The Acoustic Group
CONSULTING ACOUSTICAL & VIBRATION ENGINEERING

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28th April, 2014

E & D Danias Pty Ltd
PO Box 3247
MARRICKVILLE METRO NSW 2204

Attention: Ms S Danias

Dear Sirs,

ACOUSTIC ASSESSMENT - PROPOSED RE DEVELOPMENT VICTORIA ROAD CORRIDOR, MARRICKVILLE

The purpose of this report is to present the results of an investigation into the acoustic environment of the Victoria Road Precinct in Marrickville that is the subject of rezoning.

In early 2012 Marrickville Council undertook a review of planning controls contained with the Marrickville Local Environmental Plan 2001.

During the community consultation phase of the review a number of land owners within the Victoria Road precinct made representations to Marrickville Council seeking to rezone the existing industrial area from the current IN1 General Industrial Zoning to a zoning that would allow the site's future redevelopment for a mix of uses, including medium/high density residential/retail/commercial/creative industries and industrial.

With the general trend to remove major industrial operations from the central areas of Sydney the opportunity is available to facilitate urban renewal in areas with good access to the existing transport and community services such as the Victoria Road precinct in Marrickville.

In May, 2012 the Council resolved to consider revised planning controls for the precinct that would include an urban design study for the precinct, an initial staging plan and a response to policy issues raised by the Department of Planning with respect to the strategic context of Port Botany and Sydney Airport, consistency with S117B directions and opportunities and constraints in relation to housing.

20-22 FRED STREET, LILYFIELD, 2040, NSW, AUSTRALIA A.B.N. 73 082 704 701
ph: (612) 9555 4444 fx: (612) 9555 4442 voip: (612) 8208 8881 tag1@acoustics.com.au

This acoustic assessment forms one part of the strategic assessment having regard to potential acoustic issues relevant to the subject corridor with respect to aircraft and road traffic noise intrusion and noise emission from the development to conform with existing criteria issued by Marrickville Council.

THE SITE

The area of land that relates to the subject investigation is contained largely within the Victoria Road Precinct that is defined in Part 9 of the Marrickville DCP for Precinct 47.

With respect to the strategic location of the site the land, which is located within the suburb of Marrickville, is situated approximately 6 km south-west of the Sydney CBD, 3 km north of Sydney Kingsford Smith Airport and 8 km north-west of Port Botany Container Freight Terminal as shown in Appendix A.

At present the site is predominantly industrial and business land use with low density residential, education, entertainment and recreational uses throughout the area.

There is currently a mixture of large and small businesses with various types of uses as well as a number of vacant sites and buildings.

The subject site is bounded by or passes through major arterial roads identified as Victoria Road, Sydenham Road and Addison Road.

These arterial roads carry a significant volume of road traffic throughout the day and night that influences the acoustic environment of the study area.

The location of railway transportation is relevant for this study area but is not an acoustic issue with respect to this investigation.

The proximity of the site to Sydney Airport leads to flight tracks over portions of the site and in acoustic terms the entire site is influenced by such aircraft overflights.

Whilst Sydney Airport utilises 3 separate runways the site is located below the extended centreline of the main north – south runway (designated as 34L – 16R) that is the principal runway used for arrival and departure of larger aircraft types used for transport of passengers to overseas destinations.

The proximity of the site to the airport indicates that the aircraft using the extended centreline of the main runway are confined to a narrow corridor that as such leads to consistent and repeatable measurements somewhat independent of the weather conditions.

ASSESSMENT METHODOLOGY

An inspection of the area reveals that on an acoustic basis the principal issue of concern relates to noise intrusion into the proposed redevelopment of the site by way of road traffic and aircraft operations.

It is also noted that the Council have noise criteria applicable to noise emitted from various commercial developments which is based upon the ambient background level and utilise a noise target for commercial operations generally lower than that utilised by the EPA.

For the purpose of undertaking the acoustic assessment there was an initial expectation that aircraft noise levels across the study site would tend to be consistent with a small spread of noise levels when considering an individual aircraft type.

That is to say that for various types of aircraft there will be different noise levels but when grouped in terms of individual aircraft types (to accord with Australian Standard AS2021) there should be consistent levels for that type with a slight variation in the noise level depended upon the relationship of the receiver location in the site to the nominal centre flight path of the track.

For aircraft take off operations from an airport the actual track of the aircraft can be on the extended centreline, or to the right or left of the extended centreline, depending upon the destination/track of the aircraft once clear of the airport zone.

With respect to road traffic noise there is an expectation of higher noise levels for locations in proximity to major traffic thoroughfares. When removed from those thoroughfares there will be less of a road traffic impact such that in some of the streets forming the subject area of investigation there would be negligible through traffic and occasional or a minimal amount of local traffic.

Therefore to address the aircraft noise impacts, road traffic noise impacts and ambient background noise levels, 10 monitoring locations were selected to be used in the study where attended measurements were undertaken to cover the day, evening and early night portions to obtain noise levels relevant to air traffic, road traffic and background levels.

Appendix B indicates the 10 monitoring locations that were used in the study with respect to the current zoning of the site.

Appendix C indicates the relationship of the site with respect to aircraft ANEF noise contours applicable to Sydney Airport. It is noted that the noise contours in Appendix C do not relate to the maximum noise level of such aircraft but relate to a 24 hour average noise level that takes into account the cumulative impact of all aircraft on a "averaged" day that is the first method of assessment set out in Australian Standard AS2021 – 2000.

From the measurement results that have been obtained for this investigation the procedure is to evaluate the existing acoustic environment with respect to the relevant criteria and to identify/determine the extent and magnitude of noise controls that would be required to satisfy the relevant internal noise targets.

By way of the variation in noise level across the site one would therefore have different noise control requirements for different portions of the site which then provide a basis for the development of a master plan in that it is envisaged any redevelopment of the site would occur over time in a number of stages of which the actual design would be unknown at this present point in time.

Therefore the methodology with respect to this investigation is to identify the noise targets that would apply to the various parts of the site corresponding to the 10 measurement locations and to provide generic types of noise control measures to identify the feasibility of such development with respect to compliance with the criteria established in this assessment.

It would therefore follow in the concept of a masterplan that the overall internal and external noise targets that have been developed for the subject site would be applicable as an overall master plan concept.

Individual stages that involve specific design of the buildings are to have the appropriate controls identified for the different types of uses that may occur, with such controls being identified at the development application stage in broad planning principles with the corresponding construction certificate component for that stage requiring confirmation of the noise control measures (both noise intrusion and noise emission) that would be incorporated into the development to be built.

It is envisaged that at the time of the development application for an individual stage that there would be more detailed noise measurements with respect to both traffic and aircraft that would provide more noise data relevant to that stage of the rezoned area.

MEASUREMENT TECHNIQUES

The various acoustic criteria that apply to the development require the conduct of noise measurements utilising different parameters.

General environmental measurements were taken in accordance with the Australian Standard AS1055 *"Acoustics - Description and Measurement of Environmental Noise"* and the requirements of the noise measurement survey sheets contained in the "*Environment Protection Authority - Environmental Noise Control Manual*" and the ambient background measurement procedures set out in Appendix B of the EPA's *Industrial Noise Policy*.

Measurements of aircraft noise were conducted in accordance with Australian Standard AS2021-2005.

Sound level measurements were recorded using two Brüel & Kjær 2260 Sound Level Meters (serial No 1824813 and 2274764) for the attended surveys. The reference calibration level of each meter was checked prior to and after measurements using a Brüel & Kjær Sound Level Calibrator Type 4231 and exhibited no system drift. The calibration of each sound level meter to manufacturer's requirements is current.

MEASUREMENT RESULTS

The Victoria Road corridor is subject to a range of acoustic criteria with respect to criteria issued by the Department of Planning, the EPA and Marrickville Council, necessitating different measurement descriptors.

The *Infrastructure SEPP* nominates noise criteria that apply to the subject development being an internal noise level that is assessed with respect to the external acoustic environment.

For the purpose of this assessment a series of spot sample measurements were conducted at the 10 locations during the day, evening and night periods to ascertain the overall noise environment from which there is an indication of the traffic noise, the ambient noise and aircraft noise impacts.

It is noted that for the arterial roads passing through the study area the use of attended measurements does not provide the 15 hour and 9 hour Leq levels required for the *Infrastructure SEPP* assessment where one normally conducts measurements over a 1 week period by way of unattended logging. However the spot sample measurements provide a range of levels to give an indication of the noise controls that would be required for the proposed developments.

The statistical measurement results set out in Appendix D show a range of noise levels across the various monitoring sites. Due to the influence of aircraft operations of the subject area the statistical sound level measurements also include a component of aircraft noise that in many cases gives rise to a significant increase in the noise levels that would be just attributable to road traffic.

Therefore in dealing with the road traffic criteria it is necessary to extract the aircraft noise components, if one is then dealing with the noise targets contained in the Infrastructure SEPP or the RNP.

As expected the major arterial roads passing through the subject area of investigation experience variations in the density of traffic throughout the day thereby giving rise to a range of noise levels as a result of traffic.

As a general overview the traffic noise that is applicable to Victoria Road, Addison Road and Sydenham Road are 65 to 68 dB(A) for the day time period and 54 to 58 dB(A) at night. Such levels indicate that an open windows scenario would not satisfy the internal noise targets and that for a closed windows situation standard forms of construction for glazing (weight per size) would not achieve the internal noise targets. For the facades of buildings fronting those major roads there would need to incorporate heavy glazing and a double glazing concepts.

At the monitoring locations that are set back from the arterial roads the traffic noise levels reduce in intensity by way of distance attenuation but there is a general overview those buildings will still require specific noise control measures to satisfy the nominated noise targets, except for some of the internal roads which are removed, and subject to shielding from the major arterial traffic routes.

With the urban renewal project underway there is an expectation that with respect to road traffic noise that locations not adjacent to the arterial roads will experience a greater degree of acoustic shielding and therefore in terms of the road traffic noise can have a reduction in the attenuation so required.

In terms of the Council criteria that would apply for mechanical plant and similar, the ambient background level adjacent the major arterial roads is influenced by that traffic and the surveys found to have a day time background level in your order of 50-55 dB(A) that during breaks in traffic that at night reduces to below 45 dB(A).

The lowest ambient background levels recorded during the evening night-time period were found to be around 40 dB(A) and are typical of locations in the area not on arterial roads.

As a general overview in relation to the acoustic environment the area are at the following observations are noted.

Location 1 – Corner of Addison Road & Illawarra Road

The acoustic environment is dominated by road traffic on Addison Rd including both light and heavy vehicles. Some traffic on Illawarra Rd also contributes to the acoustic environment but such traffic is predominately light vehicles. Aircraft operations determine the maximum levels.

Location 2 – Corner of Addison Road & Cook Road

The acoustic environment is dominated by road traffic on Addison Rd including both light and heavy vehicles. The ambient background level is one of the general traffic roar throughout the day and night, although the impact of the aircraft operations at subject site is significant and dominates the overall levels.

Location 3 – Corner of Victoria Road & Cook Road

Noise at this location is dominated by the traffic on Victoria road since, as the traffic on Cook Rd is relatively low. The main runway flight path to the south east of the location resulted in air traffic being responsible for the noise peaks.

Location 4 – Corner of Fitzroy Street & Smith Street

The ambient noise at this location is predominately due to the traffic on Fitzroy St with traffic on Smith St being comparatively light. A significant amount of heavy vehicle traffic was observed on Fitzroy St at the time of the daytime measurement. Air traffic from both the main runway flight path and the third runway flight path are audible however only the main runway flight path traffic results in significant peaks above the ambient levels.

Location 5 – Hans Place

The ambient noise is dominated by traffic on Fitzroy St with traffic on Hans Pl minimal. Peaks are then due to occasional vehicles on Hans Pl and air traffic on the main runway flight path. The maximum levels due to the air traffic peaks are significantly higher than the road traffic.

Location 6 – Mitchell Street

The ambient noise at this monitoring location is dominated by road traffic on nearby Victoria Rd, both light and heavy vehicles. Very few vehicles were observed on Mitchell St since it is a no through road. The main runway flight path north-east of the measurement location cause some maximum levels due to air traffic.

Location 7 – Sydenham Road

Road traffic in this location was particularly heavy, with light and heavy vehicles dominating the noise environment. This location recorded the highest Leq and L10 values of all locations as a result of road traffic. Although the air traffic was audible from this location it was not significant compared to the heavy vehicle traffic at this location. The most significant contributor to the maxim levels was heavy vehicles accelerating after stopping at the Sydenham Road and Victoria Road traffic lights (to the south-east of the measurement location).

Location 8 – Corner of Shepard Street & Chapel Street

Road traffic at this location quite sparse compared to the other locations. As a result the ambient noise was dominated by traffic on Victoria Road to the south-east. Road traffic and air traffic on the main runway flight path to the north-east determined the maximum noise levels at this location

Location 9 –Chapel Street

This location was dominated by traffic on Victoria Road and Fitzroy Street since traffic on Chapel Street was sparse an mainly light vehicles. Being directly under the main runway flight path meant significant peaks above the background level were due to the air traffic.

Location 10 – Brompton St

Traffic was light at this location. However a metal workshop near the location was particularly audible and influenced the daytime results. The vehicular traffic at the location was predominately heavy vehicles moving at slow speeds. Similar to location 9 this location was directly under the main runway flight path meaning significant peaks were recorded due to air traffic.

Appendix D provides a series of time splice graphs showing the A-weighted variation in noise over the 15 minute period for relevant locations broken up into the various days on which measurements were undertaken. After each daily grouping of measurement results is a table showing statistical noise levels over the 10 minute period, where the L10 level is the level exceeded for 10% of the time (average maximum level), the Leq is the energy average level over the entire time of the sample measurement, and the L90 level is the background level obtained over that 15 minute period.

The Leq level is taken as the basis of the traffic noise assessment, whilst the background level is relevant for the purpose of general mechanical plant noise criteria.

For the purpose of evaluating the aircraft noise impact the maximum noise level from individual aircraft flights at various locations has been extracted from the measurement data and is summarised in Appendix E.

In terms of maximum levels from aircraft operations the measured levels for the larger aircraft types varied from 80 to 87 dB(A).

ACOUSTIC CRITERIA

The subject site can under different Authorities be subject to overlapping acoustic criteria.

Under the State Environmental Planning Policy (Infrastructure) 2007 Clause 102 identifies that where a development used for residential use, public worship, hospital, educational establishment or childcare centre is on land in or adjacent to road corridor for a freeway, a tollway or transit way or any other road with annual average daily traffic volume of more than 40,000 vehicles (based on the traffic volume data published on the website of the RTA) and at the consent authority considers is likely to be adversely affected by road noise or vibration and before determining a development application the consent authority must take into consideration guidelines issued by the Director-General for the purpose of Clause 102 of the Infrastructure SEPP.

For a development having residential use the SEPP (Infrastructure) nominates that a level of 35 dB(A) is not to be exceeded at any time between 10 PM and 7 AM in any bedroom in the building and that for anywhere else in the residential component of the building (other than a garage, kitchen, bathroom or hallway) the Leq level is not to exceed 40 dB(A) at any time.

Ancillary to the SEPP Infrastructure document is a document from the Department of Planning identified as *Development Near Rail Corridors and Busy Roads-Interim Guideline* that sets out a methodology for assessing the noise impact with respect to the requirements of Clause 102 and becomes relevant in that the expression of an LAeq noise level is meaningless unless there is a time period specified for that Leq level.

However by way of the Development Near Rail Corridors and Busy Roads – Interim Guideline, one ultimately ends up the both criteria and time periods from EPA documentation.

In dealing with road traffic noise for residential receivers a base reference document previously used by the Council has been the EPA's "*Environmental Criteria for Road Traffic Noise*" that specified an external noise target to be achieved for various different types of receivers and a corresponding internal noise level that could be derived from the external noise level. The policy set out different classification of road hierarchy with respect to noise generation (rather than traffic generation) of which Sydenham Road, Victoria Road and Addison Road would be taken as marginal arterial roads, thereby considering noise targets with respect to the day time period of 7 AM to 10 PM and a separate target in the night time period of 10 PM to 7 AM.

The ECRTN has been replaced by the *NSW Road Noise Policy* ("RNP"). The RNP sets out noise criteria with respect to new road projects but does not specify noise criteria to new developments affected by noise from the existing traffic. However the footnote to Table 3 (in the RNP) refers to Appendix C in that document, which in turn refers to internal noise goals in the *Infrastructure SEPP* (Department of Planning NSW 2007) for sensitive developments near busy roads.

The *Infrastructure SEPP* refers to new residential developments adjacent to a transport corridor, whilst the RNP refers to development impacted by traffic noise near such corridors.
The *Infrastructure SEPP* requires new sensitive residential developments to meet internal noise levels of 35 dB(A)) at any time between 10 pm and 7 am for bedrooms during the night-time period and 40 dB(A) at any time for other habitable rooms..

On reading the *Infrastructure SEPP* criteria in-conjunction with the RNP the following noise targets are obtained:

TABLE 1:

Assessment criteria for new residential developments near busy roads

Type of room	Time period	Assessment Criteria, dB
Bedrooms	Night (10 pm - 7 am)	LAeq (15 hour) - 35 (internal)
Other habitable rooms	Any time	LAeq (24 hour) - 40 (internal)

For residential dwellings adjacent to local roads and the Leq noise level that is not considered to be dominated by traffic on arterial roads then the RNP classifies those roads as local roads leading to an assessment of traffic noise with respect to an external noise target of 55 dB(A) LAeq 1 hour during the day and 50 dB(A) LAeq (1-hour) during the night. The RNP refers to new developments to the Infrastructure SEPP that in a technical sense does not cover developments adjacent to local roads.

Whereas the concept of the Infrastructure SEPP automatically leads to closed windows and the provision of mechanical ventilation for residential developments the concept for a local road having achieved the external noise targets nominated by the EPA would result for an open windows situation and internal target 10 dB below the external noise levels.

The EPA's RNP repeatable maximum (1 hour) LAeq level is used for local road and is defined as being the upper 10% of the individual Leq levels and on a numerical basis the external level would be marginally higher than the 15 hour or 9 hour analysis method used by the EPA for arterial roads

However it is noted that the development in the proposed re-zoning is also required to satisfy the aircraft noise Standard AS 2021 that specifies internal noise levels for different occupancies. If doors and windows are required to be closed to satisfy the internal targets of AS 2021 then alternative ventilation is necessary for those spaces, where such ventilation satisfies Australian Standard 1668 Part 2.

Due to the proximity of the site to Sydney Airport there is a requirement for the site to be assessed in accordance with Australian Standard 2021-2000 *"Acoustics – Aircraft Noise Intrusion, Building Siting and Construction"*.

By reference to Appendix C the site being the subject of the rezoning lies inside the ANEF 25 zone with a central portion of the site lying within the 30 ANEF noise contour zone.

Utilising the flowchart being Figure 1.1 in AS 2021 – 2000 identifies that in the first instance it is necessary to ascertain whether the building site requires compliance with AS 2021 by reference to the ANEF noise exposure level.

If the site is outside 20 ANEF it is considered to be acceptable with respect to aircraft noise and no special noise control measures would apply.

If a site lies between 20 and 25 ANEF it is considered conditionally acceptable and one then continues to evaluate the development with respect to the maximum noise level (i.e. the ANEF descriptor is no longer utilised). If a residential building site is in a zone above ANEF 25 the standard classifies that site as unacceptable and that one would proceed with the development in special cases.

The special cases in where the residential development can occur inside a 25 ANEF zone, comes from Note 4 to Table 2.1 in the standard were it is stated:

> *4. This Standard does not recommend development in unacceptable areas. However, where the relevant planning authority determines that any development may be necessary within existing built-up areas designated as unacceptable, it is recommended that such developments should achieve the required ANR determined according to Clause 3.2. For residences, schools etc the effective aircraft noise on outdoor areas associated with the buildings should be considered.*

The concept of a master plan in principle rezoning and consideration by the Department of Plan to address the acoustic issues identifies that the need for urban renewal of the industrial area is considered necessary and appropriate but in terms of noise requirements relies upon the internal spaces being appropriately treated to achieve internal noise targets.

In utilising AS2021 the internal noise target set out in Table 3.3 is a dB(A) maximum level.

The Australian Standard AS2021 sets out a procedure for determining the position of a building site with respect to an aerodrome by the determination of a distance in metres from the building site to the extended runway centreline (DS), the distance in metres from the closest end of the runway to the intersection of the extended runway centreline (DL) and the distance in metres from the further end of the runway to the intersection of the runway centreline (DT).

The subject site is affected by aircraft utilising the main runway (16R for arrivals from the north, 34L for departures to the north) of Sydney Airport.

From the location of the proposed development with respect to the runways at Sydney Airport, the position of a number of the monitoring sites used during the assessment has been determined as shown in Table 2:

TABLE 2: Position of *Monitoring Locations to Flight Track*

Runway	Main Runway (m)	
	South Direction 16R	North Direction 34L
Location 1		
DS	110	110
DL	3210	NA
DT	NA	7010
Location 10		
DS	10	10
DL	2880	NA
DT	NA	6680
Location 9		
DS	40	40
DL	2600	NA
DT	NA	4880
Location 2		
DS	190	190
DL	2985	NA
DT	NA	7185
Location 7		
DS	425	425
DL	2530	NA
DT	NA	6730

Australian Standard AS2021 contains a set of tables providing noise levels at different displacements from the flight track for aircraft operating in commercial airports around Australia. From these tables the highest aircraft noise of common aircraft across the study area will vary from 79 – 88 dB(A).

Attended measurements for our investigation found a range of noise levels depending upon the different aircraft types as set out in Appendix E where there is also a comparison of the level predicted by AS2021 for the above distance co-ordinates relative to a 747-400 landing or and long haul 747 takeoff.

The Aircraft Noise Reduction ("ANR") is based upon a recommended internal design goal for sleeping areas and dedicated lounges of not more than 50 dB(A). For other habitable spaces, AS2021 recommends an internal design sound level of 55 dB(A) whilst for bathrooms, toilets and laundries the design goal is 60 dB(A).

Therefore for the subject site any proposed buildings are required to have an ANR that will vary from 79-50 = 29 dB(A) to 88-50=38 dB(A) for sleeping areas and dedicated lounges, 24-33 dB(A) for other habitable spaces, and 19-28 dB(A) for bathrooms, toilets and laundries.

In considering the internal noise levels the frequency characteristics of the aircraft noise has a bias towards the low frequencies which therefore tends to require an attenuation performance (when expressed as an Rw value) greater than the ANR that is expressed as a dB(A).

Noise emissions from mechanical plant

Under general noise emission from mechanical plant and equipment Councils often refer to the EPA's Industrial Noise Policy Document with the intrusive noise target of background +5 dB(A) applied to industrial/commercial operations.

The EPA's *Noise Guide for Local Government* applies the intrusive noise target for mechanical plant. This level would apply at residential boundaries not associated with the subject development.

Utilising the background levels set out in Appendix C, the Council is expected to impose a day time limit for mechanical plant not exceeding 56 + 5 = 61 dB(A) at the nearest residential boundary, 48 + 5 = 53 dB(A) during the evening and 42 + 5 = 47 dB(A) during the night, provided such noise was free from tonal and intermittent characteristics.

In relation to commercial premises Marrickville Council has issued noise requirements for such plant set at background +3 dB and also consideration of octave bands.

As to whether the Council would impose their more stringent noise criteria for mechanical plant associated with residential development rather than commercial development is unknown.

However where there is air conditioning equipment associated with residential dwellings apart from the general background +5 dB(A) requirement there is also a specification under the regulations to the Protection of the Environment Operations Act that requires noise from air conditioning plant to be inaudible in any habitable room of any residential premises (other than the source of the noise) during the period of 10 PM to 7 AM Monday to Friday's or 8 AM on Sundays and public holidays.

If in large scale residential development there is mechanical plant, air conditioning plant located on the roof is a common chiller then that plant would fall under the more stringent criteria and similarly if there are individual air conditioning units for apartments and the like then there needs to be consideration in the selection of such plant with respect to the overall noise targets bearing in mind that a building could have a number of individual plant items.

Sound transmission and insulation

In terms of acoustic controls with respect to sound transmission and insulation the various developments will be required to satisfy the acoustic provision of the Building Code of Australia.

Part F5 of the Building Code of Australia sets out Sound Transmission and Insulation specifications to safeguard occupants from illness or loss of amenity as a result of undue sound from different occupancies and common spaces in the building.

Under Part F5 of the BCA there is a requirement for sound insulation rating of floors to have an $R_w + C_{tr}$ (airborne) not less than 50 and an impact rating $L_{w,n} + C_i$ (impact) not more than 62 if it separates sole-occupancy units or a sole-occupancy unit from a plant room, lift shaft, stairway, public corridor, public lobby or the like, or parts of a different classification.

There is also the requirement for a wall in a Class 2 component to have an Rw +Ctr (airborne) not less than 50 if it separates sole-occupancy units and an Rw (airborne) not less than 50 if it separates a sole-occupancy unit from a plant room, lift shaft, stairway, public corridor, public lobby or the like, or parts of a different classification.

The *Building Code of Australia* sets out in Specification F5.2 forms of construction for the walls and floors that are deemed-to-satisfy provisions of the BCA.

Any form of construction that is not contained in the BCA is required to either have a test certificate in terms of a laboratory measurement of that construction, or an appropriately qualified opinion that the construction that has been provided is not inferior to that specified in the BCA.

The Council in relation to other developments have required certification of the constructions used in the buildings to achieve the required acoustic performance set out in the BCA, where such certification is provided at the construction certificate stage.

Required Noise Reduction

The measurement results appended to this report set out a range of noise levels at various monitoring locations in the study area.

Is a general concept if one is seeking to satisfy a the *Infrastructure SEPP* requirements for residential occupancies adjacent to the major roads then for a typical external facade level of 58 to 60 dB(A) for the night-time period necessitates a noise reduction from outside to inside of not less than 25 dB(A).

The aircraft noise levels across the site vary from an average maximum level of 79 dB(A) at location 7 up to a level of 87-88 dB(A) for locations 2 and 10. For a bedroom situation the attenuation from outside to inside would vary from 29 - 38 dB(A).

The provision of noise controls to satisfy the aircraft noise internal limit from AS20211 will automatically satisfy the road traffic noise criteria applicable as any part on the subject site, that a such simplifies in acoustic terms the design parameters.

Typically for normal building construction the outside to inside attenuation for an open window is taken as 10 dB(A), and 20 – 25 dB(A) for a closed window. Considering a maximum noise level in the order of 88 dB(A) reveals to achieve the internal noise targets for rooms that would have a direct view of the aircraft, the doors and windows would need to be closed.

Using a normalised spectrum for aircraft overflights to the maximum level of 88 dB(A) reveals that standard forms of construction encountered for residential dwellings cannot satisfy the design goals and that there would need to be an acoustic upgrading of the building envelope. Whilst the aircraft noise reduction is expressed in an A-weighted value (outside noise level less the noise target) the sound attenuation performance of building elements is expressed in an apparent weighted reduction index (R_w) which are not identical.

An approximation of the A-weighted value of attenuation is the R_w - 5 to 7 dB.

In approaching the noise control measures the ANR of 38 dB(A) for bedrooms indicates, for an entire glass wall construction an R_W performance in the order of 42 to 45. Reducing the amount of open area of glass and having the remainder of the wall being of solid masonry permits a reduction of the sound insulation performance for the window by reason of the smaller surface area.

Such a degree of attenuation typically involves double glazed systems for the purpose of achieving the satisfactory internal noise levels. This can be either by proprietary windows achieving the required performance, or the provision of two separate windows/doors with an airspace where there is an expectation of an external glazing of 10.38 laminated glass or 8.5 mm VLam Hush glazing with 100 mm airgap and then 6.3 8mm laminated glass for the internal glazing.

If however in the design phase if a balcony were to become a winter gardens then the intermediate space provides a greater separation between the glazing that as such the glazing can be downgraded in performance.

The degree of attenuation required for the glazing is achievable and has occurred on other properties subject to similar aircraft noise levels.

As the general concept in terms of building elements the external constructions area of heavyweight construction which for simplicity in terms of overall design one should suggest concrete slabs for the roof rather than lightweight structures which will not achieve the required acoustic performance.

CONCLUSION

As part of the technical assessments with respect to the Victoria Road precinct noise levels across the site have been monitored a number of locations that have identified that the principal noise impact upon the subject area is aircraft noise.

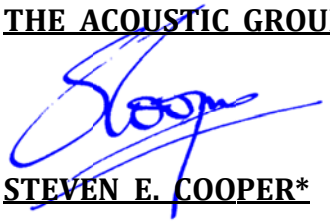
Whilst there is noise from road traffic that would require noise controls to satisfy either the EPA's RNP requirements or the *Infrastructure SEPP* internal requirements, on examining the aircraft maximum noise levels as a result of the aircraft overflying the subject site is has been established that compliance with Australian Standard AS2021-200 requirements to achieve a satisfactory internal noise levels will automatically result in compliance with the road traffic criteria.

Therefore in terms of simplification of the subsequent development applications for each of the stages, whilst would in a general sense require assessment of traffic noise to determine compliance with the Infrastructure SEPP, the principal site investigations for the various stages of the project will be to obtain a larger sample of the aircraft operations with respect to the specific sites although the contents of Appendix D of this report give an indication of the noise levels and spectral characteristics for a number of locations that would form the basis of acoustic assessment.

General acoustic matters in relation to noise emission from mechanical plant and sound insulation requirements for different occupancies of residential accommodation would fall under normal Council criteria and are not envisaged to be a particular onerous task in terms of satisfying that criteria.

Yours faithfully,

THE ACOUSTIC GROUP PTY LTD



STEVEN E. COOPER*

APPENDIX A: Site Location

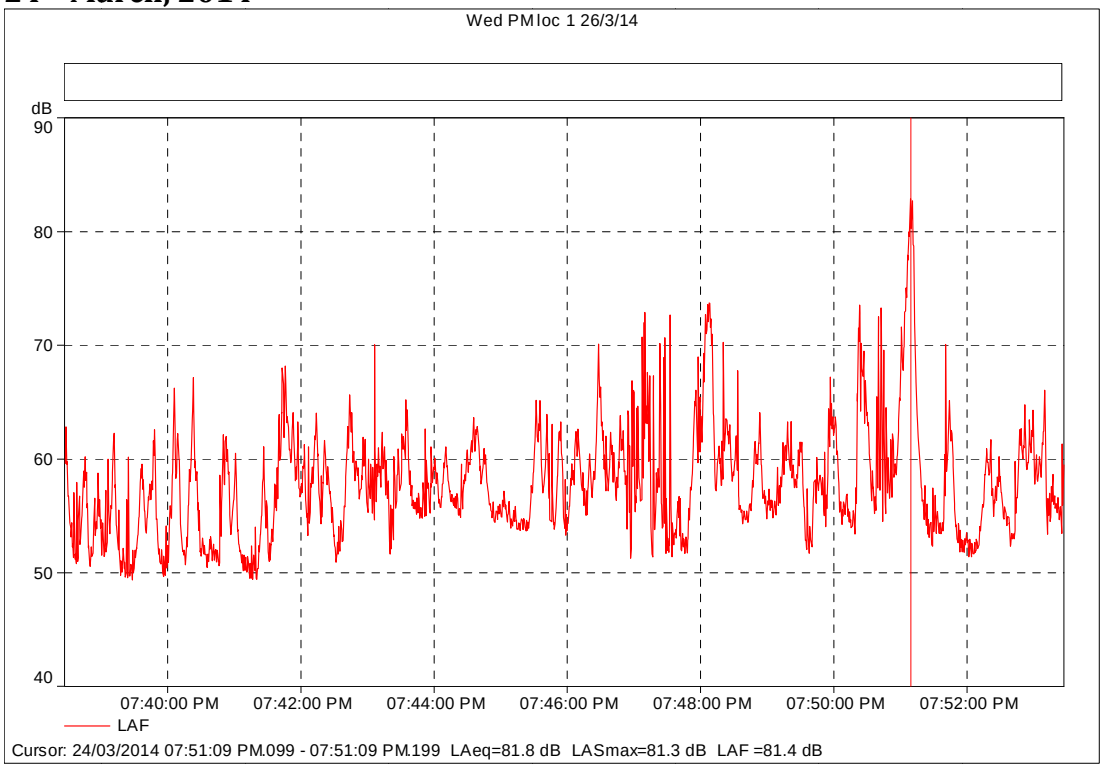

Sydenham
Marrickville
Google earth

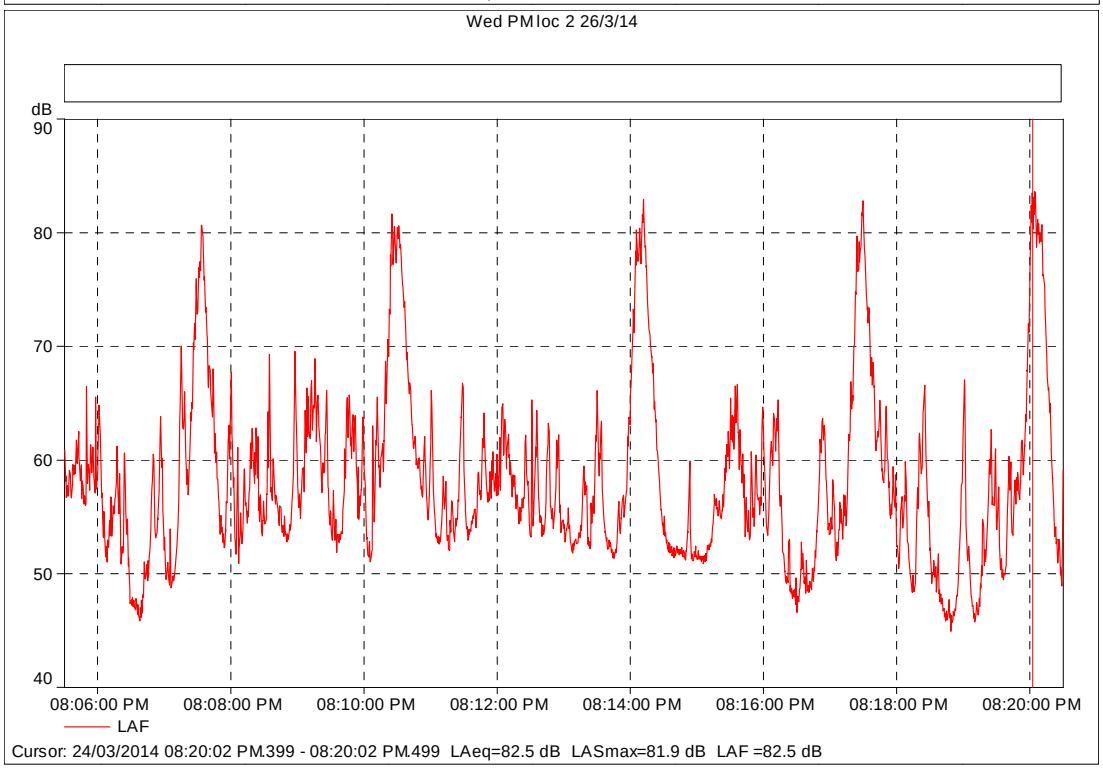
APPENDIX B: Measurement Locations

APPENDIX C: Aircraft Noise Contours

APPENDIX D: Measurement Results

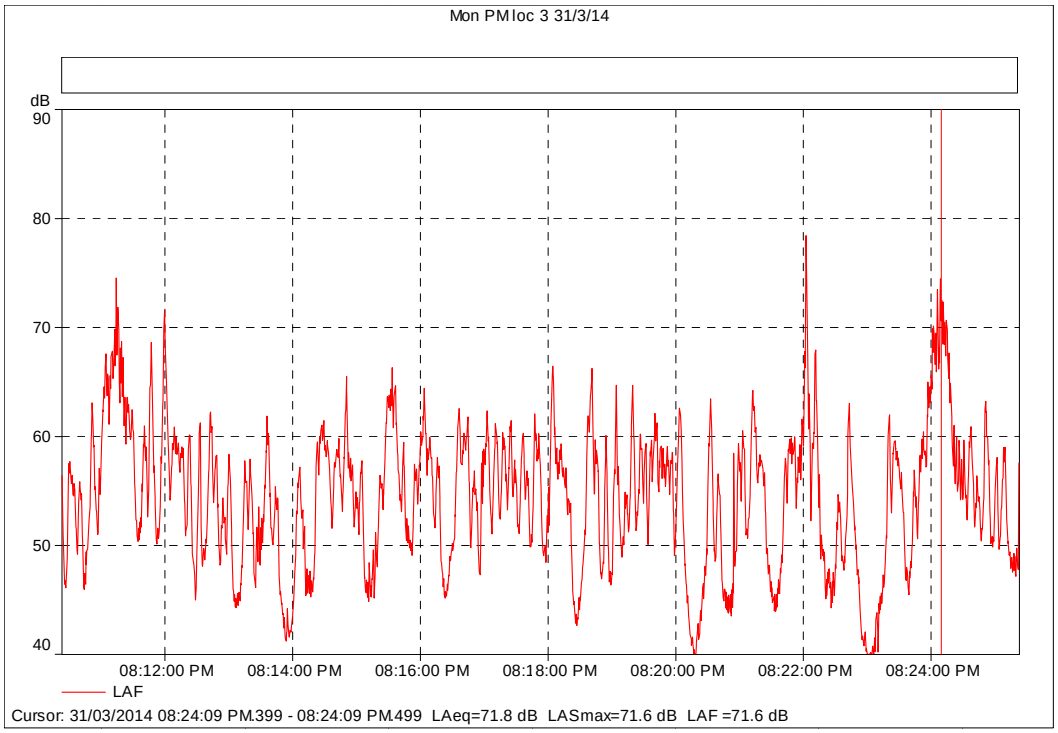
24th March, 2014

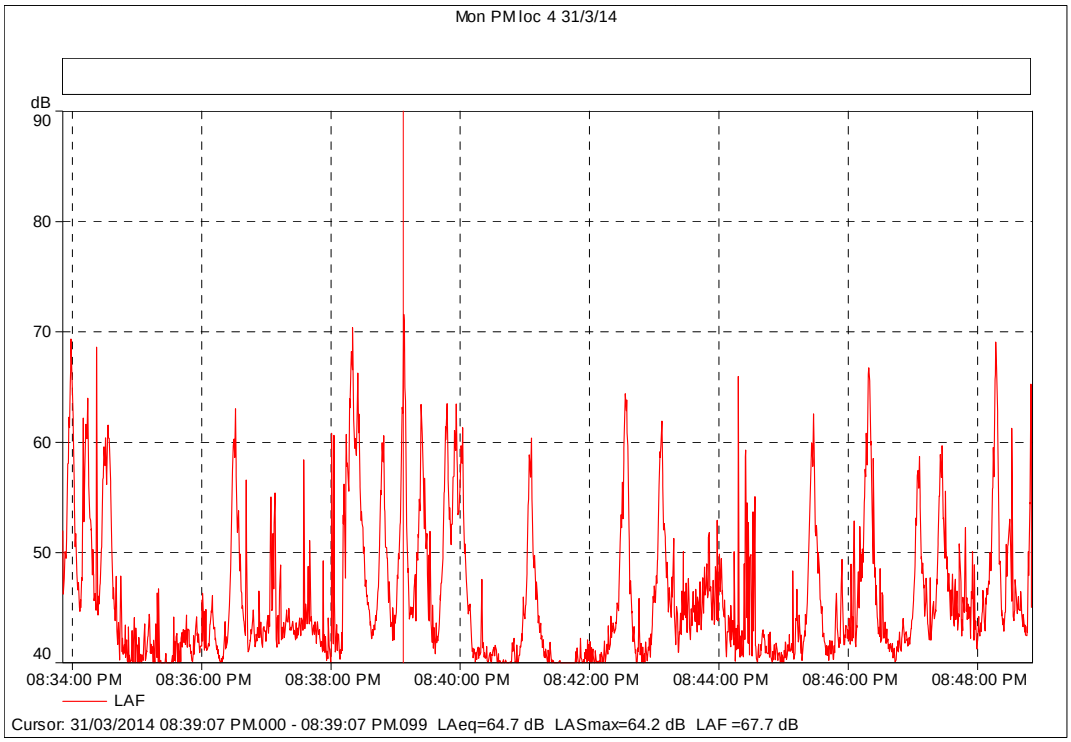


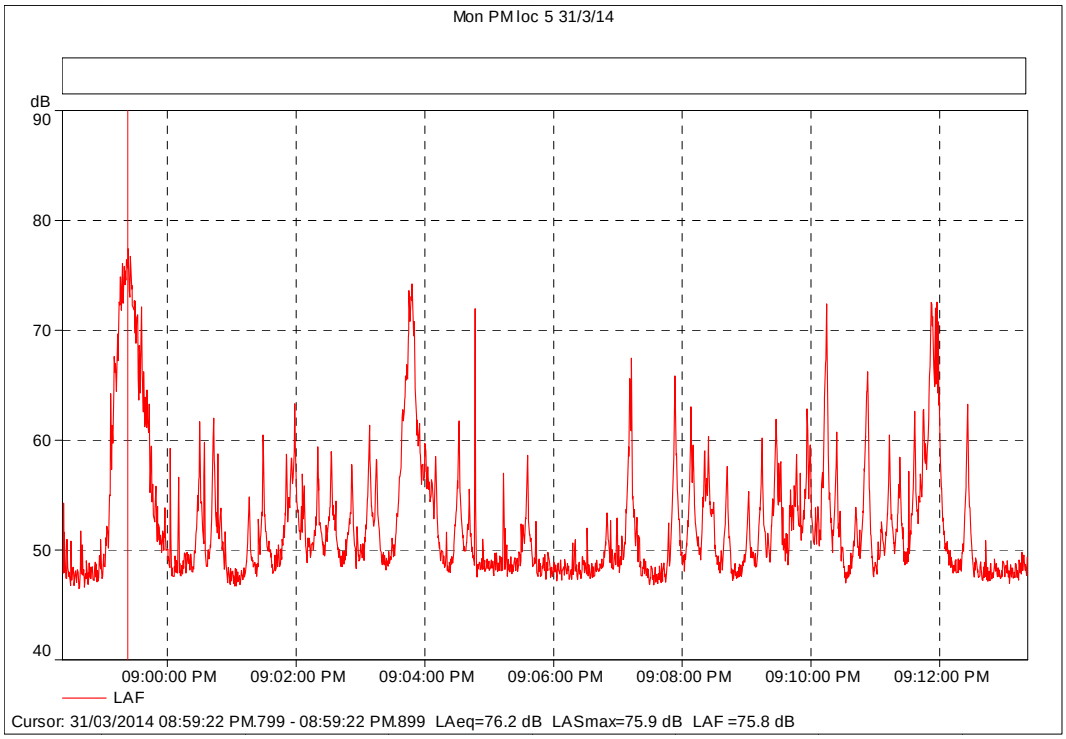


Location	Parameter	dB(A)	A -weighted Octave Band Centre Frequency (Hz)								
			31	63	125	250	500	1k	2k	4k	8k
1	L10	63	71	71	66	61	59	59	56	49	43
	Leq	63	66	68	64	61	59	58	55	51	46
	L90	52	57	60	58	53	50	45	42	35	-
2	L10	68	72	71	70	66	65	64	61	54	41
	Leq	68	69	68	66	65	65	63	61	57	46
	L90	50	55	57	53	48	46	43	42	34	-

31st March, 2014

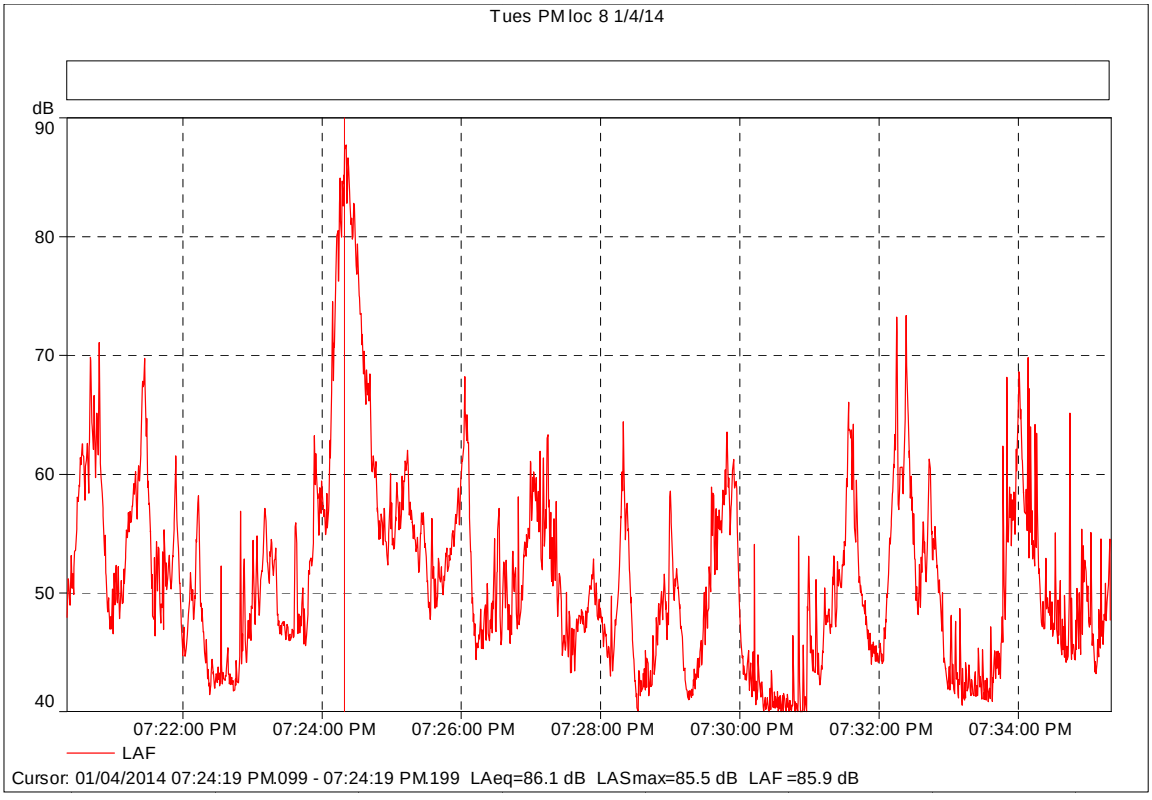


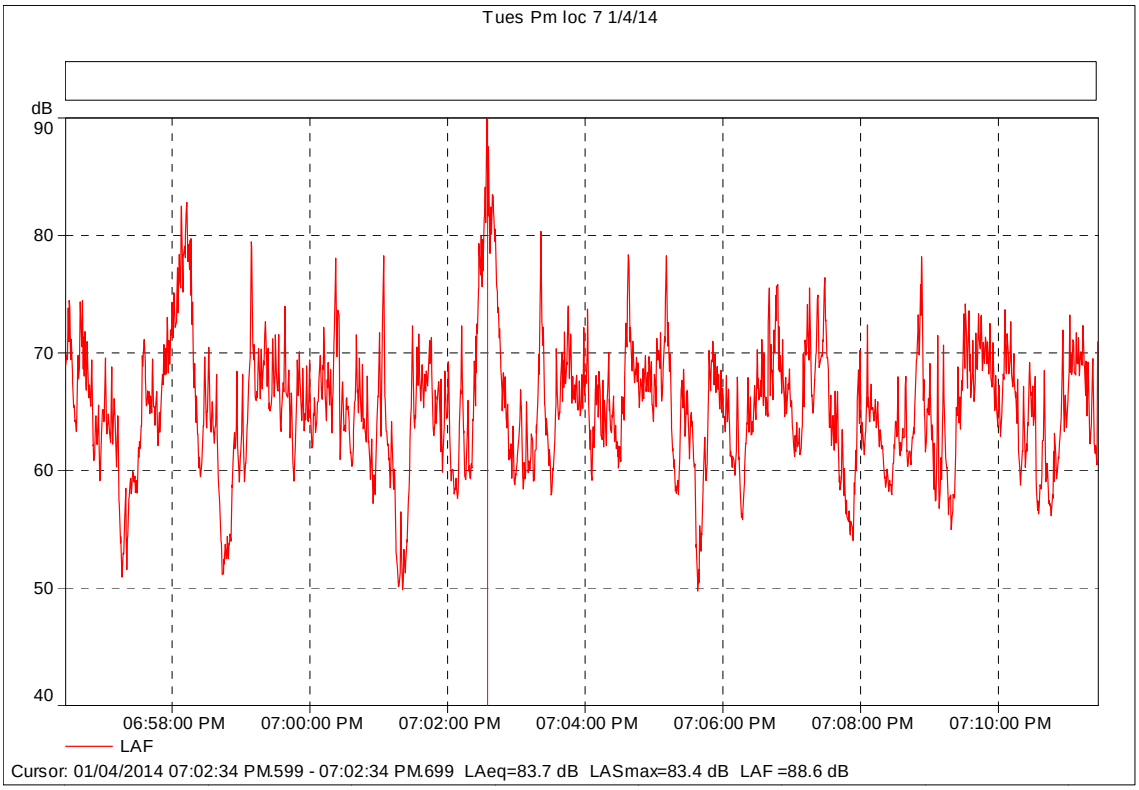

Mon PM loc 4 31/3/14
dB
90
80
70
60
50
40
08:34:00 PM
08:36:00 PM
08:38:00 PM
08:40:00 PM
08:42:00 PM
08:44:00 PM
08:46:00 PM
08:48:00 PM
LAF
Cursor: 31/03/2014 08:39:07 PM.000 - 08:39:07 PM.099 LAeq=64.7 dB LASmax=64.2 dB LAF =67.7 dB

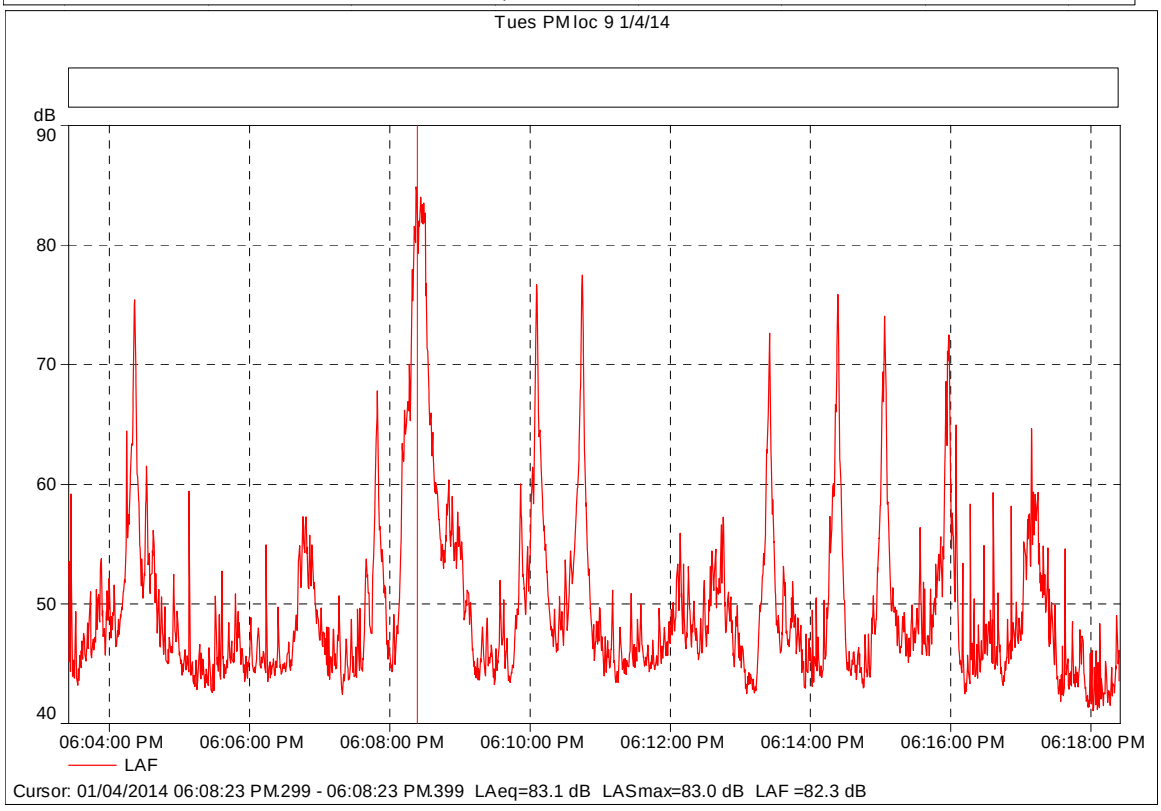

Mon PM loc 5 31/3/14
dB
90
80
70
60
50
40
09:00:00 PM
09:02:00 PM
09:04:00 PM
09:06:00 PM
09:08:00 PM
09:10:00 PM
09:12:00 PM
LAF
Cursor: 31/03/2014 08:59:22 PM.799 - 08:59:22 PM.899 LAeq=76.2 dB LASmax=75.9 dB LAF =75.8 dB

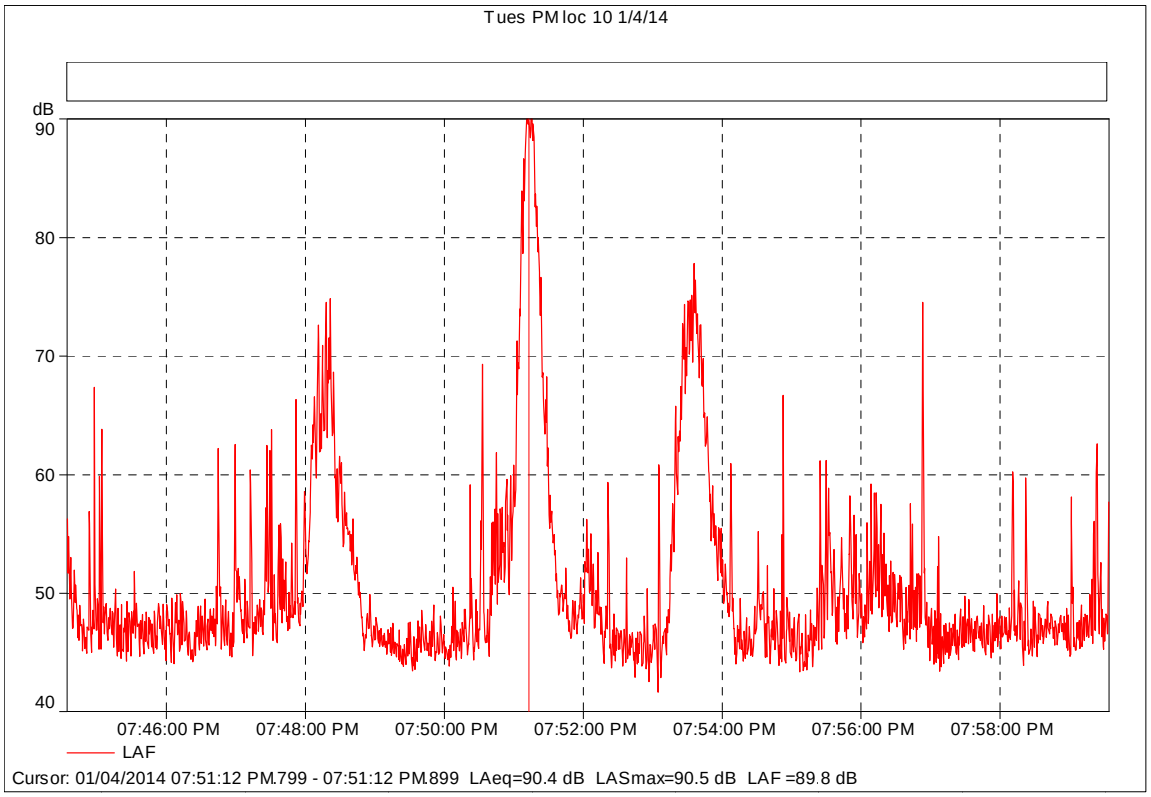
Location	Parameter	dB(A)	A -weighted Octave Band Centre Frequency (Hz)								
			31	63	125	250	500	1k	2k	4k	8k
3	L10	62	66	70	66	61	58	58	54	45	42
	Leq	60	62	67	62	60	56	54	51	41	39
	L90	46	51	52	47	43	41	40	36	31	-
4	L10	56	58	57	55	54	51	52	49	40	32
	Leq	53	56	60	54	52	48	49	46	37	30
	L90	40	49	46	46	41	37	34	-	-	-
5	L10	60	68	67	62	58	56	56	51	43	37
	Leq	60	65	64	61	60	57	55	52	45	39
	L90	48	55	56	54	49	44	42	36	31	33

1st April, 2014



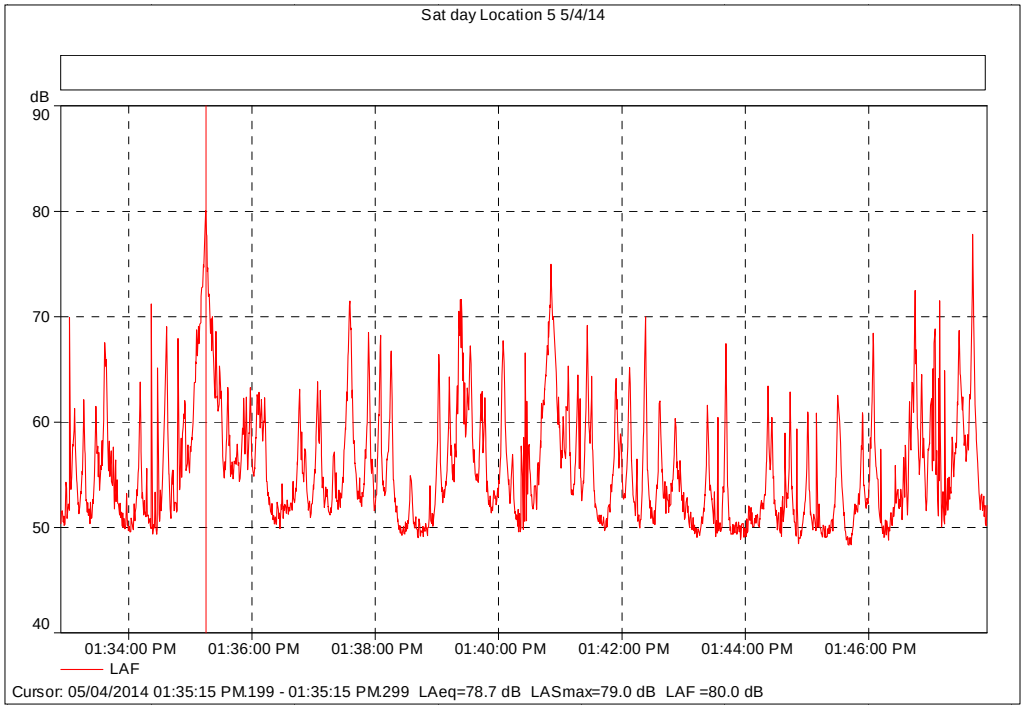

Tues Pm loc 7 1/4/14
dB
90
80
70
60
50
40
06:58:00 PM
07:00:00 PM
07:02:00 PM
07:04:00 PM
07:06:00 PM
07:08:00 PM
07:10:00 PM
LAF
Cursor: 01/04/2014 07:02:34 PM.599 - 07:02:34 PM.699 LAeq=83.7 dB LASmax=83.4 dB LAF =88.6 dB

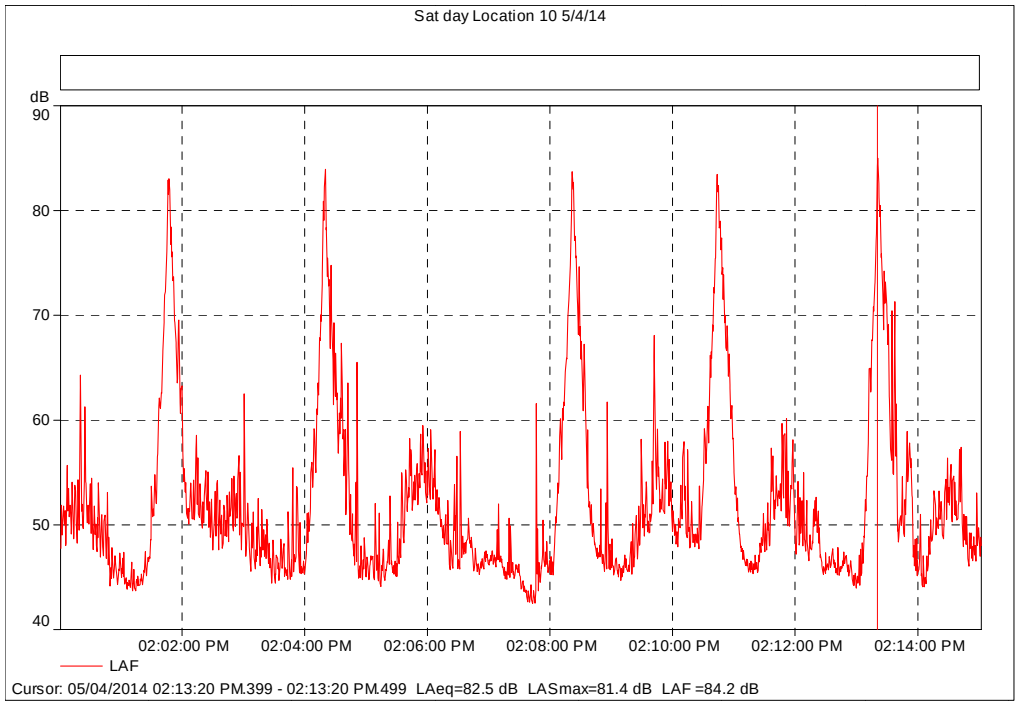

Tues PM loc 9 1/4/14
dB
90
80
70
60
50
40
06:04:00 PM
06:06:00 PM
06:08:00 PM
06:10:00 PM
06:12:00 PM
06:14:00 PM
06:16:00 PM
06:18:00 PM
LAF
Cursor: 01/04/2014 06:08:23 PM.299 - 06:08:23 PM.399 LAeq=83.1 dB LASmax=83.0 dB LAF =82.3 dB



Location	Parameter	dB(A)	A -weighted Octave Band Centre Frequency (Hz)								
			31	63	125	250	500	1k	2k	4k	8k
9	L10	59	67	67	63	59	55	54	50	42	32
	Leq	64	67	65	64	63	61	59	58	52	39
	L90	44	53	54	50	44	39	39	35	-	-
6	L10	71	77	79	77	70	67	67	64	56	48
	Leq	70	74	76	74	68	65	65	63	56	46
	L90	59	63	64	58	54	53	53	51	43	33
7	L10	71	77	79	77	70	67	67	64	57	48
	Leq	70	74	76	74	68	65	65	63	56	46
	L90	59	63	64	58	55	53	53	51	44	34
8	L10	61	73	72	68	61	57	56	53	46	39
	Leq	67	72	71	69	68	66	61	57	48	37
	L90	42	52	51	48	42	39	37	34	-	-
10	L10	59	69	69	64	59	56	53	52	44	36
	Leq	70	69	69	68	68	67	65	64	58	46
	L90	45	50	51	48	45	40	38	34	36	31

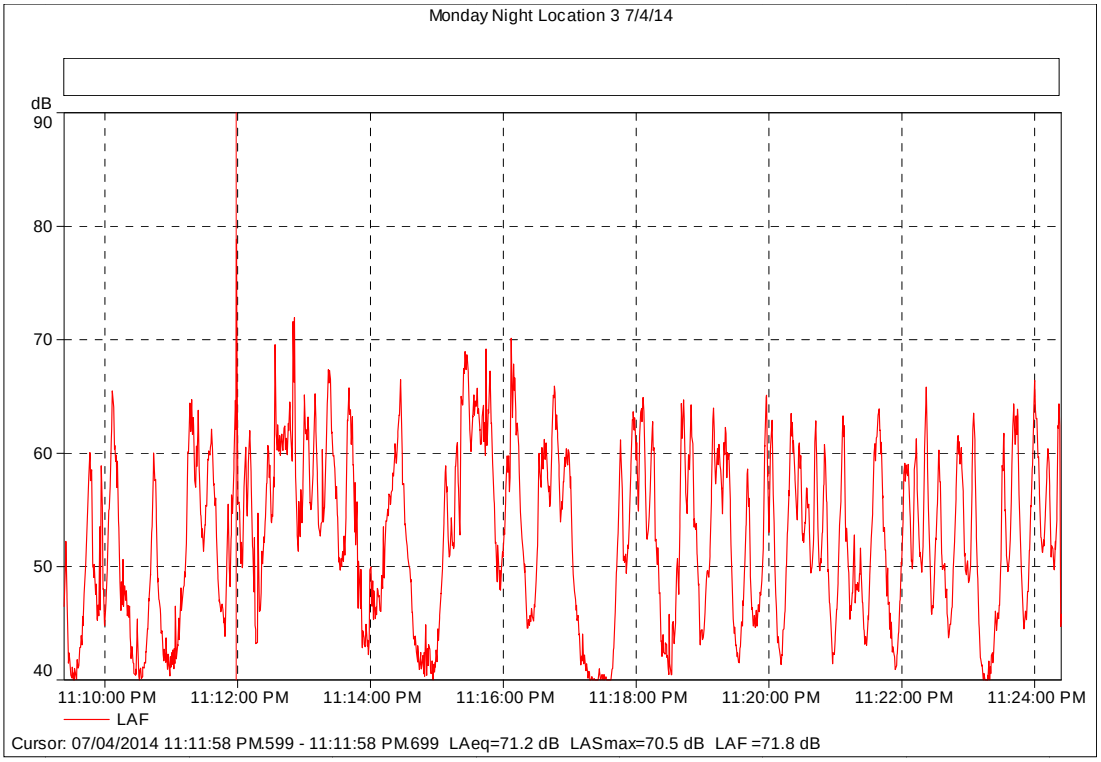
5th April, 2014

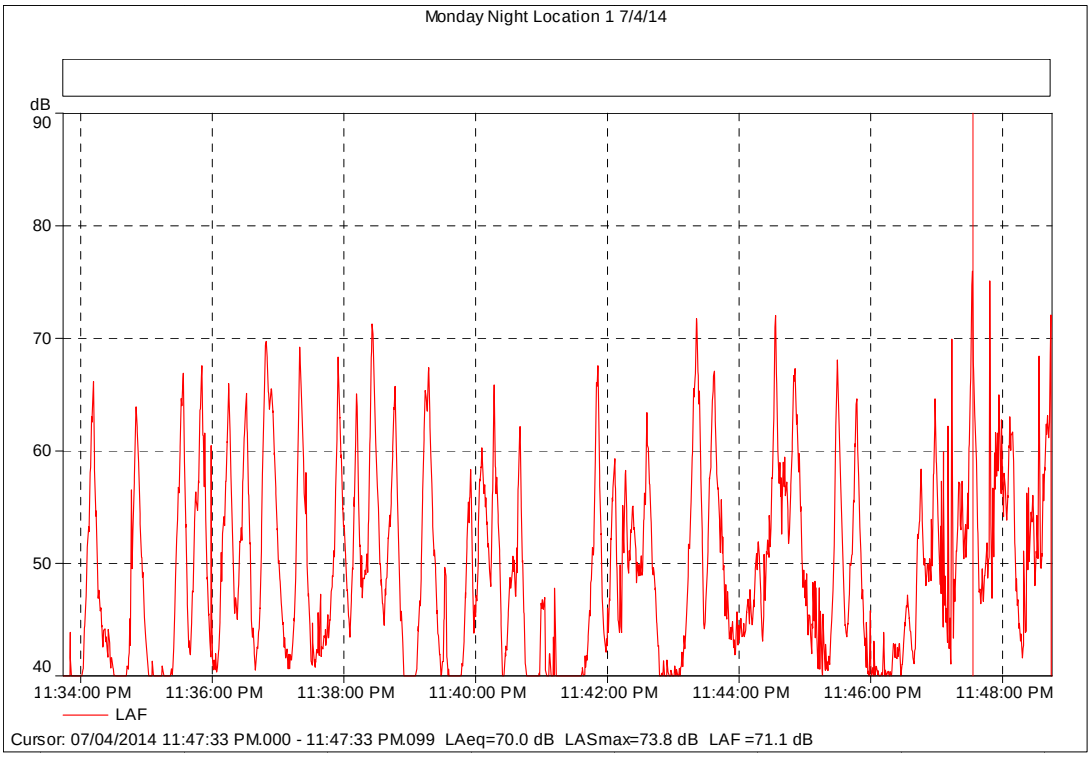


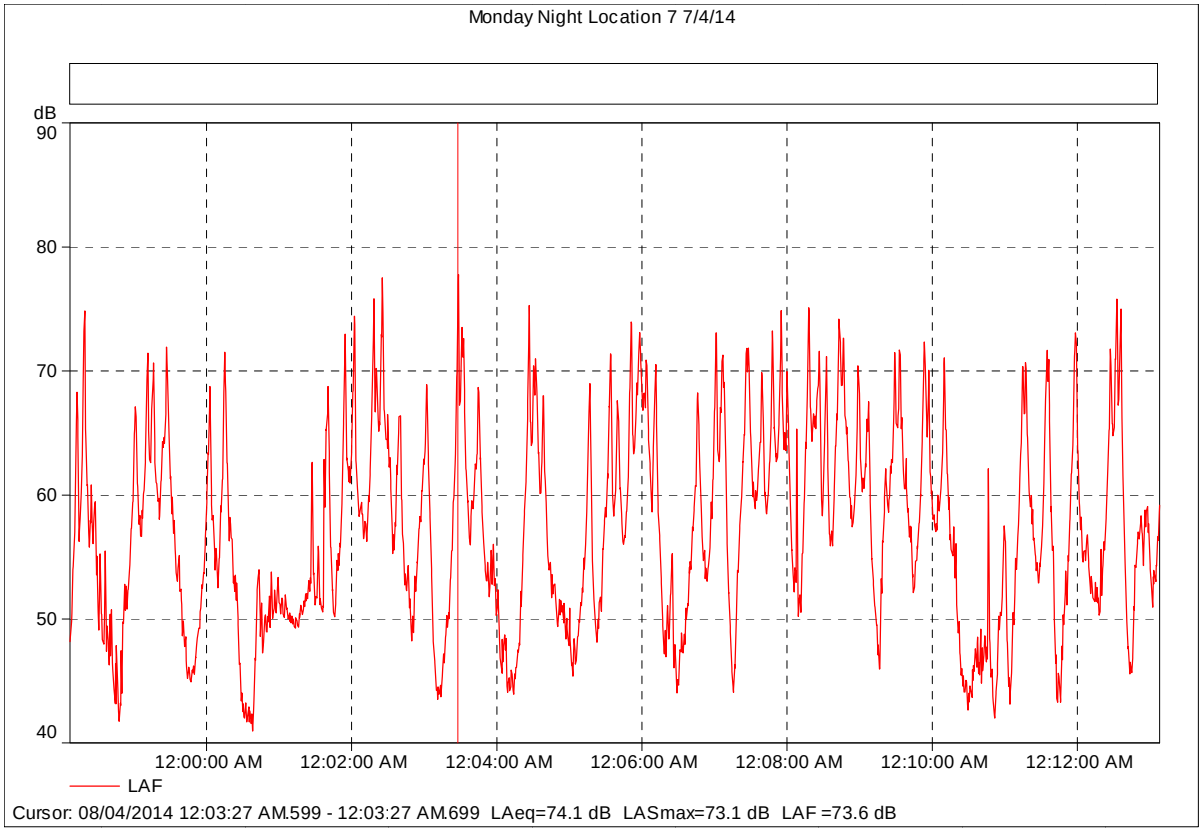


Location	Parameter	dB(A)	A -weighted Octave Band Centre Frequency (Hz)								
			31	63	125	250	500	1k	2k	4k	8k
5	L10	63	67	68	66	61	58	59	55	48	41
	Leq	61	64	66	65	59	57	56	53	49	44
	L90	50	57	59	56	51	47	45	41	36	-
10	L10	65	65	65	64	62	62	61	56	49	36
	Leq	66	64	63	63	63	63	61	59	58	52
	L90	46	53	54	51	45	42	40	36	-	-

7th April, 2014

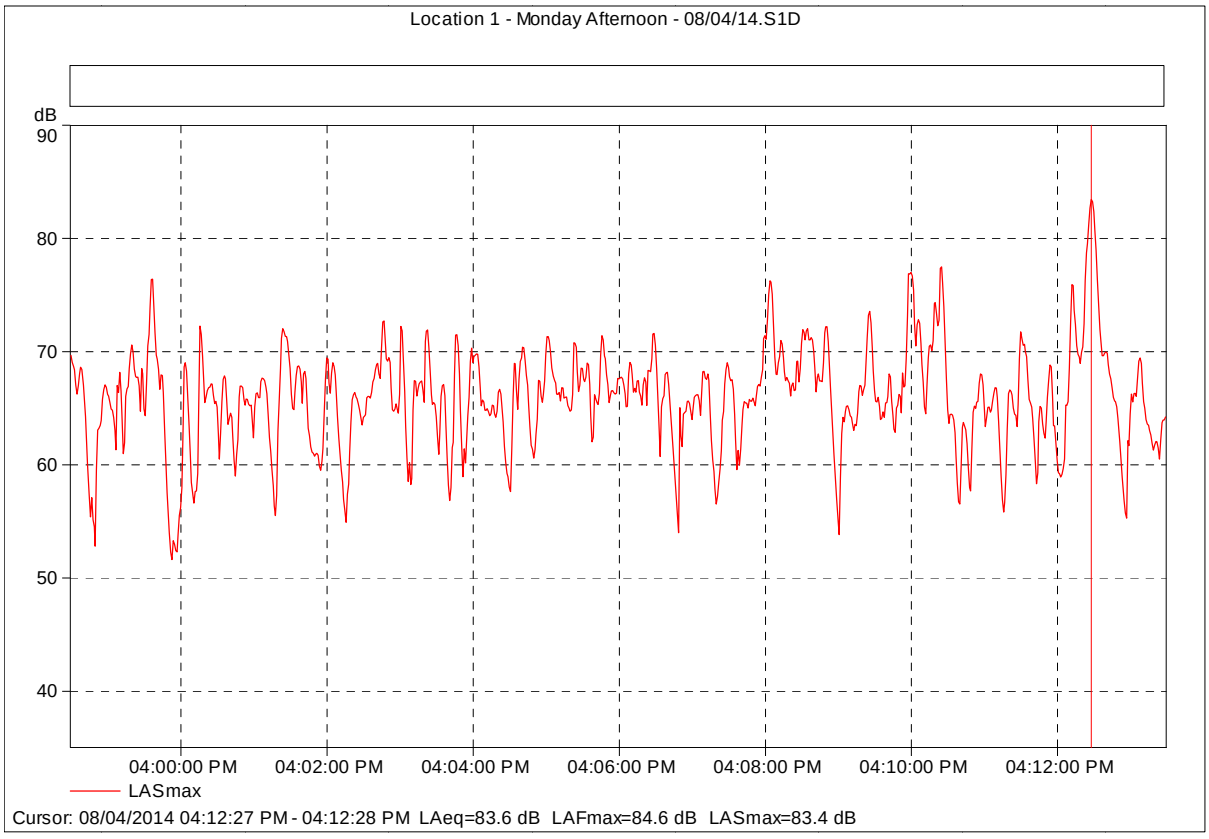



Monday Night Location 1 7/4/14
dB
90
80
70
60
50
40
11:34:00 PM
11:36:00 PM
11:38:00 PM
11:40:00 PM
11:42:00 PM
11:44:00 PM
11:46:00 PM
11:48:00 PM
LAF
Cursor: 07/04/2014 11:47:33 PM.000 - 11:47:33 PM.099 LAeq=70.0 dB LASmax=73.8 dB LAF =71.1 dB


Monday Night Location 7 7/4/14
dB
90
80
70
60
50
40
12:00:00 AM
12:02:00 AM
12:04:00 AM
12:06:00 AM
12:08:00 AM
12:10:00 AM
12:12:00 AM
LAF
Cursor: 08/04/2014 12:03:27 AM.599 - 12:03:27 AM.699 LAeq=74.1 dB LASmax=73.1 dB LAF =73.6 dB

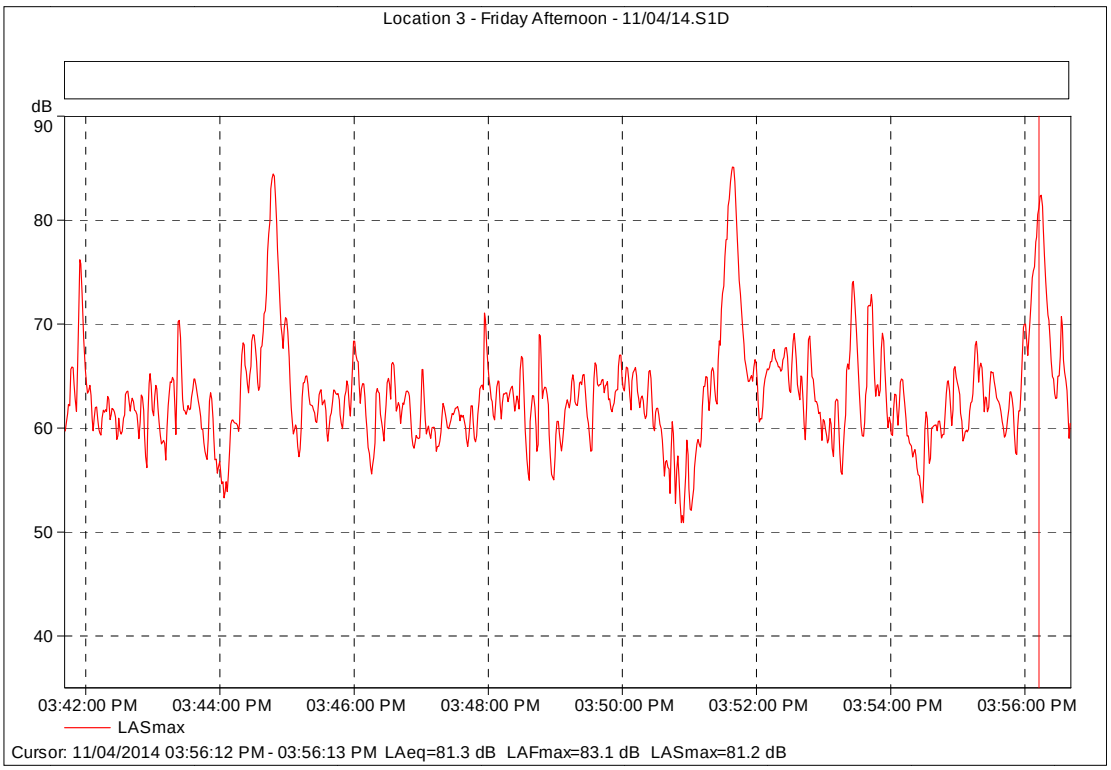
Location	Parameter	dB(A)	Octave Band Centre Frequency (Hz)								
			31	63	125	250	500	1k	2k	4k	8k
3	L10	62	64	66	60	57	56	58	56	48	39
	Leq	58	60	63	59	54	53	54	51	43	37
	L90	42	50	51	46	41	38	37	33	31	-
1	L10	62	62	68	61	57	56	58	55	47	39
	Leq	58	62	68	59	54	52	54	51	44	36
	L90	39	47	50	45	38	34	34	31	-	-
7	L10	68	63	67	61	61	62	65	62	54	45
	Leq	64	61	65	58	56	57	60	58	49	40
	L90	47	50	51	48	45	43	43	39	-	-

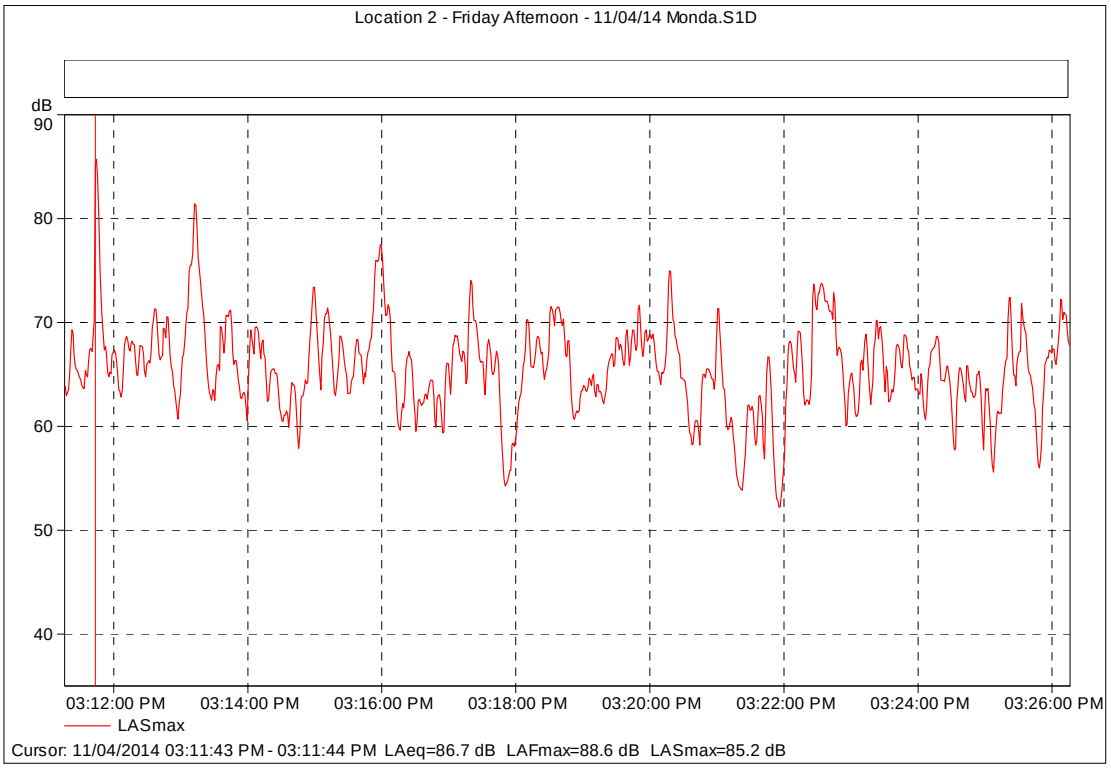
8th April 2014

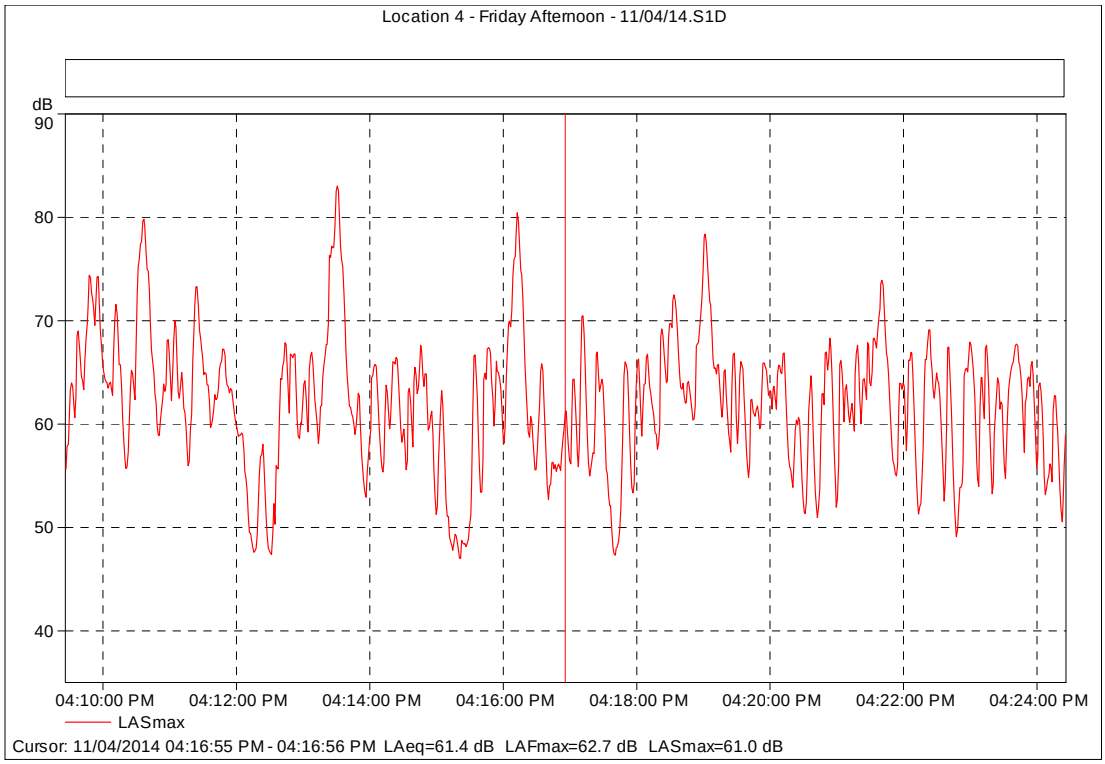


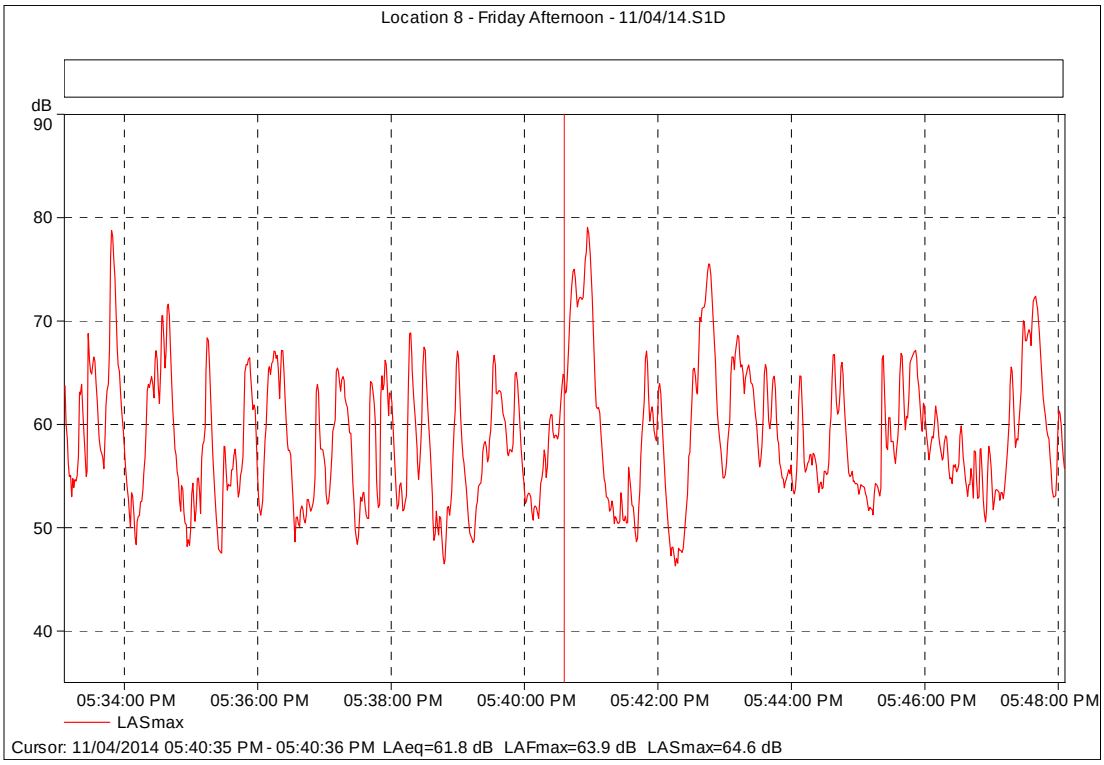
Location	Parameter	dB(A)	Octave Band Centre Frequency (Hz)								
			31	63	125	250	500	1k	2k	4k	8k
1	Leq	68	71	76	71	66	64	63	60	55	49
	L10	70	74	77	73	68	66	66	63	57	51
	L90	58	61	62	57	54	54	53	50	43	34

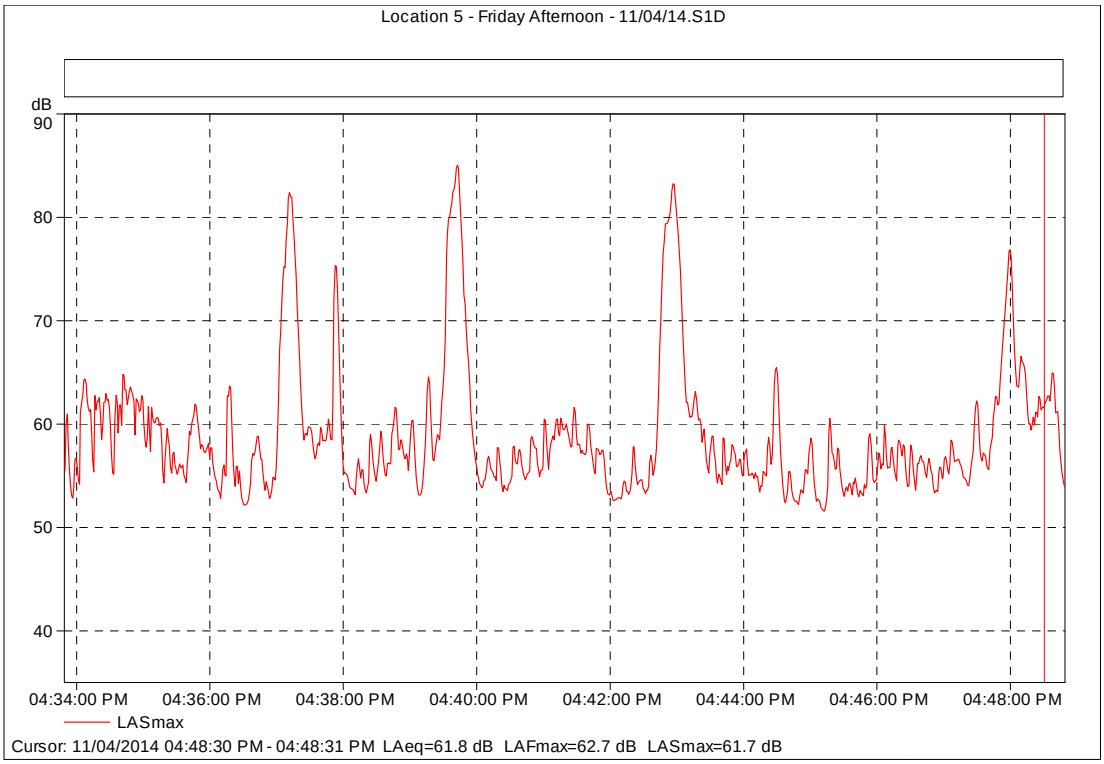
11th April 2014




Location 2 - Friday Afternoon - 11/04/14 Monda.S1D
dB
90
80
70
60
50
40
03:12:00 PM
03:14:00 PM
03:16:00 PM
03:18:00 PM
03:20:00 PM
03:22:00 PM
03:24:00 PM
03:26:00 PM
LASmax
Cursor: 11/04/2014 03:11:43 PM - 03:11:44 PM LAeq=86.7 dB LAFmax=88.6 dB LASmax=85.2 dB

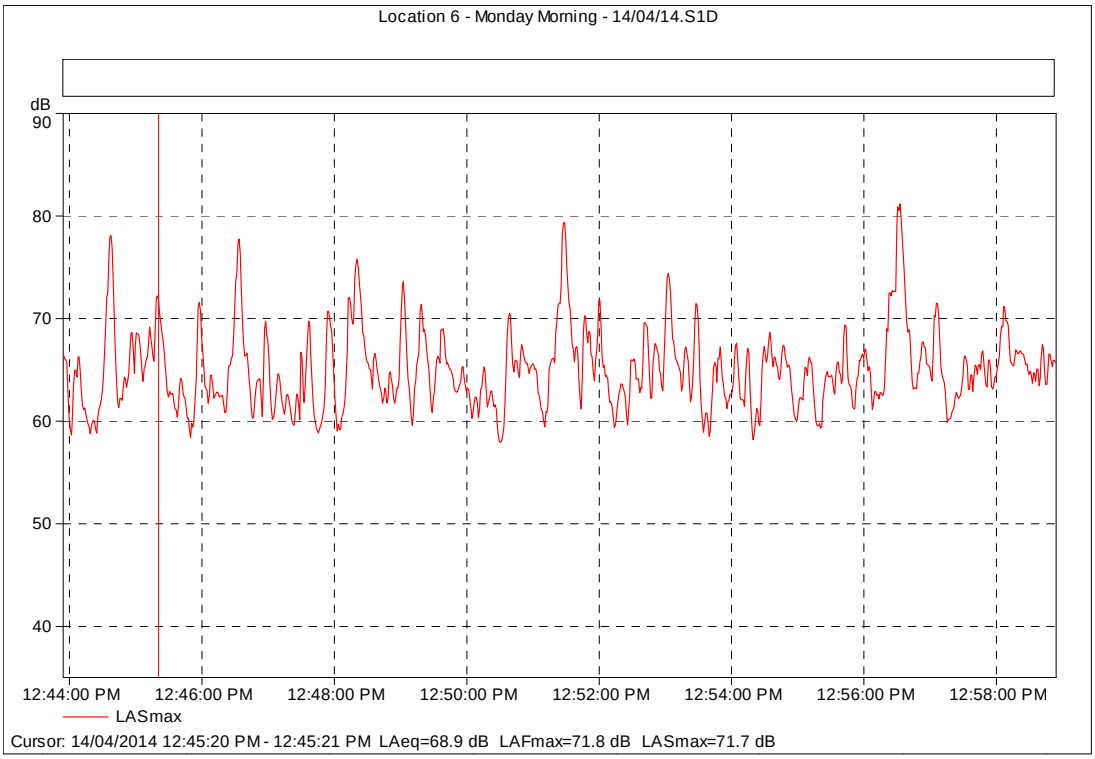

Location 4 - Friday Afternoon - 11/04/14.S1D
dB
90
80
70
60
50
40
04:10:00 PM
04:12:00 PM
04:14:00 PM
04:16:00 PM
04:18:00 PM
04:20:00 PM
04:22:00 PM
04:24:00 PM
LASmax
Cursor: 11/04/2014 04:16:55 PM - 04:16:56 PM LAeq=61.4 dB LAFmax=62.7 dB LASmax=61.0 dB

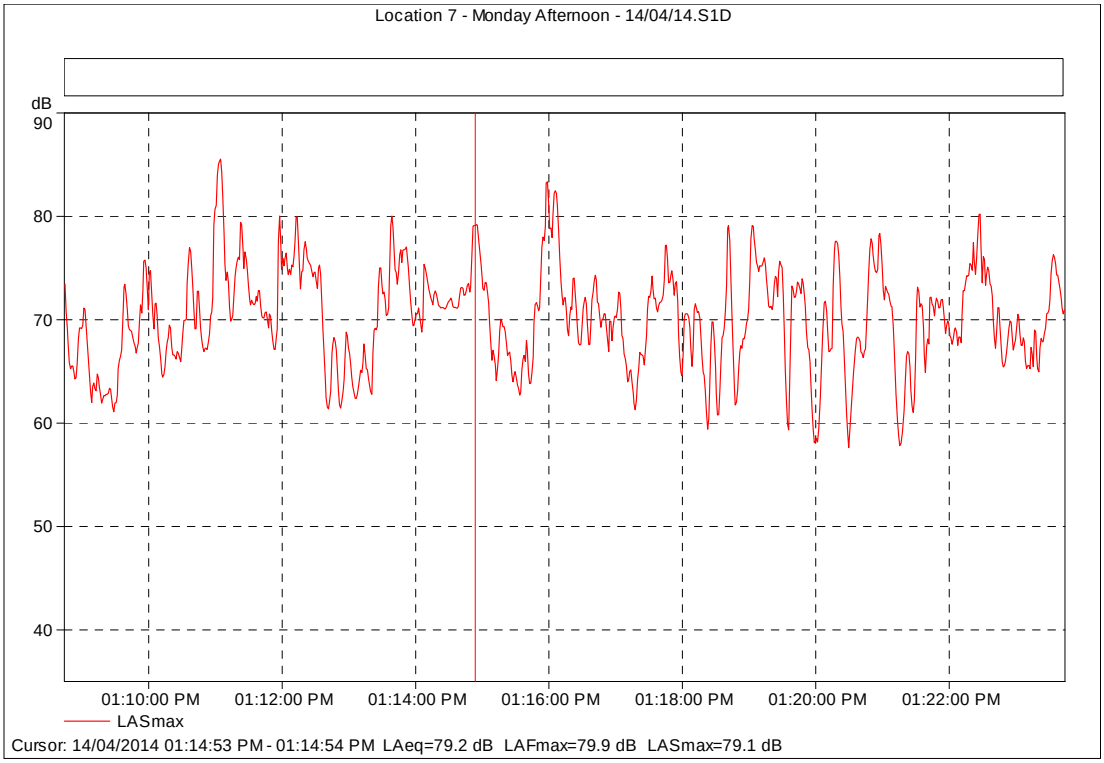

Location 8 - Friday Afternoon - 11/04/14.S1D
dB
90
80
70
60
50
40
05:34:00 PM
05:36:00 PM
05:38:00 PM
05:40:00 PM
05:42:00 PM
05:44:00 PM
05:46:00 PM
05:48:00 PM
LASmax
Cursor: 11/04/2014 05:40:35 PM - 05:40:36 PM LAeq=61.8 dB LAFmax=63.9 dB LASmax=64.6 dB

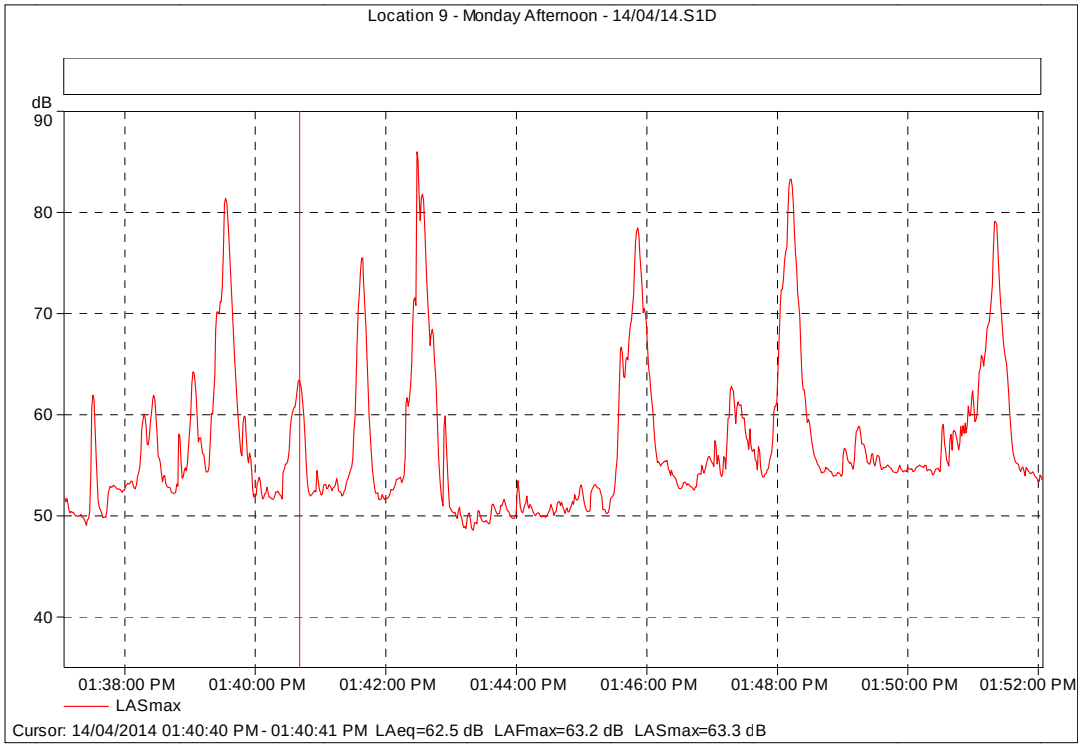

Location 5 - Friday Afternoon - 11/04/14.S1D
dB
90
80
70
60
50
40
04:34:00 PM
04:36:00 PM
04:38:00 PM
04:40:00 PM
04:42:00 PM
04:44:00 PM
04:46:00 PM
04:48:00 PM
LASmax
Cursor: 11/04/2014 04:48:30 PM - 04:48:31 PM LAeq=61.8 dB LAFmax=62.7 dB LASmax=61.7 dB

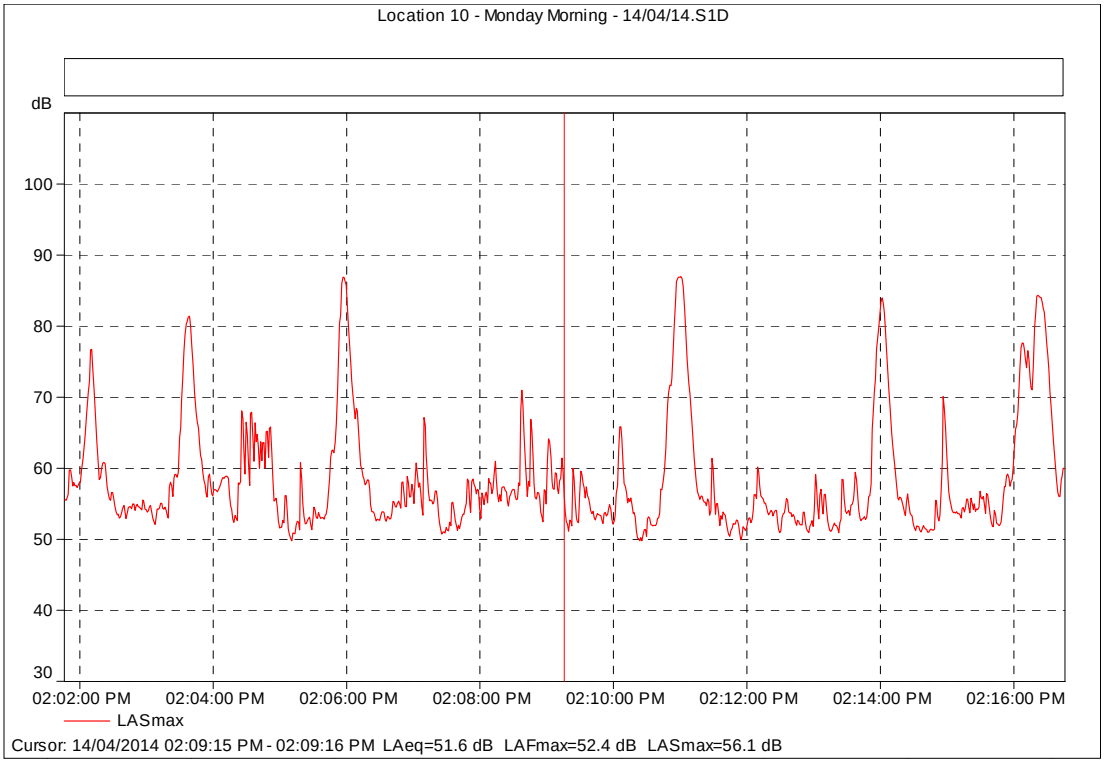
Location	Parameter	dB(A)	Octave Band Centre Frequency (Hz)								
			31	63	125	250	500	1k	2k	4k	8k
2	Leq	70	77	76	72	68	66	66	63	57	50
	L10	68	74	74	70	66	64	63	60	55	49
	L90	59	68	63	60	57	54	54	51	44	36
3	Leq	68	70	71	68	66	64	64	61	58	51
	L10	68	74	74	70	66	65	64	60	54	46
	L90	56	64	62	58	54	52	52	48	41	31
4	Leq	66	67	71	66	63	62	62	60	55	46
	L10	69	70	74	70	66	64	65	61	56	46
	L90	51	57	59	55	51	46	46	43	35	---
5	Leq	68	67	67	64	65	65	63	61	58	47
	L10	65	71	70	67	62	61	60	58	52	44
	L90	53	59	60	57	52	51	47	44	39	32
8	Leq	63	66	70	67	62	60	59	56	51	43
	L10	66	70	72	69	64	62	62	58	53	45
	L90	50	57	58	53	48	44	44	41	35	---

14th April 2014






Location 9 - Monday Afternoon - 14/04/14.S1D
dB
90
80
70
60
50
40
01:38:00 PM
01:40:00 PM
01:42:00 PM
01:44:00 PM
01:46:00 PM
01:48:00 PM
01:50:00 PM
01:52:00 PM
LASmax
Cursor: 14/04/2014 01:40:40 PM - 01:40:41 PM LAeq=62.5 dB LAFmax=63.2 dB LASmax=63.3 dB


Location 10 - Monday Morning - 14/04/14.S1D
dB
100
90
80
70
60
50
40
30
02:02:00 PM
02:04:00 PM
02:06:00 PM
02:08:00 PM
02:10:00 PM
02:12:00 PM
02:14:00 PM
02:16:00 PM
LASmax
Cursor: 14/04/2014 02:09:15 PM - 02:09:16 PM LAeq=51.6 dB LAFmax=52.4 dB LASmax=56.1 dB

Location	Parameter	dB(A)	Octave Band Centre Frequency (Hz)								
			31	63	125	250	500	1k	2k	4k	8k
6	Leq	67	71	74	68	65	64	62	59	54	44
	L10	69	74	77	71	67	66	65	62	55	47
	L90	60	65	65	63	60	56	54	51	44	34
7	Leq	72	78	78	73	69	68	68	65	60	55
	L10	75	82	81	76	72	71	71	69	63	57
	L90	62	68	68	63	59	58	57	55	49	41
9	Leq	67	67	70	64	64	63	61	58	56	58
	L10	67	70	74	66	62	63	62	60	53	43
	L90	50	58	58	55	51	47	44	41	34	---
10	Leq	71	70	70	67	66	66	65	64	63	55
	L10	69	72	71	66	64	64	64	62	59	49
	L90	51	56	56	52	49	48	46	43	37	---

APPENDIX E: Aircraft Maximum Noise Levels

Location 1

Location	Date	Time	Type	Operation	Max meas. dB(A)	AS2021 dB(A)
1	08/04/2014	03:12 PM	737 - XXX	Landing	84	83

Location	dB(A)	Octave Band Centre Frequency (Hz)								
		31	63	125	250	500	1k	2k	4k	8k
1	84	81	82	80	79	80	79	77	72	67

Location 2

Location	Date	Time	Type	Operation	Max meas. dB(A)	AS2021 dB(A)
2	11/04/2014	2.11 PM	747 - 400	Landing	87	87

Location	dB(A)	Octave Band Centre Frequency (Hz)								
		31	63	125	250	500	1k	2k	4k	8k
2	87	79	78	85	86	84	81	80	74	71

Location 7

Location	Date	Time	Type	Operation	Max meas. dB(A)	AS2021 dB(A)
7	14/04/2014	1.15PM	747 - 400	Landing	79	79

Location	dB(A)	Octave Band Centre Frequency (Hz)								
		31	63	125	250	500	1k	2k	4k	8k
7	79	86	79	75	76	75	75	72	68	61

Location 9

Location	Date	Time	Type	Operation	Max meas. dB(A)	AS2021 dB(A)
9	14/04/2014	1.48 PM	737 - XXX	Landing	84	86

Location	dB(A)	Octave Band Centre Frequency (Hz)								
		31	63	125	250	500	1k	2k	4k	8k
9	84	78	74	78	81	81	78	76	75	65

Location 10

Location	Date	Time	Type	Operation	Max meas. dB(A)	AS2021 dB(A)
10	14/04/2014	2.06 PM	767 - XXX	Landing	87	88

Location	dB(A)	Octave Band Centre Frequency (Hz)								
		31	63	125	250	500	1k	2k	4k	8k
10	87	83	81	88	83	84	82	80	75	69