due to the small number of additional heavy vehicles forecast during the operational phase of the project refer to Section 6.0 for operational traffic numbers.

Therefore, from a vibration perspective, the issue of impacts caused by the construction and operation of the Eastern Creek Data Centre need not be considered further.

4.10 Road traffic noise criteria

DECCW's Environmental Criteria for Road Traffic Noise (ECRTN) has been used to assess the noise arising from traffic generated by the proposed development. The ECRTN guidelines are applicable for traffic movements generated during the construction phase of the project as well as additional traffic generated during the operational phase.

4.10.1 Road traffic noise levels

The main road providing access to the proposed development is Wallgrove Road. This road would be classified as an existing collector road. Table 15 presents the road traffic noise criteria from the DECCW for land use developments with a potential to create additional traffic on existing collector roads. The external noise criteria are applied 1 m from the external facade of the affected building.

Table 15 Road traffic noise criteria – Collector roads

Period	Parameter	Criterion
Collector Roads		
Day (7:00 am – 10:00 pm)	$L_{Aeq\ (15hr)}$	60 dB(A)
Night (10:00 pm – 7:00 am)	$L_{Aeq\ (9hr)}$	55 dB(A)

Note that where the criteria have already been exceeded the DECCW recommends that

> *"Where feasible and reasonable, existing noise levels should be mitigated to meet the noise criteria. Examples of applicable strategies include appropriate location of private access roads; regulating times of use; using clustering; using quiet vehicles; and using barriers and acoustic treatments.*
>
> *In all cases traffic arising from the development should not lead to an increase in existing noise levels of more than 2 dB."*

5.0 Construction Noise Assessment

The construction of Eastern Creek Data Centre will most likely involve various stages and activities as outlined below in Table 16. At the point in time that this assessment was undertaken a contractor had not yet been selected for the construction of the Data Centre. As a result of the contractor not being selected the following phases have been developed from experience on similar projects, and as a result is only an indicative list of construction stages and activities. It will be required for this to be reassessed when the selection of a contractor is finalised and the construction program and associated equipment has been formulated.

Two key noise producing typical construction phases have been modelled at the site to give an indication on the noise emissions that the nearest residential and commercial receivers will experience. The two important construction phases that have been modelled are the site preparation and the erection of the buildings structure.

Table 16 Eastern Creek Data Centre – Construction program

Eastern Creek Data Centre Construction Program
Site establishment
Site establishment includes the set up of facilities and services to support the construction activities. The main activities are to establish facilities such as access roads, offices, amenities, construction camp, initial storage areas and stores buildings, security arrangements, etc and arrange critical services such as power, water, communications, etc. During this early stage, any additional geotechnical investigations are completed to enable detailed foundation designs to be finalised.
Site preparation
Site preparation involves primarily civil works to clear and level the main site and surrounding areas as applicable, establish drainage systems, install facilities for underground services (e.g. reticulated water, electrical conduits), etc ready for erection of the equipment.
Excavation and construction of foundations and underground services
Depending on the final foundation design, excavation for foundations will be undertaken. Formwork is assembled, concrete is poured and completed foundations are back-filled. Once the major foundations are complete, foundations for other structures, plant and equipment can commence. Where specific underground services are required these services are installed in conjunction with the foundation works to avoid subsequent excavation and disturbance of the foundations.
Erection of building structure
Generally once the foundations are complete, erection of building structure can commence. First the basic “shell” of the building is completed to allow access for lifting and installation of equipment into the building. It also maximises the space available for site-run minor pipework and cabling. Once the equipment is installed, the construction of the building can be completed.
On-site pre-assembly of component parts and installation
Equipment and components will be progressively delivered to site. The size of most deliveries will be dictated by the method of transport and any associated limitations. Larger equipment will be delivered in modules or components for pre-assembly at site prior to installation.

5.1 Construction noise assessment scenario

Two construction scenarios have been modelled, for the purpose of this assessment.

The two construction scenarios modelled are considered to be the nosiest activities and are described below:

- Site preparation which will include large civil construction equipment noise sources such as vibratory rollers, concrete mixer trucks, graders, excavators, trucks; and
- During steelwork/equipment which will include cranes, flat bed delivery trucks, generators, concrete saws and grinders.

The acoustic impact at sensitive receptors resulting from construction activities has been assessed based on a likely construction scenario. The assumed scenario is considered to be representative of likely site activities and the impact has been assessed based on the 'worst case' i.e. the shortest distance between source and receivers.

Typical sound power levels used for the construction noise assessment have been included in Appendix D.

The predicted construction noise levels at nearby sensitive receivers are shown in Table 17. Noise contour plots for the two construction scenarios are presented in Appendix C.

Table 17 Predicted construction noise levels – Site preparation

Receiver	Location	Construction Noise Management Levels dB(A)	Predicted L_{Aeq} Noise Levels, dB(A)	Predicted Exceedance dB(A)
		Day	Day	Day
R1	138-140 Burley Rd, Horsley Park	44	41	-
R2	198-222 Burley Rd, Horsley Park	44	39	-
R3	223 Walworth Rd, Horsley Park	44	38	-
R4	3 Cetus Place, Erskine Park	44	<20	-
R5	17 Tirage Place, Minchinbury	44	<20	-

Table 18 Predicted construction noise levels – Erection of structure

Receiver	Location	Construction Noise Management Levels dB(A)	Predicted L_{Aeq} Noise Levels, dB(A)	Predicted Exceedance dB(A)
		Day	Day	Day
R1	138-140 Burley Rd, Horsley Park	44	40	-
R2	198-222 Burley Rd, Horsley Park	44	38	-
R3	223 Walworth Rd, Horsley Park	44	37	-
R4	3 Cetus Place, Erskine Park	44	<20	-
R5	17 Tirage Place, Minchinbury	44	<20	-

Construction activities associated with the two construction scenarios do not result in any predicted exceedance of the noise management level at nearby sensitive residential locations during the daytime (i.e. DECCW's standard construction hours).

5.1.1 Discussion

The construction noise impact assessment results presented in Table 17, Table 18 and Appendix C are for neutral weather conditions. The predicted construction noise levels are well below the established construction noise management levels. Under adverse weather conditions construction noise levels may increase by up to 5 dB(A), however, construction noise levels would still remain below the established construction noise criteria at all assessment locations during the daytime period.

The predicted construction noise emissions from the proposed Eastern Creek Data Centre indicates compliance under adverse meteorological conditions at all assessment locations during the daytime period.

5.1.2 Industrial premises

The noise impact at the closest industrial type receivers, existing Eastern Creek Data Centre is predicted to be 56 dB(A). This complies with the construction noise management levels for industrial type premises.

6.0 Road Traffic Noise Assessment

6.1 Construction and operational traffic noise

Traffic generated during the construction and operation phase of the Data Centre are predicted to be insignificant, therefore the construction and operational traffic impact on local roads would be minimal.

7.0 Operational Acoustic Assessment

7.1 Equipment

7.1.1 Backup emergency generator - MTU 3 MW Generator

The following assessment is based upon the ten (10) backup emergency generators to be installed on the southern boundary of the site. The location of the generator has been based upon the location shown on Drawing W1001 Issue K, for Project Number 10212102 AR, Dated 16 September 2010 drawn by Woodhead Architects, refer to Figure 2. Data for the final pieces of equipment that are to be installed was not available at the time of this assessment, and so this assessment has been based upon the acoustic characteristics of a CAT C175-16 2.4 MW Generator, with an enclosure and exhaust silencers attached, so as to model the spectrum of a typical similar sized generator with attenuation.

Information provided to AECOM by Hewlett Packard Engineers stated that with the backup generator installed with an acoustic enclosure that will produce a sound pressure level of 65 dB(A) at 5 feet from the entire installed unit, including both the exhaust and mechanical noise of the generator (this information is based upon the enclosure design provided by Professional Power Produces, Inc. 448 W. Madison St, Darien, WI 53114, Project 151027 Drawing 13656D100, Rev. D, dated 02/21/06). The modelled spectrum has been adjusted accordingly to comply with this specification. The assessment has been conducted assuming the standby generator has been fitted an acoustic enclosure that will achieve this noise emission. The sound power levels as used in the assessment are provided in Table 20.

The proposed function of this standby generator is as follows:

- Provide backup power in emergency and power failure situations.

The following table presents the sound power levels for the standby generator at maximum load that have been used for this assessment.

Table 19 Generator with attenuation sound power level

Description	Octave band noise levels, dB								
Frequency, Hz	dB(A)	63	125	250	500	1000	2000	4000	8000
Backup Generator with Acoustic Enclosure, SWL, dB	93	84	81	74	74	81	85	88	88

7.2 Roof top fan units – Twin City Model 36D4 TCVA Axial Fan Unit

The Eastern Creek Data Centre is to include 80 Model 36D4 TCVA Axial Fan Units, as part of the Indirect Air-Side Economizer (IASE) cooling systems, which are to be installed on the roof of the development for the purposes of cooling of the Data Centre. The operational acoustic assessment has been based upon the fans each having the sound power levels presented in Table 20.

Table 20 Model 36D4 TCVA Axial Fan Sound Power Level (SWL)

Description	Octave band noise levels, dB								
Frequency, Hz	dB(A)	63	125	250	500	1000	2000	4000	8000
36D4 TCVA Axial Fan – Inlet SWL, dB	80	82	80	80	79	75	68	64	65

7.3 60 MVA Transformers

The Eastern Creek Data Centre is to include a substation in the south-east corner of the site which is to include two 60 MVA transformers, refer to Figure 2. The transformers may operate at full load during the day and night period. The 60 MVA transformers that are to be installed have been modelled using a scaled spectrum from

measured sound pressure levels of transformers obtained by AECOM in previous acoustic assessments. We have been informed by AECOM Electrical Engineers that the 60 MVA transformers that are to be installed on site are to have a sound power of 91 dB(A) in the 'standard limit' configuration and 84 dB(A) in the 'reduced limit' configuration. It has been assumed that the new transformers will be fan cooled. A representative noise level was used for each transformer based upon the assumption of up to 12 fans per transformer. The overall noise levels have been scaled to an overall sound power level of 84 dB(A), as the 'reduced limit' has been selected as a result of predicted noise levels at the nearest affected receiver.

The operational acoustic assessment has been based upon the transformers each having the sound power levels presented in Table 21.

Table 21 60 MVA transformer sound power level (SWL)

Description	Octave band noise levels, dB								
Frequency, Hz	dB(A)	63	125	250	500	1000	2000	4000	8000
60 MVA Transformer including up to 12 cooling fans	84	79	79	83	84	77	72	68	62

7.4 Methodology

Noise levels from the proposed development in operation have been predicted at nearby noise sensitive receivers using SoundPLAN 7.0 (industry standard) noise modelling software.

The modelling includes:

- Ground topography;
- Buildings and structures;
- All sources behave as point sources;
- All sources are 'on' during any 15 minute period to simulate a worst case;
- Ground Absorption (set at 60%); and
- Representative operational noise sources.

It can be expected that there may be differences between predicted and measured noise levels due to variations in instantaneous operating conditions, plant in operation during the measurement and also the location of the plant equipment.

7.4.1 Modelling assumptions

The following assumptions have been made in modelling operation of the proposed Data Centre Stage 1 development scenarios:

- The worst case scenario is with all 80 36D4 TCVA Roof Top Fan Units and substation operation at full capacity;
- All fan units will be in operation in an emergency situation, along with all generators operating at full capacity; and
- The overall noise levels of the transformers have been based on sound power level of 84 dB(A), in the 'reduced limit' configuration.

7.4.2 Meteorological conditions modelled

The noise contribution of the proposed operational scenarios at the nearest residential and industrial type receivers has been estimated based on the following meteorological parameters:

Night-time - Calm meteorological conditions

Night-time calm meteorological conditions are described by 10^{o} C air temperature, 70% Relative Humidity, 0.5 m/s wind speed, 0^{o} C/100 m temperature gradient and an air stability class D.

Table 22 and Appendix C present the computed noise emissions from the SoundPLAN model at the nearest noise assessment locations under calm meteorological conditions.

Prevailing wind conditions

Wind conditions model for the construction and normal operational scenarios was:

- 3 m/s from all directions during the evening period (prevailing wind period).

Table 22 and Appendix C present the computed noise emissions from the SoundPLAN model at the nearest noise assessment locations under prevailing wind conditions during the evening period.

7.5 Residential receivers

7.5.1 Environmental noise emission during normal operation

The results of the environmental noise emissions during normal operations at nearby residential receivers are presented in Table 22 and the noise contour maps are presented in Appendix C.

Table 22 Noise contribution at worst affected residential receivers during worst case operational conditions

Receiver	Location	Neutral (Night-time)			Worst Case Wind Conditions[1] 3 m/s From all Directions (Evening)		
		Result	Criterion	Exceed	Result	Criterion	Exceed
R1	138-140 Burley Rd, Horsley Park	26	27	-	30	32	-
R2	198-222 Burley Rd, Horsley Park	24	27	-	N/A	N/A	-
R3	223 Walworth Rd, Horsley Park	23	27	-	N/A	N/A	-
R4	3 Cetus Place, Erskine Park	<20	27	-	N/A	N/A	-
R5	17 Tirage Place, Minchinbury	<20	27	-	N/A	N/A	-

Notes:

1. Refer to Table 13 to reference when and which receivers are wind affected.

The noise emission of the combined noise producing equipment to be installed as part of the Eastern Creek Data Centre at the M7 Business Hub is predicted to comply with the night-time noise impact criterion at all noise sensitive receivers, located to the south and south-west of the subject site along Burley Road, Horsley Park. The results of this assessment are presented in Table 22 and the noise contour maps are presented in Appendix C. Compliance will also be achieved at all other critical noise sensitive receivers.

Transformers are generally a tonal sound source, and as such it is required to assess the predicted noise levels at the receiver against the INP tonality criteria presented in Section 4.4. The predicted results from SoundPlan were analysed to assess the contribution of each noise source on the nearest affected receiver. The combined noise level from the roof top fans contributed 26 dB(A) to the receiver at 138-140 Burley Rd, Horsley Park, while the predicted noise level from the two transformers at this receiver was below 15 dB(A). On the basis that the predicted noise levels from the transformers are well below the noise level generated by all the roof top fans, the substation would be indiscernible at the nearest affected receiver, and as such would also be indiscernible at all other sensitive receiver locations. As such the noise from the transformers will be 'drowned out' and a tonality penalty consistent with the requirements of the INP will not apply.

7.5.2 Environmental noise emission during emergency operations

The results of the environmental noise emissions during emergency operations at nearby residential receivers are presented in Table 23 and the noise contour maps are presented in Appendix C.

Table 23 Noise contribution at worst affected residential receivers in worst case emergency operations conditions

Receiver	Location	Neutral (night-time)		
		Result	Criterion	Exceed
R1	138-140 Burley Rd, Horsley Park	28	42	-
R2	198-222 Burley Rd, Horsley Park	24	42	-
R3	223 Walworth Rd, Horsley Park	24	42	-
R4	3 Cetus Place, Erskine Park	<20	42	-
R5	17 Tirage Place, Minchinbury	<20	42	-

The noise emission of the combined emergency noise producing equipment to be installed as part of the Eastern Creek Data Centre at the M7 Business Hub is predicted to comply with the night-time noise impact criterion at the noise sensitive receivers most likely to be affected, located to the south and south-west of the subject site along Burley Road, Horsley Park. The results of this assessment are presented in Table 23 and the noise contour maps are presented in Appendix C. Compliance will also be achieved at all other critical noise sensitive receivers.

7.6 Commercial receivers

7.6.1 Environmental noise emission during normal operation

The results of the environmental noise emissions during normal operations at nearby commercial receivers are presented in Table 24 and the noise contour maps are presented in Appendix C.

Table 24 Noise contribution at worst affected commercial receivers in worst case operational conditions

Noise source	Assessment Period	Noise contribution, dB(A)		
Normal Operations		Commercial receiver (Toll, M7 Business Park, Eastern Creek)	Criterion	Compliance
Roof Top Fan Units	During Use	43	65	Yes

The noise emission of the combined noise producing equipment to be installed as part of the Eastern Creek Data Centre at the M7 Business Hub is predicted to comply with the noise impact criterion at the most likely affected

commercial receiver, located to the west of the subject site along on Roberts Road, Eastern Creek. The results of this assessment are presented in Table 24 and the noise contour maps are presented in Appendix C. Compliance will also be achieved at all other critical noise sensitive receivers.

7.6.2 Environmental noise emission during emergency operations

The results of the environmental noise emissions during emergency operations at nearby commercial receivers are presented in Table 24 and the noise contour maps are presented in Appendix C.

Table 25 Noise contribution at worst affected commercial receivers in worst case operational conditions

Noise source	Assessment Period	Noise contribution, dB(A)		
Normal Operations		**Commercial receiver (Toll, M7 Business Park, Eastern Creek)**	**Criterion**	**Compliance**
Roof Top Fan Units + Backup Generators	During Use	47	70	Yes

The noise emission of the combined noise producing equipment to be installed as part of the Eastern Creek Data Centre at the M7 Business Hub is predicted to comply with the noise impact criterion at the most likely to be affected commercial noise receiver, located to the west of the subject site along on Roberts Road, Eastern Creek. The results of this assessment are presented in Table 24 and the noise contour maps are presented in Appendix C. Compliance will also be achieved at all other critical noise sensitive receivers.

7.7 Sleep disturbance

The application notes for the DECCW *Industrial Noise Policy* (2000) recommend that sleep disturbance is assessed based on the emergence of the $L_{A1\ (1\ minute)}$ noise level over the corresponding $L_{A90\ (15\ minute)}$ noise level.

The following screening criterion for sleep disturbance is recommended for the assessment of sleep disturbance:

$$L_{A1\ (1\ minute)} < L_{A90\ (15\ minute)} + 15\ dB(A)$$

The night-time noise emissions from the data centre would generally be associated with relatively constant activities. Therefore no significant peak noise events would be expected.

The 600 m separation between the site and the nearest residential receivers means that the maximum external noise levels are not predicted to exceed 47 dB(A) due to the night-time operations of the Eastern Creek Data Centre. Therefore, the assessment indicates compliance at all assessment locations during the night-time period.

8.0 Conclusion

This report presents the results of a study on noise emission from the proposed Eastern Creek Data Centre, which is to be located between Roberts Road and Capicure Drive, Eastern Creek within the M7 Business Hub , Eastern Creek.

Construction noise and vibration

Two key noise producing typical construction phases have been modelled at the Site to give an indication of the noise emissions that the nearest residential and commercial receivers will experience. The two important construction phases that have been modelled are the site preparation and the erection of the buildings structure.

The construction noise and vibration assessment was conducted in accordance with NSW Department of Environment, Climate Change and Water (DECCW) '*Interim Construction Noise Guidelines' (ICNG)*.

The construction noise assessment indicates compliance with DECCW's ICNG acoustic requirements at all assessment locations during the daytime (i.e. during DECCW's standard construction hours).

The construction vibration assessment indicates that due to the large buffer distance between the Data Centre site and nearby residential receivers, the risk of discomfort, regenerated noise and structural damage impacting on receivers is extremely low.

Operational noise and vibration

The operational environmental noise emission criteria for the development have been quantified in Section 4 of this report and have been established to comply with the SEPP 59 – Central Western Sydney Economic and Employment Area – Eastern Creek Precinct and the Department of Environment, Climate Change and Water's Industrial Noise Policy of NSW dated January 2000.

The operational noise impact assessment indicates compliance under neutral and prevailing meteorological conditions at all assessment locations during the daytime, evening and night-time periods. Compliance is conditional that the equipment installed produce noise levels similar or less that those shown in Section 7.0.

No items of plant and equipment used in operation of the Data Centre are expected to generate significant levels of vibration and therefore, operational vibration impacts are consequently expected to be negligible.

Sleep disturbance

The sleep disturbance assessment was conducted in accordance with NSW DECCW's Industrial Noise Policy (INP) guidelines. The assessment indicates compliance at all assessment locations during the night-time period.

Road traffic noise

The road traffic noise assessment was conducted in accordance with NSW DECCW's Environmental Criteria for Road Traffic Noise (ECRTN) guidelines.

The road traffic noise assessment associated with construction and operational phase of the Data Centre indicates compliance with DECCW ECRTN acoustic criteria.

Appendix A

Acoustic Terminology

Appendix A Acoustic Terminology

The following is a brief description of acoustic terminology used in this report.

Sound power level	The total sound emitted by a source
Sound pressure level	The amount of sound at a specified point
Decibel [dB]	The measurement unit of sound
A Weighted decibels [dB(A])	The A weighting is a frequency filter applied to measured noise levels to represent how humans hear sounds. The A-weighting filter emphasises frequencies in the speech range (between 1kHz and 4 kHz) which the human ear is most sensitive to, and places less emphasis on low frequencies at which the human ear is not so sensitive. When an overall sound level is A-weighted it is expressed in units of dB(A).
Decibel scale	The decibel scale is logarithmic in order to produce a better representation of the response of the human ear. A 3 dB increase in the sound pressure level corresponds to a doubling in the sound energy. A 10 dB increase in the sound pressure level corresponds to a perceived doubling in volume. Examples of decibel levels of common sounds are as follows:
	0dB(A) Threshold of human hearing
	30dB(A) A quiet country park
	40dB(A) Whisper in a library
	50dB(A) Open office space
	70dB(A) Inside a car on a freeway
	80dB(A) Outboard motor
	90dB(A) Heavy truck pass-by
	100dB(A) Jackhammer/Subway train
	110 dB(A) Rock Concert
	115dB(A) Limit of sound permitted in industry
	120dB(A) 747 take off at 250 metres
Frequency [f]	The repetition rate of the cycle measured in Hertz (Hz). The frequency corresponds to the pitch of the sound. A high frequency corresponds to a high pitched sound and a low frequency to a low pitched sound.
Equivalent continuous sound level [Leq]	The constant sound level which, when occurring over the same period of time, would result in the receiver experiencing the same amount of sound energy.
Lmax	The maximum sound pressure level measured over the measurement period
Lmin	The minimum sound pressure level measured over the measurement period
L10	The sound pressure level exceeded for 10% of the measurement period. For 10% of the measurement period it was louder than the L10.
L90	The sound pressure level exceeded for 90% of the measurement period. For 90% of the measurement period it was louder than the L90.
Ambient noise	The all-encompassing noise at a point composed of sound from all sources near and far.

Background noise	The underlying level of noise present in the ambient noise when extraneous noise (such as transient traffic and dogs barking) is removed. The L90 sound pressure level is used to quantify background noise.
Traffic noise	The total noise resulting from road traffic. The Leq sound pressure level is used to quantify traffic noise.
Day	The period from 0700 to 1800 h Monday to Saturday and 0800 to 1800 h Sundays and Public Holidays.
Evening	The period from 1800 to 2200 h Monday to Sunday and Public Holidays.
Night	The period from 2200 to 0700 h Monday to Saturday and 2200 to 0800 h Sundays and Public Holidays.
Assessment background level [ABL]	The overall background level for each day, evening and night period for each day of the noise monitoring.
Rating background level [RBL]	The overall background level for each day, evening and night period for the entire length of noise monitoring.

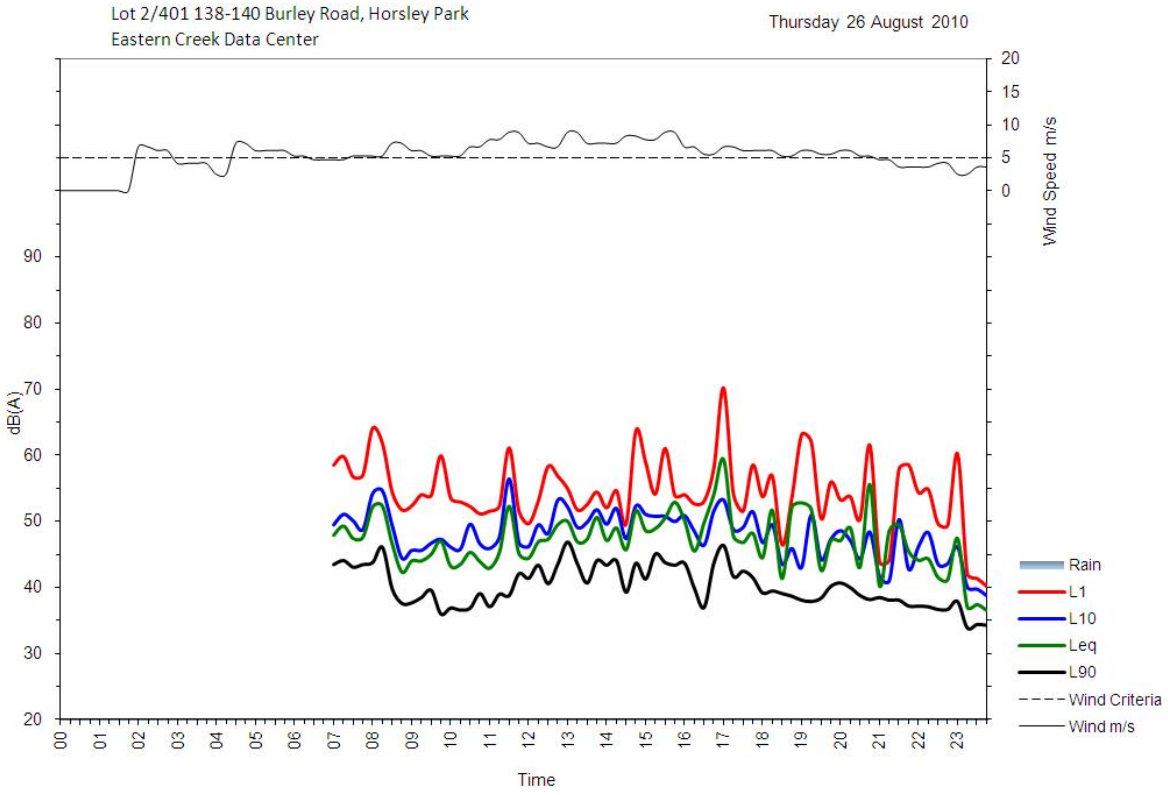
*Definitions of a number of terms have been adapted from Australian Standard AS1633:1985 “Acoustics – Glossary of terms and related symbols”, the DECCW’s NSW Industrial Noise Policy and the DECCW’s Environmental Criteria for Road Traffic Noise.

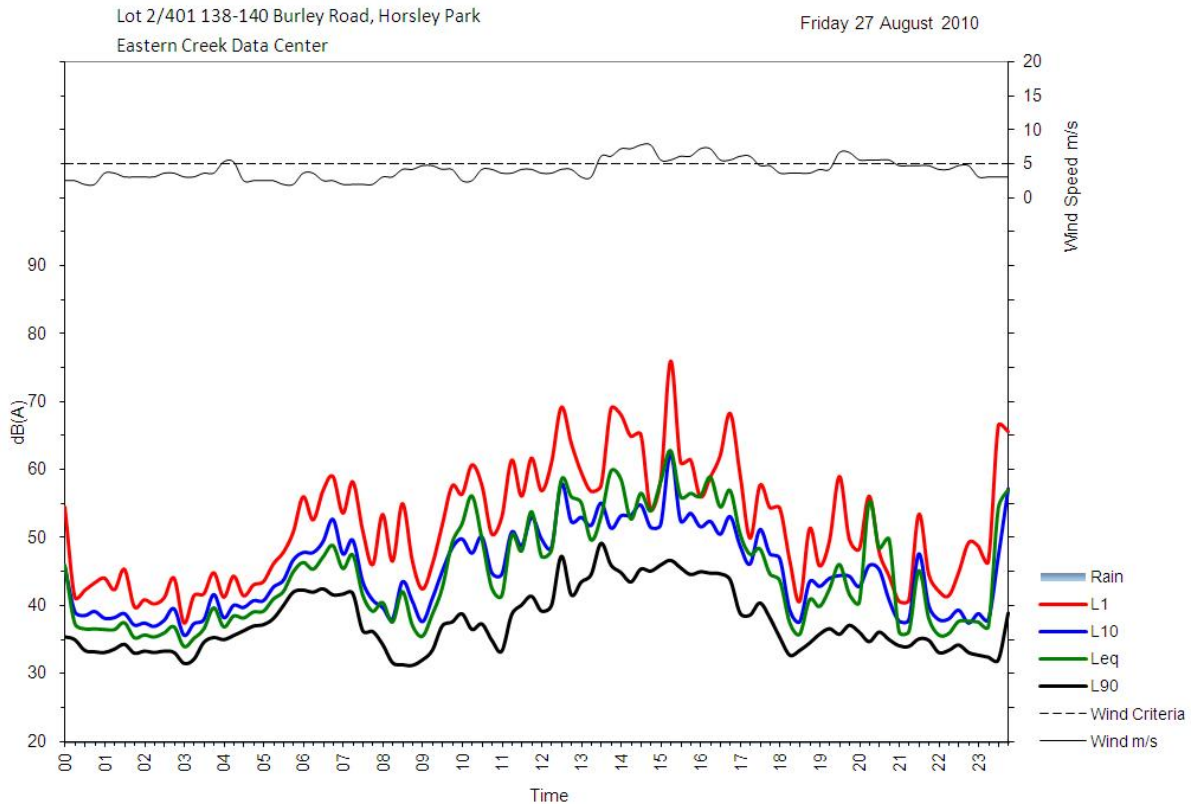
Appendix B

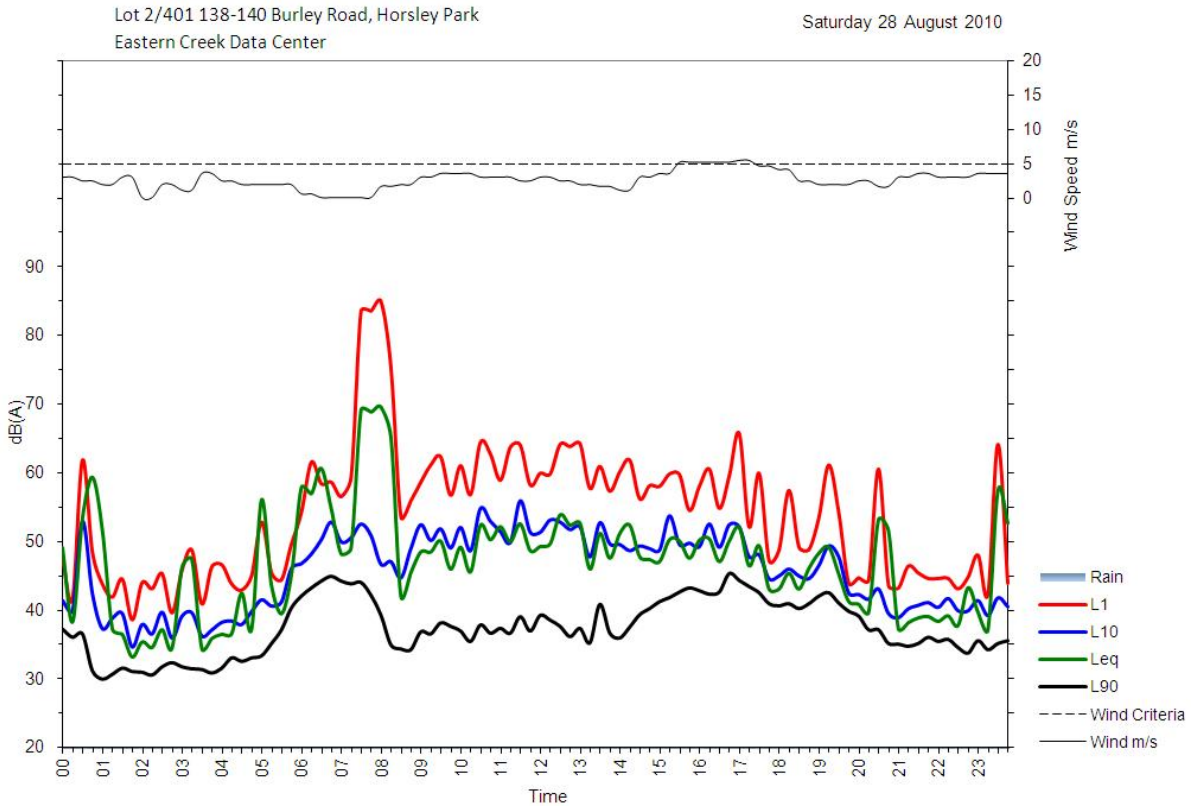
Noise Logging Graphs

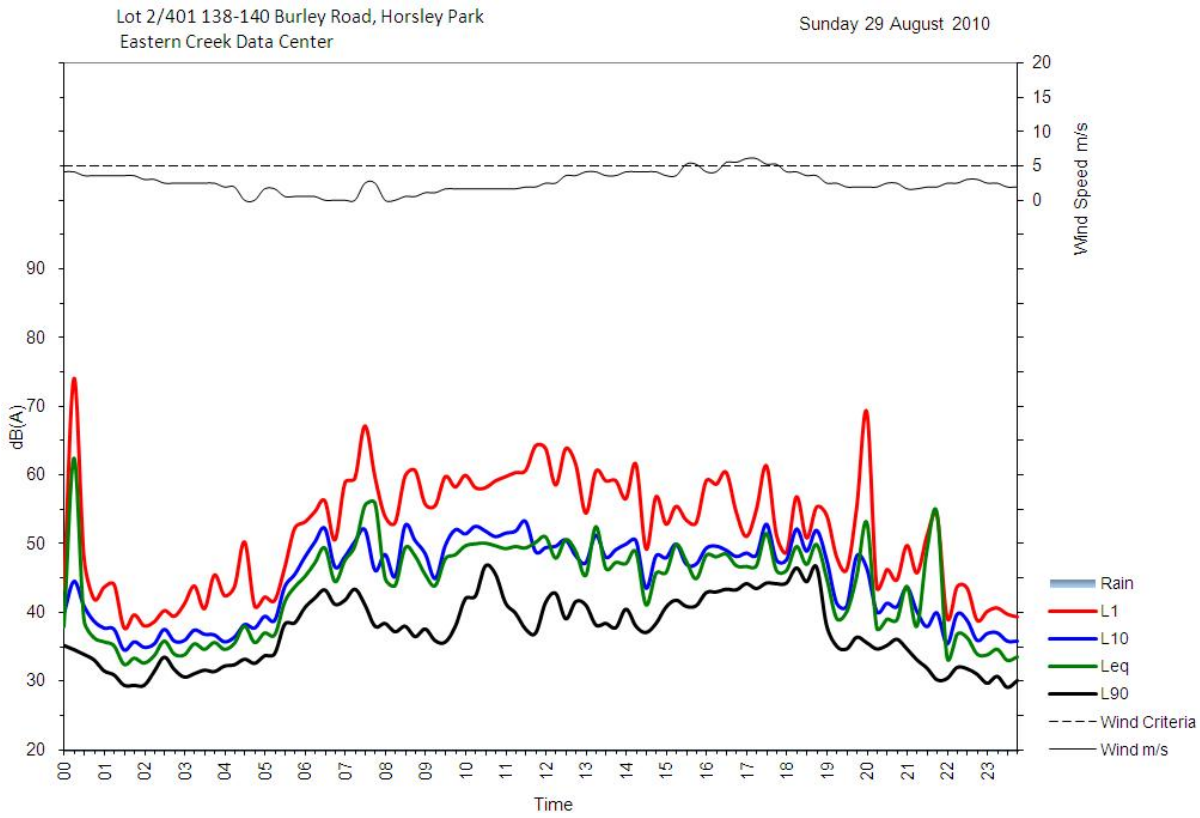
Appendix B Noise Logging Graphs

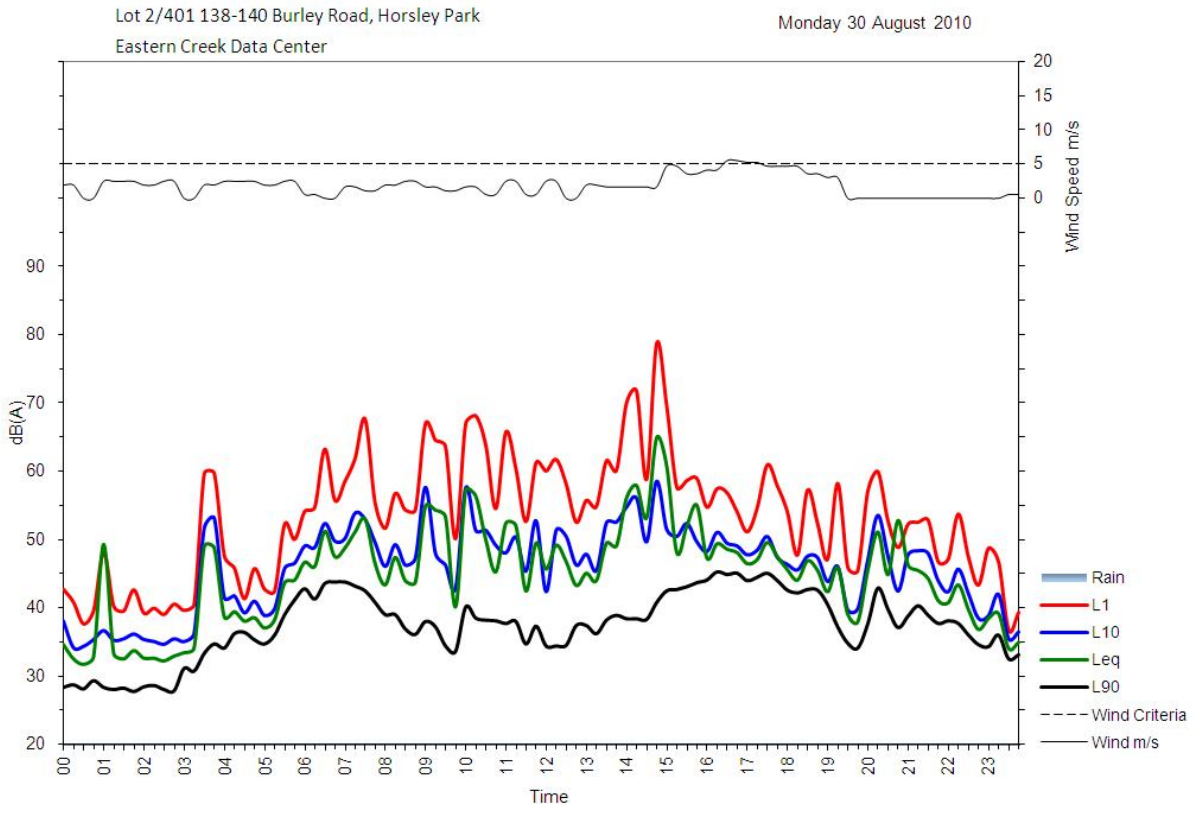
Lot 2/401 138-140 Burley Road, Horsley Park

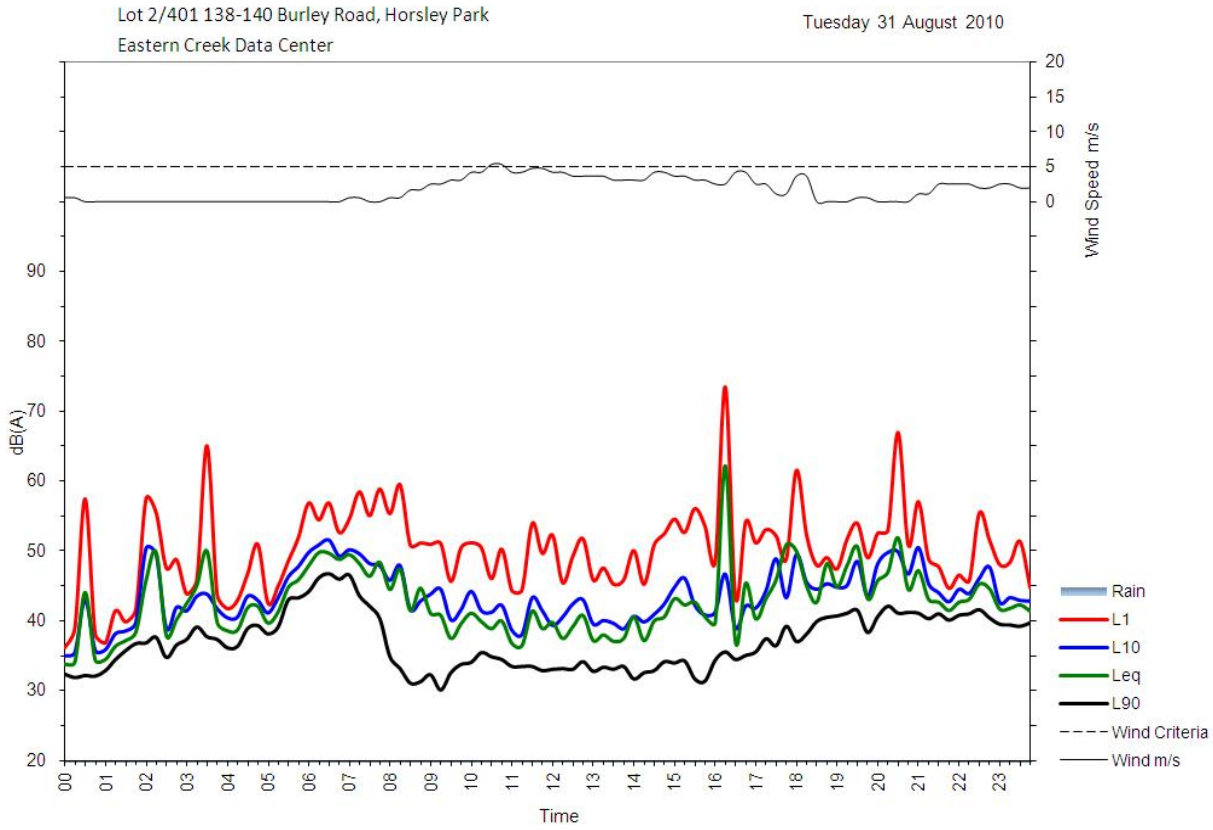


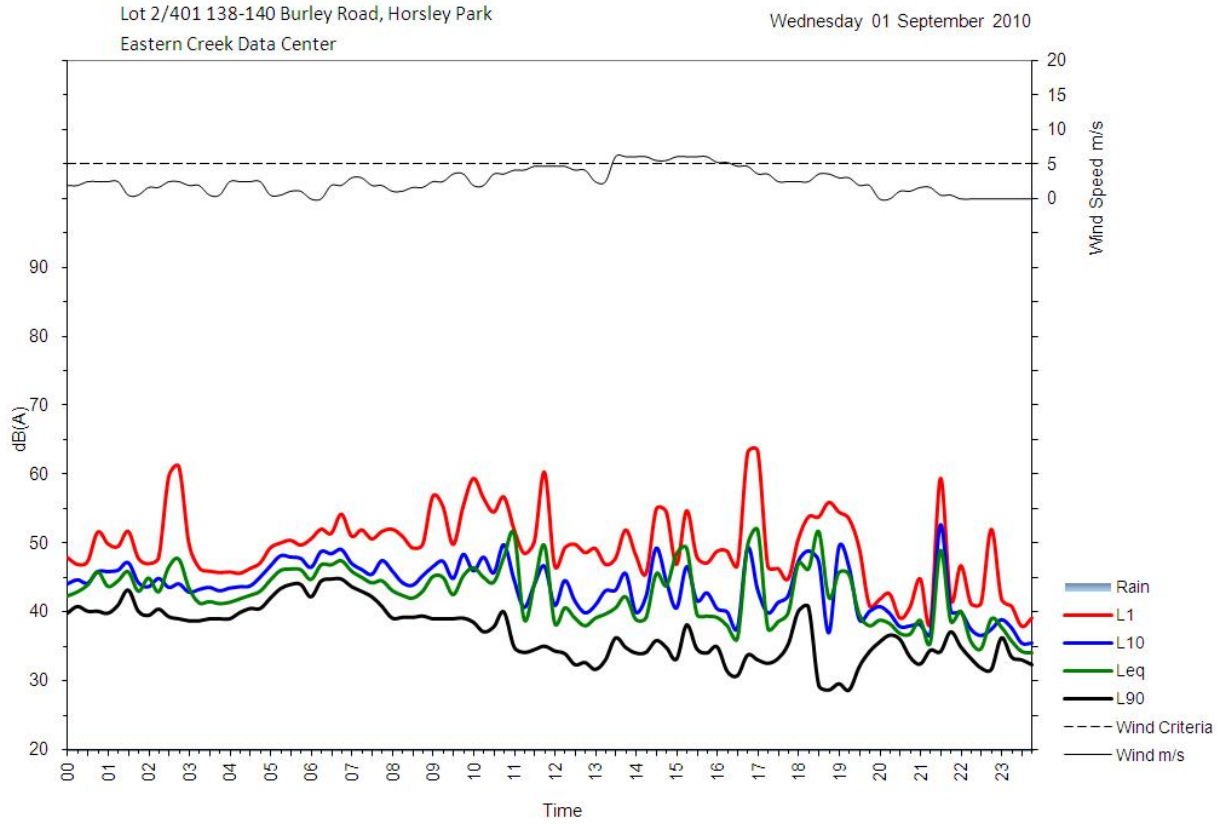

Lot 2/401 138-140 Burley Road, Horsley Park
Eastern Creek Data Center
Friday 27 August 2010
dB(A)
Wind Speed m/s
Time
Rain
L1
L10
Leq
L90
Wind Criteria
Wind m/s

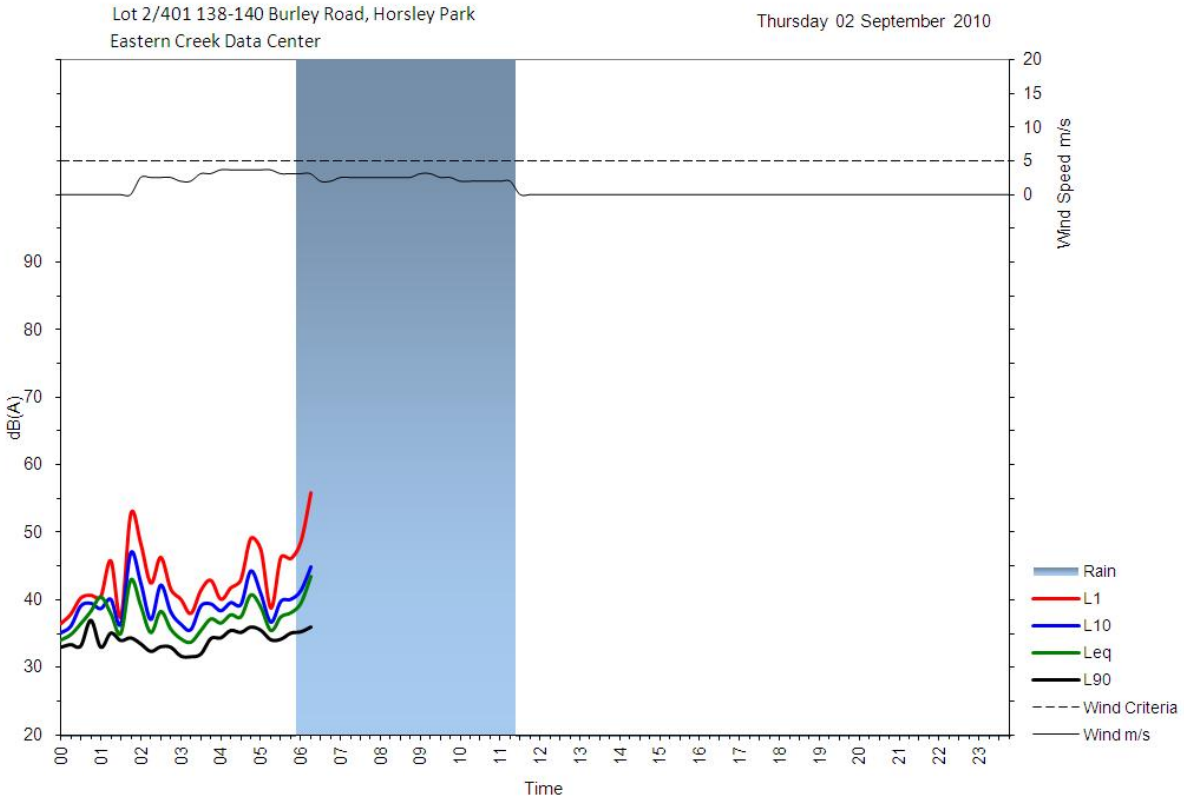

Lot 2/401 138-140 Burley Road, Horsley Park
Eastern Creek Data Center
Saturday 28 August 2010
dB(A)
Wind Speed m/s
Time
Rain
L1
L10
Leq
L90
Wind Criteria
Wind m/s


Lot 2/401 138-140 Burley Road, Horsley Park
Eastern Creek Data Center
Sunday 29 August 2010
dB(A)
Wind Speed m/s
Time
Rain
L1
L10
Leq
L90
Wind Criteria
Wind m/s


Lot 2/401 138-140 Burley Road, Horsley Park
Eastern Creek Data Center
Monday 30 August 2010
dB(A)
Wind Speed m/s
Time
Rain
L1
L10
Leq
L90
Wind Criteria
Wind m/s


Lot 2/401 138-140 Burley Road, Horsley Park
Eastern Creek Data Center
Tuesday 31 August 2010
dB(A)
Wind Speed m/s
Time
Rain
L1
L10
Leq
L90
Wind Criteria
Wind m/s


Lot 2/401 138-140 Burley Road, Horsley Park
Eastern Creek Data Center
Wednesday 01 September 2010
dB(A)
Wind Speed m/s
Time
Rain
L1
L10
Leq
L90
Wind Criteria
Wind m/s


Lot 2/401 138-140 Burley Road, Horsley Park
Eastern Creek Data Center
Thursday 02 September 2010
dB(A)
Wind Speed m/s
Time
Rain
L1
L10
Leq
L90
Wind Criteria
Wind m/s

Appendix C

L_{Aeq} Noise Emission Contour Maps

Appendix C L_{Aeq} Noise Emission Contour Maps

AECOM

N

R1

R2

R3

Sound pressure level L_{Aeq}, dB(A)

- 27 - 32
- 32 - 37
- 37 - 42
- 42 - 47
- 47 - 52
- 52 - 57
- > 57

EASTERN CREEK DATA CENTRE, M7 BUSINESS HUB, EASTERN CREEK

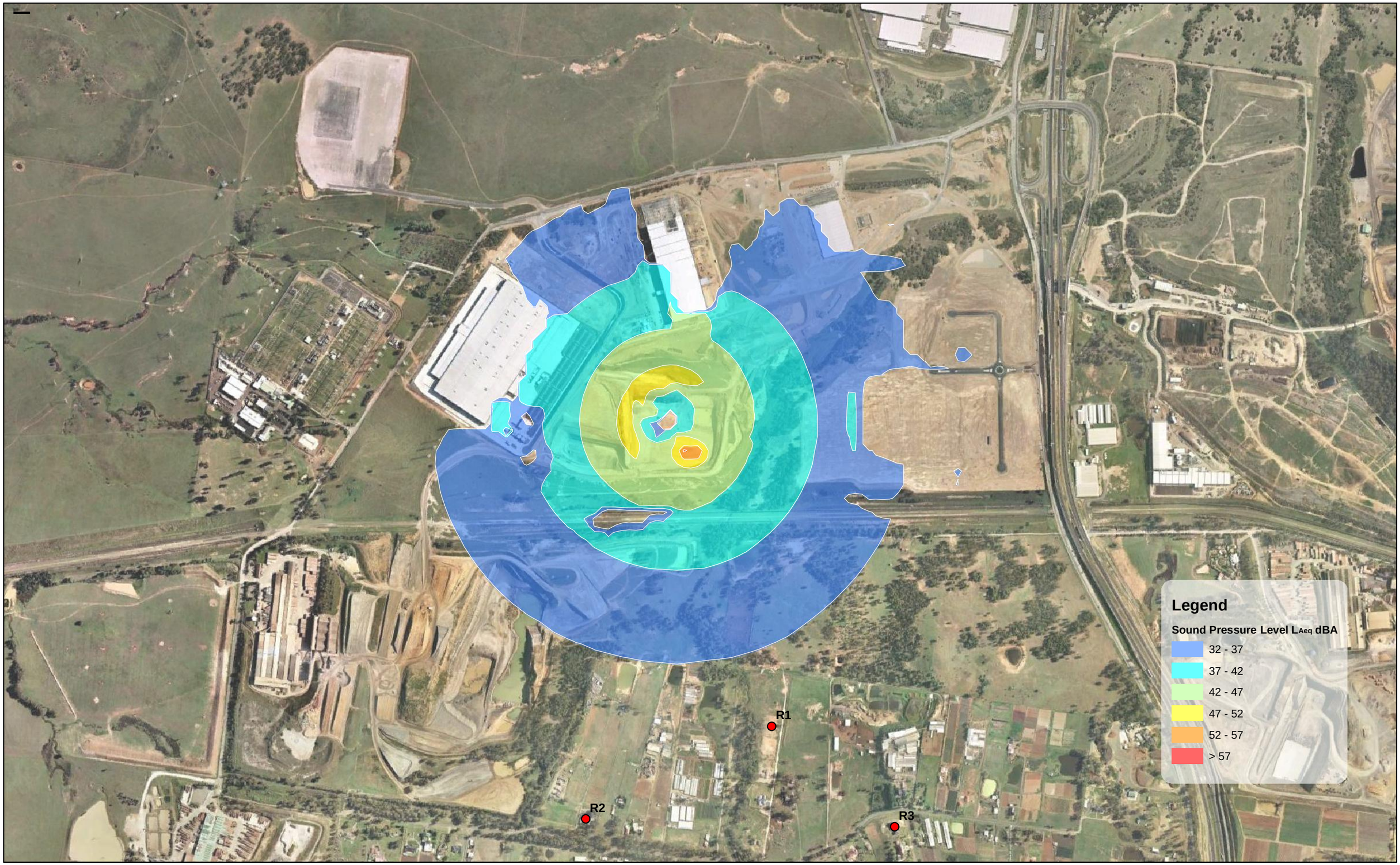
NORMAL OPERATIONS - NIGHT - NEUTRAL CONDITIONS

AUG 2010

60161037

0 100 200 400 m

AECOM



EASTERN CREEK DATA CENTRE, M7 BUSINESS HUB, EASTERN CREEK

NORMAL OPERATIONS - EVENING - WORST CASE 3 m/s WIND IN ALL DIRECTIONS

AUG 2010

60161037

0 100 200 400 m

AECOM

N

R1

Sound pressure level L_{Aeq}, dB(A)

- 42 - 47
- 47 - 52
- 52 - 57
- 57 - 62
- 62 - 67
- 67 - 72
- > 72

EASTERN CREEK DATA CENTRE, M7 BUSINESS HUB, EASTERN CREEK

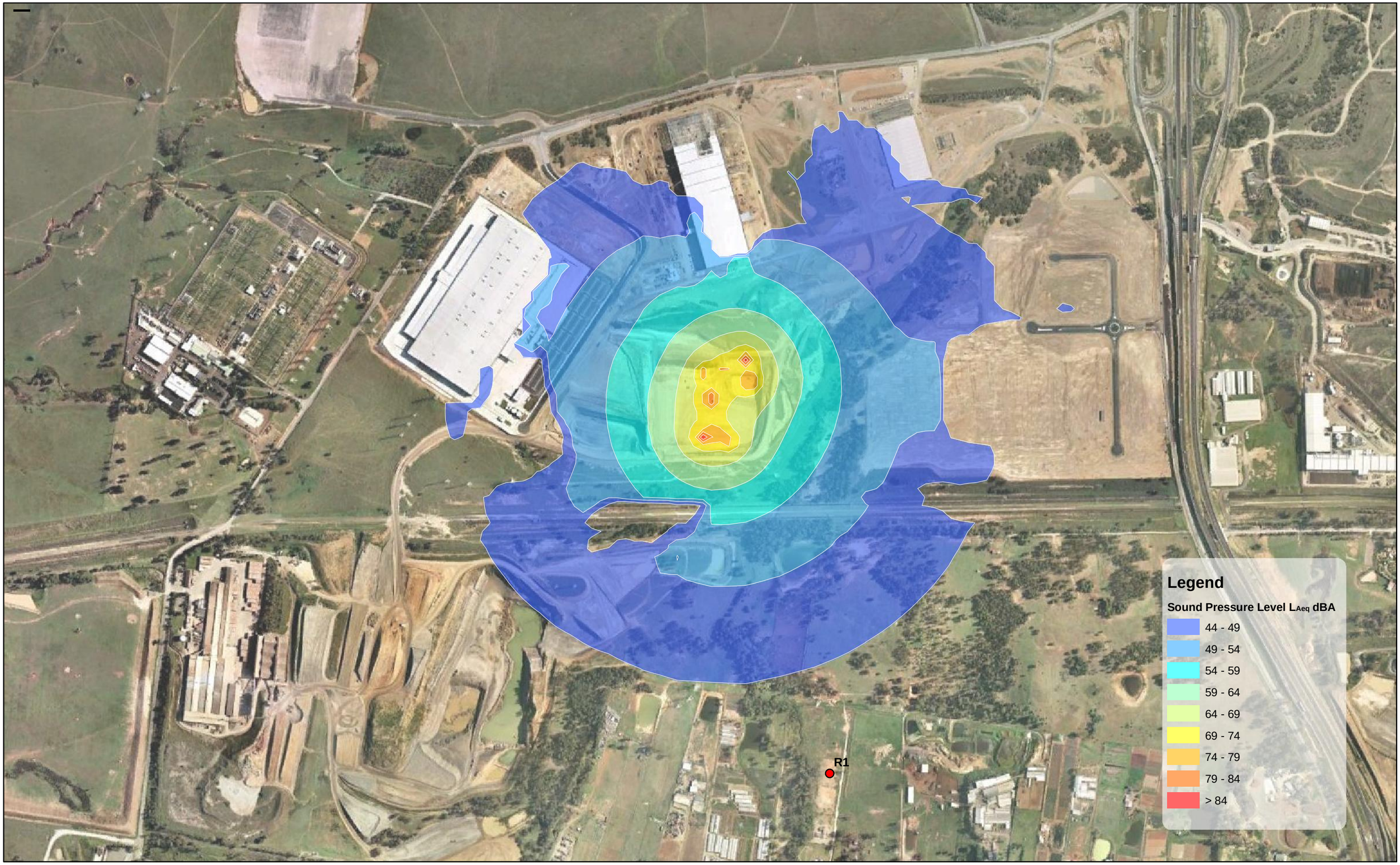
EMERGENCY OPERATIONS - NIGHT

AUG 2010

60161037

0 100 200 400 m

AECOM



EASTERN CREEK DATA CENTRE, M7 BUSINESS HUB, EASTERN CREEK

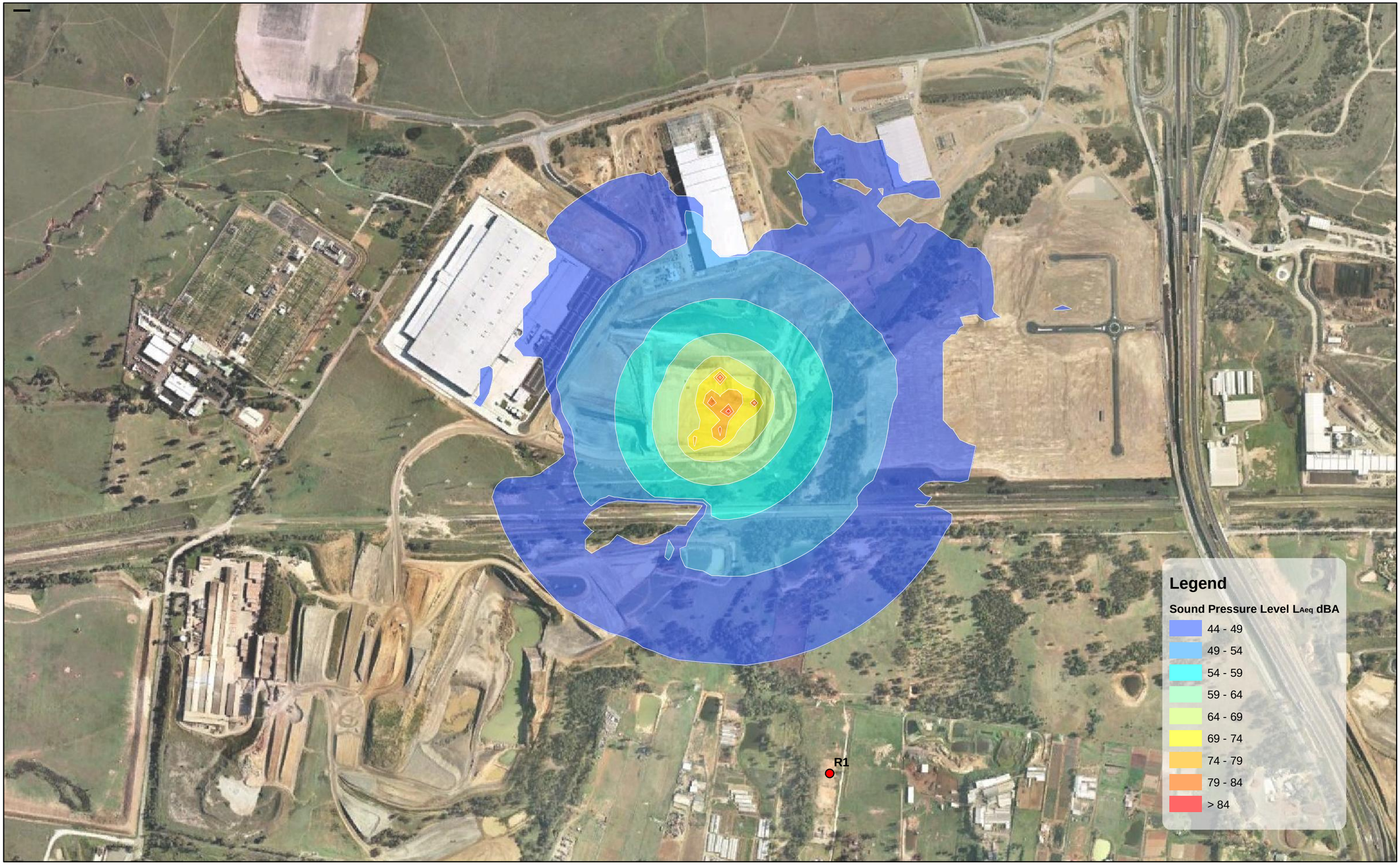
CONSTRUCTION NOISE - DAY - SITE PREPARATION

AUG 2010

60161037

0 100 200 400 m

AECOM



EASTERN CREEK DATA CENTRE, M7 BUSINESS HUB, EASTERN CREEK

CONSTRUCTION NOISE - DAY - ERECTION OF STRUCTURE

AUG 2010

60161037

0 100 200 400 m

Appendix D

Construction Noise Equipment

Appendix D Construction Noise Equipment

Table D1 – Construction activities and plant equipment

Equipment	Number of Modelled	Sound Power Level for 1 Unit - L_{Aeq} dB(A)
Site Preparation		
Vibratory Roller	1	101
Trucks	4	108
Grader	1	107
Excavator	2	104
Concrete Truck + Concrete Pump	1	
Steelwork/Equipment Erection		
Tower Cranes	1	104
Truck Mounted Crane	1	105
Trucks	2	108
Concrete Saw/Grinder	1	107
Excavator	1	104
Hand Tools	1	94
Concrete Truck + Concrete Pump	1	110
Generator	1	88

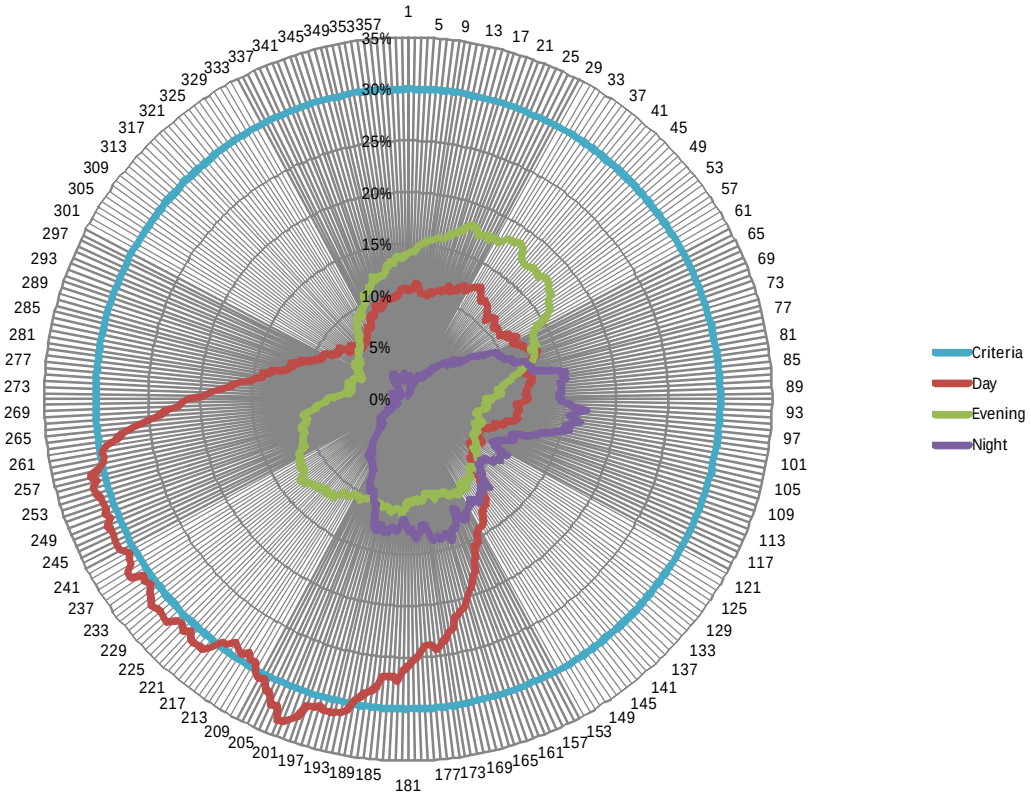
Source: Department for Environment, Food and Rural Affairs (DEFRA), UK

Appendix E

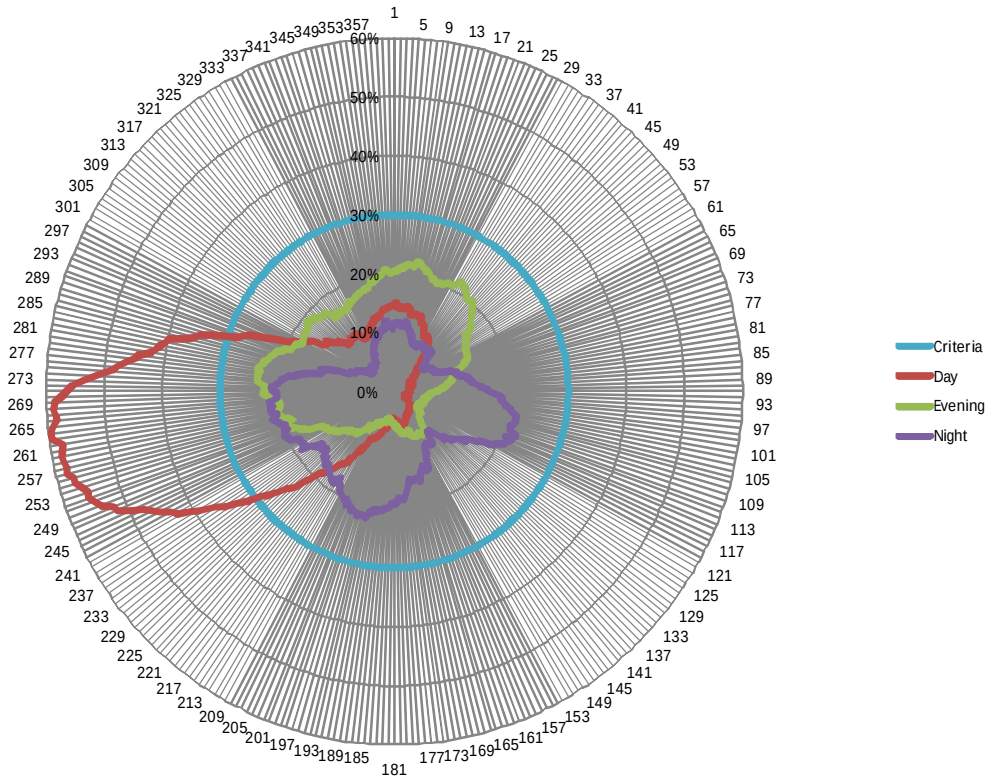
Assessment of Wind

Appendix E Assessment of Wind Effects

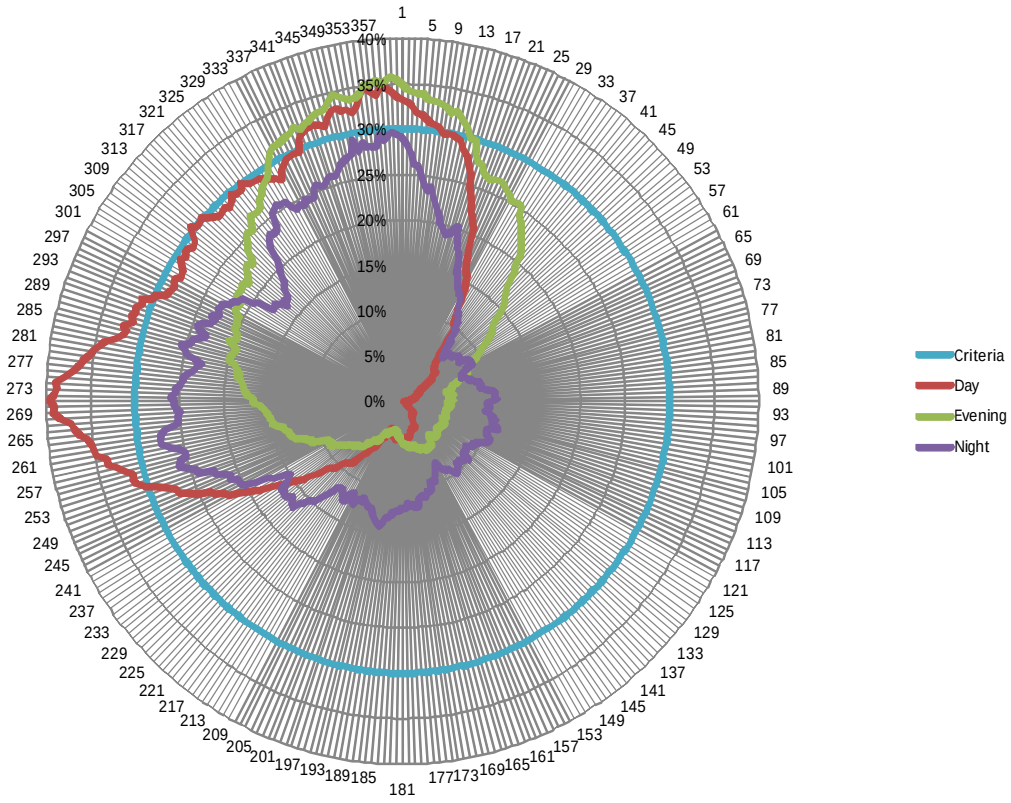
Summer



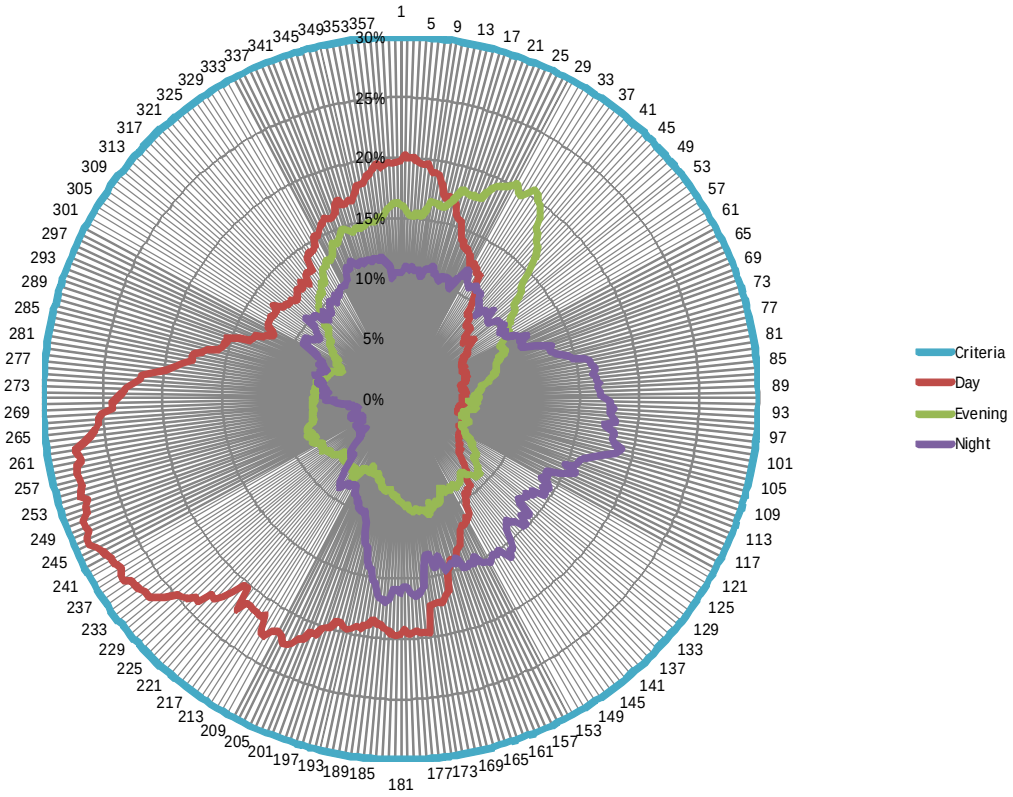
Autumn



Winter



Spring


1
5
9
13
17
21
25
29
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73
77
81
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345
349
353
357
30%
25%
20%
15%
10%
5%
0%
Criteria
Day
Evening
Night