ATKINS

National Police Air Service

North Weald Helicopter Noise Assessment

NPAS

25 July 2017

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Executive summary

Atkins noise and vibration (ANV) was commissioned to undertake a helicopter noise assessment for the proposed relocation of the National Police Air Service (NPAS) operations to the North Weald Airfield.

To assess the proposed NPAS operations at the North Weald Airfield, noise measurements were undertaken with one of the NPAS helicopters at the North Weald Airfield to simulate the proposed NPAS operations.

Both baseline noise monitoring and noise measurements during helicopter operations were undertaken at locations representative of the nearest sensitive receptors to each of the three recommended flight paths to the proposed NPAS hangar location at North Weald Airfield. The helicopters are not bound to the runways and can therefore utilise the recommended flight paths for landings and take-offs directly to the NPAS hangar location.

The noise measurements and assessment shows that there are no predicted noise levels above the Lowest Observed Adverse Effect Level (LOAEL) criterion of 50 dB L_{Aeq} during daytime.

During the night-time (2300 – 0700), there are a few exceedances of the LOAEL criteria (40 dB L_{Aeq} and 60 dB L_{Amax}) due to helicopter movements along the northeast and west flight paths. The south flight path has no exceedances of the LOAEL criteria. There are no predicted exceedances of the Significant Observed Adverse Effect Level (SOAEL) criteria (55 dB L_{Aeq} and 80 dB L_{Amax}) at any receptors due to proposed NPAS operations.

With the appropriate noise management and control measures, as outlined in Section 5, there are no anticipated adverse noise effects from the NPAS operations at the new site.

1. Introduction

Atkins noise and vibration (ANV) has been commissioned to undertake a helicopter noise assessment for the proposed relocation of the National Police Air Service (NPAS) operations to the North Weald Airfield.

This report describes the assessment methodology, the baseline conditions and the potential noise effects of the proposed NPAS helicopter operations at the North Weald Airfield.

A glossary of acoustic terminology is provided in Appendix A.

1.1. Current Site

NPAS is currently located at Lippitts Hill. The current base at Lippitts Hill sits on top of a 300 ft hill and has houses immediately adjacent to the boundary, North, East and South East. The site incorporates a helipad and a landing strip that conforms to the minimum length required for Commercial Air Transport Operations. The helipad is within 100m of the boundary and the landing strip is immediately adjacent to the southern boundary. These geographic limitations mean that all operations are conducted within 300m of housing and aircraft cross the boundary at approximately 100 ft during arrivals and less than 100 ft during departures from the landing strip. All departures and arrivals take place in an arc from 150 degrees to 260 degrees to avoid directly overflying properties, however lateral separation is minimal due to the proximity of some properties. Helicopters cannot take-off or land with a wind from the rear which means that under certain conditions it is not possible to use the runway for take-off and landing, using the “clear area“ profile. The “clear area” profile is the preferred take-off and landing profile similar to an airplane i.e. about 300m close to ground before gradually climbing and gradually descending when landing. In these conditions take-off and landing must be from the helipad using the Vertical Take-off and Landing (VTOL) profile which takes longer, giving a greater noise exposure.

1.2. Proposed Site

North Weald is an established airfield bordered by the M11 motorway on the West side, see Figure 1-1. The proposed base location would allow flights to depart and approach to the centre of the airfield. The runway greatly exceeds the minimum required and would allow all take-offs and landings to be conducted using a “clear area” profile, this profile is the fastest way to approach and depart, compared to the VTOL profile required when taking off or landing from a helipad (as sometimes required when operating from the Lippitts Hill helipad).

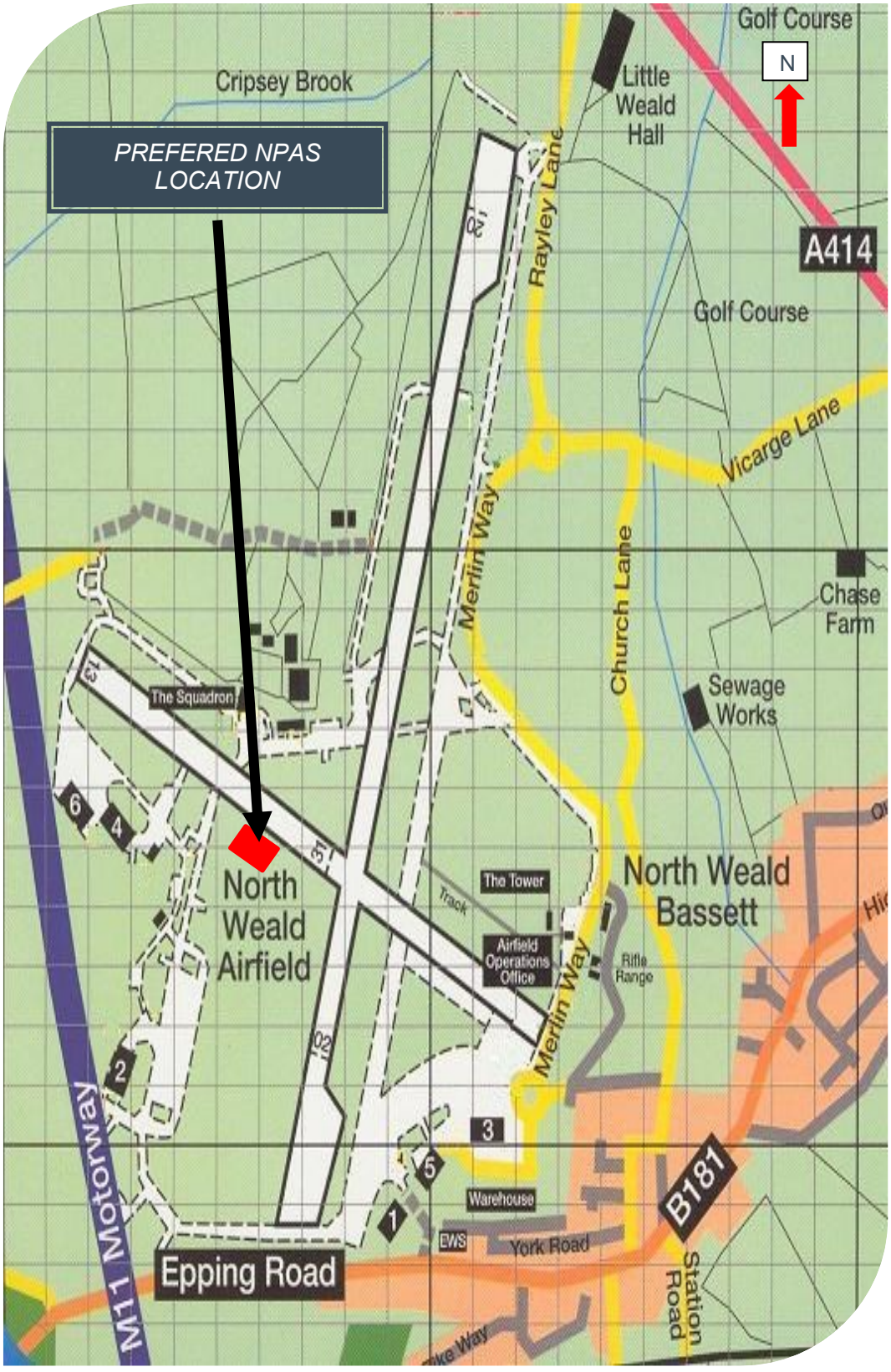
The proposed NPAS hangar location at the North Weald Airfield is shown in Figure 1-1. The nearest sensitive receptors to the departure/arrival point at the proposed NPAS hangar location are approximately:

N – 430m
SE – 700m
NW – 700m
SW – 900m
E – 1200m

Utilising a “clear area” profile would allow helicopters to cross the airfield boundary at a minimum of 200ft during departure and 500ft on arrival. Utilising the preferred flight paths as shown in Figure 1-2 would also give substantial lateral separation to the nearest sensitive receptors. The helicopters are not restricted to a straight approach path and can vary approach and departure routes to avoid habitation and ensure that they do not constantly fly over the same area. They also have the ability to vary their angle of approach which enables them to keep above 500ft until inside the airfield boundary, this is not possible at Lippitts Hill due to the small size of the site.

The Epping Forest District Local Plan 2011-2033 is included in Appendix B, this shows the future planned land use for areas surrounding the airfield.

Figure 1-1 Site Location



1.3. Proposed NPAS Operations

NPAS London has currently a fleet of three helicopters, one is always in maintenance with the other two operating. The current helicopters are EC145 rotary craft.

NPAS estimate that the future demand would be up to 7,000 movements per year. North Weald Airfield has current operations of approximately 36,500 movements per year (50-100 movements per weekday and about 150 movements on weekend days). This is an increase of the current operations up to 19%.

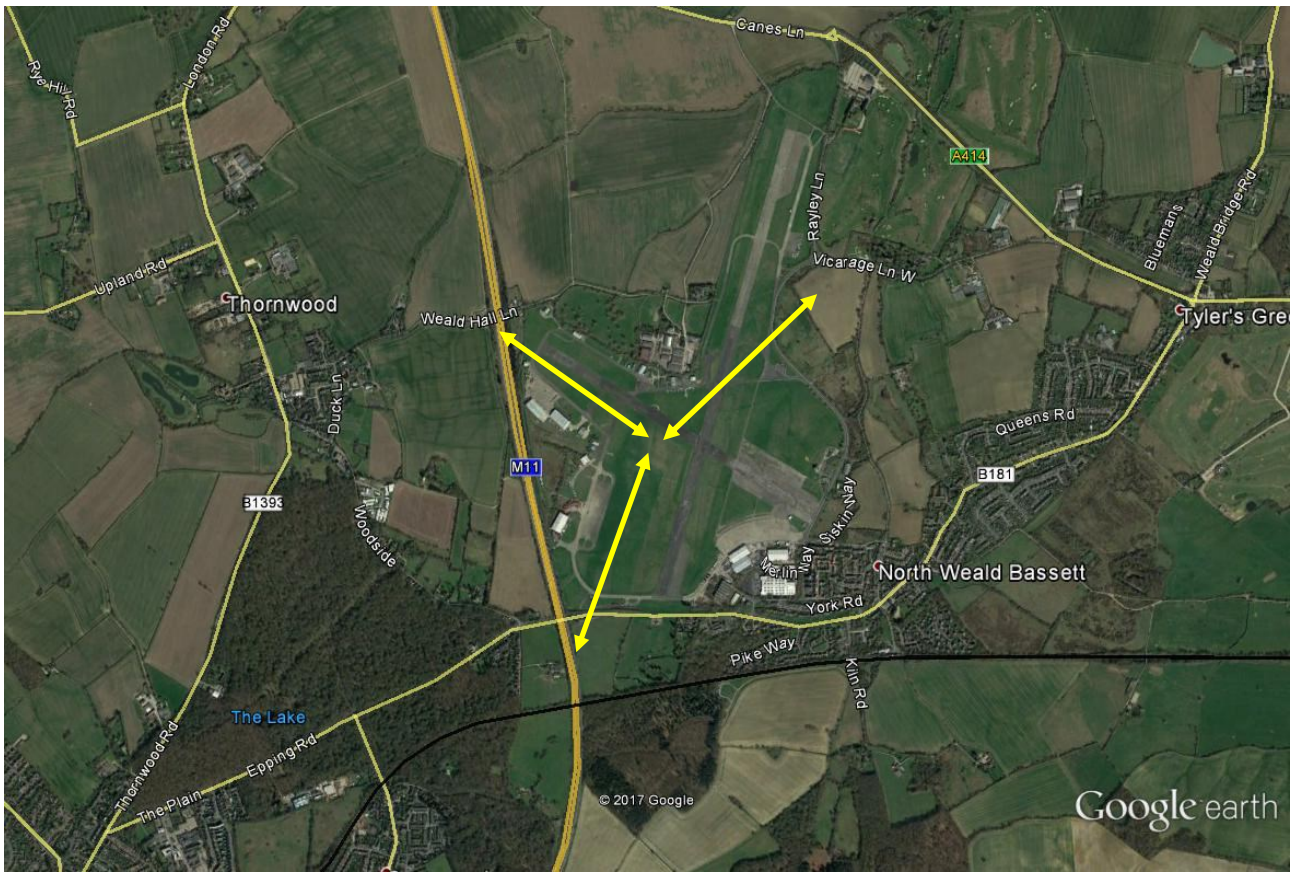
North Weald Airfield has currently no night-time operations. It is understood that the air ambulance services currently operate until 10pm. NPAS will require some night-time movements, estimated to be an average 4 flights per night.

Each aircraft is ground run daily for approximately 8 minutes to carry out a compressor wash, there will be other occasional ground runs for maintenance purposes. All ground runs are conducted during daytime 7 days a week.

A new hangar, design as shown in Appendix C, would be constructed for NPAS. North Weald Airfield managers have indicated that the preferred location of this hangar is as shown in Figure 1-1.

In discussions with NPAS pilots, the NPAS Base Manager at Lippitts Hill (David Howell) and the North Weald Airfield managers, it was established that the most likely flight paths for NPAS helicopter operations will be as shown in Figure 1-2. These flight paths are chosen to, as far as reasonably practicable, avoid the nearest sensitive receptors. All take-off and landings would be undertaken utilising the “clear area” profile, the VTOL profile would only be undertaken on a few occasions per year during daytime for training purposes.

Figure 1-2 Recommended Flight Paths



2. Legislation, Policy and Guidance

2.1. Noise Policy Statement for England

The Noise Policy Statement for England (NPSE) sets out the long-term vision of Government noise policy: to promote good health and a good quality of life through the effective management of noise within the context of Government policy on sustainable development.

The NPSE outlines three aims for the effective management and control of environmental, neighbour and neighbourhood noise:

- Avoid significant adverse impacts on health and quality of life;
- Mitigate and minimise adverse impacts on health and quality of life; and
- Where possible, contribute to the improvement of health and quality of life.

In its aims, the NPSE uses the key phrases “significant adverse” and “adverse”. The NPSE states in its explanatory note that there are two established concepts that are currently being applied to noise impacts, which are:

NOEL – No Observed Effect Level. This is the level below which no effect can be detected.

LOAEL – Lowest Observed Adverse Effect Level. This is the level above which adverse effects on health and quality of life can be detected.

The NPSE then extends this concept to include:

SOAEL – Significant Observed Adverse Effect Level. This is the level above which significant adverse effects on health and quality of life occur.

The NPSE notes that it is not possible to have a single objective noise-based measure that defines SOAEL that is applicable to all sources of noise in all situations. Consequently, the SOAEL is likely to vary for different noise sources, receptors and times. It is for the project to identify relevant SOAELs taking account of the sources of exposure and receptors.

2.2. The National Planning Policy Framework

The National Planning Policy Framework (NPPF), which reflects the NPSE, was introduced by the Department of Communities and Local Government (DCLG) in March 2012. The document sets out the Government’s planning policies for England and how these are expected to be applied.

The NPPF includes statements relating to noise and the requirement to take it into account in the planning process. Section 109 indicates that the planning system should contribute to and enhance the natural and local environment by:

> *‘preventing both new and existing development from contributing to or being put at unacceptable risk from, or being adversely affected by unacceptable levels of soil, air, water or noise pollution or land instability.’*

Section 123 is specifically related to noise, requiring planning policy decisions to:

- Avoid noise from giving rise to significant adverse impacts on health and quality of life as a result of new development;
- Mitigate and reduce to a minimum other adverse impacts on health and quality of life arising from noise from new development, including the use of conditions;

- Recognise that development will often create some noise and existing businesses wanting to develop in continuance of their business should not have unreasonable restrictions put on them because of changes in nearby land uses since they were established; and

- Identify and protect areas of tranquillity which have remained relatively undisturbed by noise and are prized for their recreational and amenity value for this reason.

The NPPF does not, therefore, provide absolute limits on noise that are acceptable or unacceptable in a given situation. It does however, set out the need to use planning decisions, including through the use of conditions, to avoid or mitigate adverse impacts on health and quality of life resulting from noise. The Planning Practice Guidance issued by the DCLG advises on how planning can manage potential noise impacts. In this guidance it advises that local planning authorities' plan making and decision taking should take account of the acoustic environment and in doing so consider:

- Whether or not a significant adverse effect is occurring or likely to occur;

- Whether or not an adverse effect is occurring or likely to occur; and

- Whether or not a good standard of amenity can be achieved.

In line with the explanatory note of the NPSE, this would include identifying whether the overall effect of the noise exposure is, or would be, above or below the SOAEL and the LOAEL for the given situation.

2.3. World Health Organisation Guidelines

The World Health Organisation (WHO) Guidelines for Community Noise was published in 2000 as a response to a need for action together with a generic need for improvements in legislation at a national level. Although not legislation, this document provides general guidance and guidelines which have been set for different health effects, using the lowest noise level that produces an adverse health effect in specific human environments. The guideline levels which are relevant to this assessment are set out in Table 2-1.

Table 2-1: WHO Guidelines for Community Noise Levels

Specific Environment	Critical health effect(s)	$L_{Aeq,T}$ (dB)	Time base, T (hours)	$L_{AF,max}$ (dB)
Outdoor Living Area	Serious annoyance, daytime and evening	55	16	-
	Moderate annoyance, daytime and evening	50		
Dwelling, indoors	Speech intelligibility and moderate annoyance, daytime and evening	35	16	-
Inside bedrooms	Sleep disturbance, night-time	30	8	45[1]
Outside bedrooms	Sleep disturbance, window open (outdoor values)	45	8	60

[1] Should not exceed 45 dB L_{AFmax} more than 10-15 times a night

The WHO Night Noise Guidelines (NNGL) was published in 2009 and may be considered as an extension to, as well as an update of the WHO Guidelines for Community Noise. The document presents the conclusions of the WHO working group responsible for preparing guidelines for exposure to noise during sleep to protect the public from adverse health effects. The NNGL presents proposed guidelines and interim targets which are reproduced in Table 2-2.

Table 2-2: Night Noise Guidelines and Interim Targets

WHO NNGL Target	$L_{night,outside}$ (dB)[1]
Interim target	55
LOAEL	40
NOEL	30

[1] The A-weighted average sound level over the 8 hour night period of 23:00 – 07:00 hours

The night noise guideline NOEL and LOAEL and the interim targets relate to the overall noise exposure of the population to environmental noise. The interim target is proposed in instances where the night noise guideline LOAEL cannot be achieved in a short-term period.

2.4. Possible Options for the Identification of SOAEL and LOAEL in Support of the NPSE

The Department of Environment, Food & Rural Affairs (DEFRA) commissioned a research study of potential LOAEL or SOAEL to support the NPSE. The DEFRA 2015 research paper "Possible Options for the Identification of SOAEL and LOAEL in Support of the NPSE" examined the exposure-response relationship in relation to the following identified health effects; namely annoyance, sleep, stress, cardiovascular, quality of life, well-being and general health and performance on cognitive mental health. The reported indicative LOAEL and SOAEL values and ranges for aircraft noise are summarised in Table 2-3.

Table 2-3 Possible Outdoor Values or Range of Values for LOAEL and SOAEL – Aircraft

Annoyance dB $L_{Aeq,16hr}$		Sleep dB L_{night}		Performance Cognitive mental health dB $L_{Aeq,T}$	
LOAEL	SOAEL	LOAEL	SOAEL	LOAEL	SOAEL
52 (50-54)	60 (58-62)	41 (40-49)	53 (47-60)	50	-

Note: Values in brackets indicate possible range of values.

2.5. ERCD Report 0905 "Aircraft Noise and Sleep Disturbance: A Review" April 2009

The Environmental Research and Consultancy Department (ERCD) was commissioned by the Civil Aviation Authority (CAA) to undertake a review of field and laboratory studies of the effects of aircraft noise exposure on sleep. One of the conclusions of this review is quoted below:

> *"The results suggested that below outdoor event levels of 90 dBA SEL (about 80 dBA Lmax), Aircraft Noise Events (ANEs) are most unlikely to cause any increase in measured sleep disturbance from that which occurs naturally during normal sleep. For those ANEs above this level, the average arousal rate was about 1 in 30."*

2.6. Summary of Noise Impact Criteria

Based on the above guidance documents, the LOAEL and SOAEL was determined and applied to assess potential noise impacts for the project. The outdoor LOAEL and SOAEL applied for this study is summarised in Table 2-4.

Table 2-4: Outdoor Aircraft Noise LOAEL and SOAEL

Time period	Noise Level
LOAEL	
Day	50 dB $L_{Aeq,16hr}$
Night	40 dB $L_{Aeq,8hr}$
Night	60 dB L_{Amax}
SOAEL	
Day	60 dB $L_{Aeq,16hr}$
Night	55 dB $L_{Aeq,8hr}$
Night	80 dB L_{Amax} (90 dB SEL)

3. Noise Surveys

This section presents the methodology and results of the baseline noise monitoring and attended measurements during helicopter operations at the North Weald Airfield.

A baseline noise survey was carried out in July 2017 in order to establish the current prevailing ambient and background noise levels in the areas surrounding the North Weald Airfield. Approximately 1 week of baseline noise data was captured at three monitoring locations.

Attended measurements during helicopter operations simulating the proposed situation (i.e. landing and take-off to the proposed hangar location along the three flight paths) were undertaken on 5 July 2017.

3.1. Instrumentation

All noise measurements were undertaken using Class 1 sound level meters meeting the requirements in BS EN 61672-1: 2013 “Electroacoustics – Sound level meters”. Calibration of all sound level meters and field calibrators has also have been checked periodically against national standards, or the relevant measurement standard in use. In addition, the calibration of each sound level meter has been checked and recorded at the start and end of each measurement using calibrators (Class 1) meeting the requirements of BS EN 60942 2003 “Electroacoustics – Sound calibrators”, with any significant drift noted.

A weather station was installed at monitoring location 1 and 2. This was recording temperature, humidity, rainfall, wind speed and wind direction at 1 minute intervals during the monitoring period. This information has been used in the analysis of data, as appropriate.

The instrumentation used for the measurements are presented in Table 3-1. Instrumentation calibration certificates are available on request.

Table 3-1 Instrumentation

Monitoring ID	Sound Level Meter	Acoustic Calibrator	Comment
M1	01dB FUSION (Serial No. 11201)	01dB CAL21 (Serial No. 34565048)	Baseline noise monitoring and attended helicopter measurements
M2	01dB FUSION (Serial No. 11201)	01dB CAL21 (Serial No. 34565048)	Baseline noise monitoring
	RION NL-52 (Serial No. 00620854)	RION NC-74 (Serial No. 35125802)	Attended helicopter measurements
M3	B&K 2238 (Serial No. 2381613)	RION NC-74 (Serial No. 35125802)	Baseline noise monitoring and attended helicopter measurements
M4	RION NL-52 (Serial No. 00620857)	RION NC-74 (Serial No. 31525804)	Attended helicopter ground run measurements

3.2. Monitoring Locations

Baseline noise monitoring was undertaken at the locations in Figure 3-1. These locations were selected to be representative of the nearest sensitive receptors adjacent to each of the recommended flight paths for NPAS.

The setting on the noise loggers at monitoring locations M1 to M3 were changed to 1 second logging and noise measurements were undertaken at the same locations as the baseline monitoring during simulated helicopter operations on 5 July 2017. Near field measurements were also undertaken at monitoring location M4 (shown in Figure 3-2) at 50m distance from the helicopter undertaking a ground run.

Figure 3-1 Monitoring Locations relative to Recommended Flight Paths

Figure 3-2 Additional Attended Measurement Location during Helicopter Ground Run

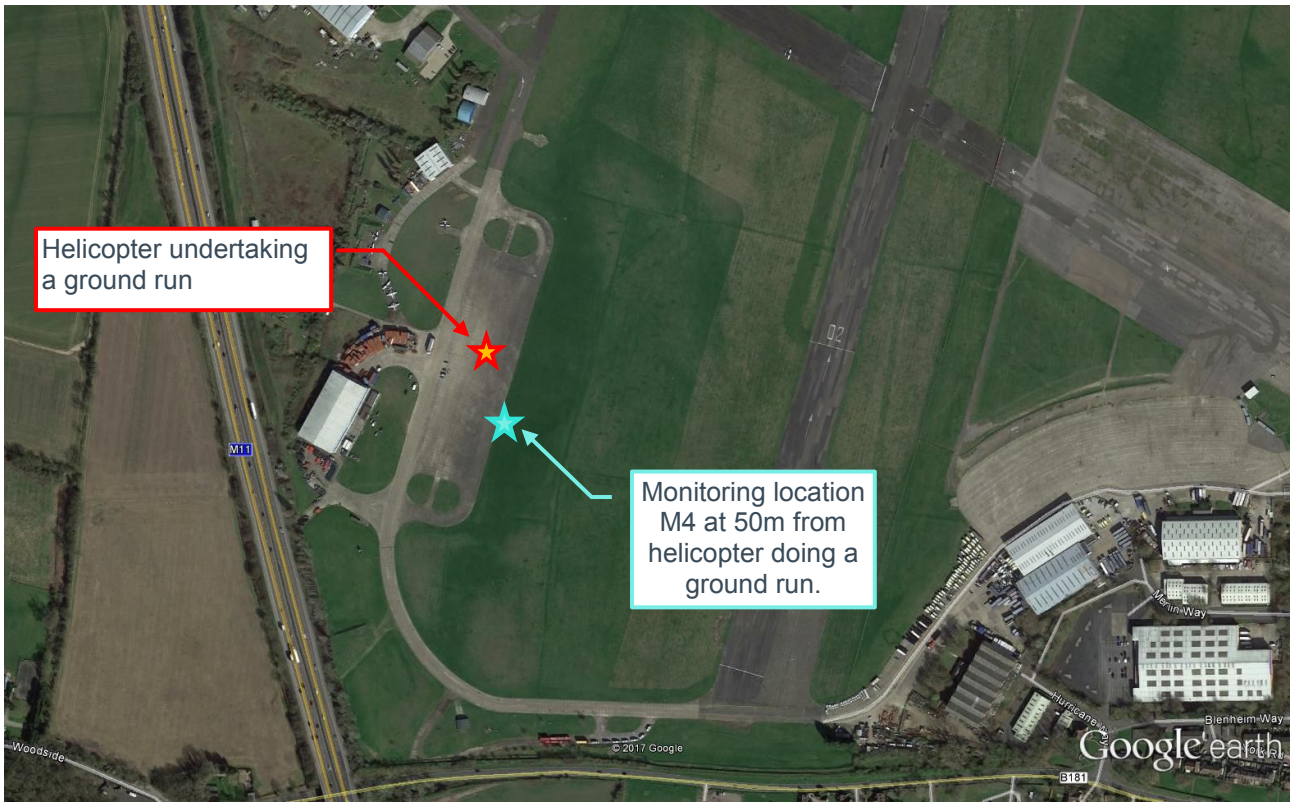


Table 3-2 summarises the monitoring locations which have been used for this assessment and gives relevant details for each.

Table 3-2 Monitoring Locations

Ref.	Locations and Rationale for Measurement Position
M1	At the boundary fence to the nursing home at the end of Weald Hall Lane. Nearest sensitive receptor to the northeast flight path.
M2	Monitoring in field opposite to residential properties on Siskin Way. Representative of noise levels at the nearest sensitive receptors at North Weald Bassett. Potentially exposed to noise levels from the northeast and south flight paths.
M3	At the boundary to Smiths Caravan site. A single receptor at the end of the western runway nearest to the western flight path.
M4	At 50m distance from the helicopter undertaking a ground run

3.3. Baseline Monitoring Results

The baseline noise data is presented in Appendix D, both as noise graphs in Figure D-1 to Figure D-3 and summarised for each monitoring location in Table D-1 to Table D-3.

The wind was generally below 5 m/s during the whole monitoring period. It was raining from the evening and through the night to 28 June. Otherwise the weather was calm and temperatures in the mid-twenties during daytime going down to low tens during night-time.

A summary of the ranges of baseline noise levels at each monitoring location is presented in Table 3-3.

The existing ambient noise levels are significantly higher, as expected, at the monitoring location M3 which is located close to the M11 motorway and exposed to significant road traffic noise. However, the highest maximum noise levels were found at the monitoring location M1 which is located close to the northern runway and exposed to existing aircraft take-off and landing noise levels during the daytime of above 80 dB(A).

The monitoring location M2 near the residential areas of North Weald Bassett has the lowest existing ambient noise levels. This is due to being located away from the M11 motorway and Epping Road and the road traffic noise associated with these and it is more than 500m from the nearest runway.

Table 3-3 Baseline Noise Levels

Monitoring Location		Average[1] dB $L_{Aeq,T}$	Highest dB $L_{AFmax,T}$	Average[2] dB $L_{A90,T}$
M1	Day (07:00-23:00)	50 - 62	85 - 103	42 - 46
	Night (23:00-07:00)	44 - 48	70 - 81	40 - 45
M2	Day (07:00-23:00)	48 - 53	76 - 90	37 - 47
	Night (23:00-07:00)	41 - 53	71 - 80	31 - 47
M3	Day (07:00-23:00)	56 - 64	79 - 91	53 - 60
	Night (23:00-07:00)	56 - 61	73 - 82	53 - 58

[1] Logarithmic average of $L_{Aeq,T}$.

[2] Arithmetic average of $L_{A90,15min}$ during day and night periods.

3.4. Helicopter Operations Measurement Results

To assess the potential noise levels from the proposed NPAS helicopter operations at the North Weald Airfield, noise measurements were undertaken during helicopter operations with one of NPAS helicopters at the North Weald Airfield on 5 July 2017.

The flight paths that were used during the helicopter operations are shown in Figure 3-1.

The helicopter operations included the following:

- Northeast flight path to and from proposed NPAS hangar location
  - Landing “clear area” profile
  - Take-off “clear area” profile
- West flight path to and from proposed NPAS hangar location
  - Landing “clear area” profile
  - Take-off “clear area” profile
- South flight path to and from proposed NPAS hangar location
  - Landing “clear area” profile
  - Take-off “clear area” profile
- At proposed NPAS hangar location
  - Landing VTOL profile
  - Take-off VTOL profile
- Just to the south of proposed NPAS hangar location
  - Ground run
  - Hover taxing

The following sections presents the measurement results from the above helicopter operations at the North Weald Airfield.

For each of the above helicopter operations, the time history of the measured noise levels have been presented for each monitoring location where the helicopter noise was identified above the ambient noise. In addition, the following parameters have been calculated and presented:

- dB L_{Amax} – The A weighted maximum noise level during the event (i.e. take-off or landing);
- SEL – The Sound Exposure Level is the A weighted sound pressure level integrated over the duration of the event and normalised to 1 second time period. This is representative of the total sound energy of the event normalised to 1 second time period. This is often used to predict the daytime $L_{Aeq,16hr}$ and night-time $L_{Aeq,8hr}$ when the number of events during daytime and night-time are known.

3.4.1. Northeast Flight Path to and from Proposed NPAS Hangar Location

Noise levels were measured at 1 second intervals at all three monitoring locations during two “clear area” profile take-off and one landing along the northeast flight path as shown in Figure 3-3. The time history of the measured noise levels during the take-off and landings are presented in Appendix E, Figure E-1 (monitoring location M1) and Figure E-2 (monitoring location M2).

The noise levels at location M3 was not above the ambient noise levels during take-off and landing along the northeast flight path.

The determined maximum noise level and SEL during each landing and take-off have been summarised in Table 3-4.

Figure 3-3 Northeast Flight Path and Monitoring Locations

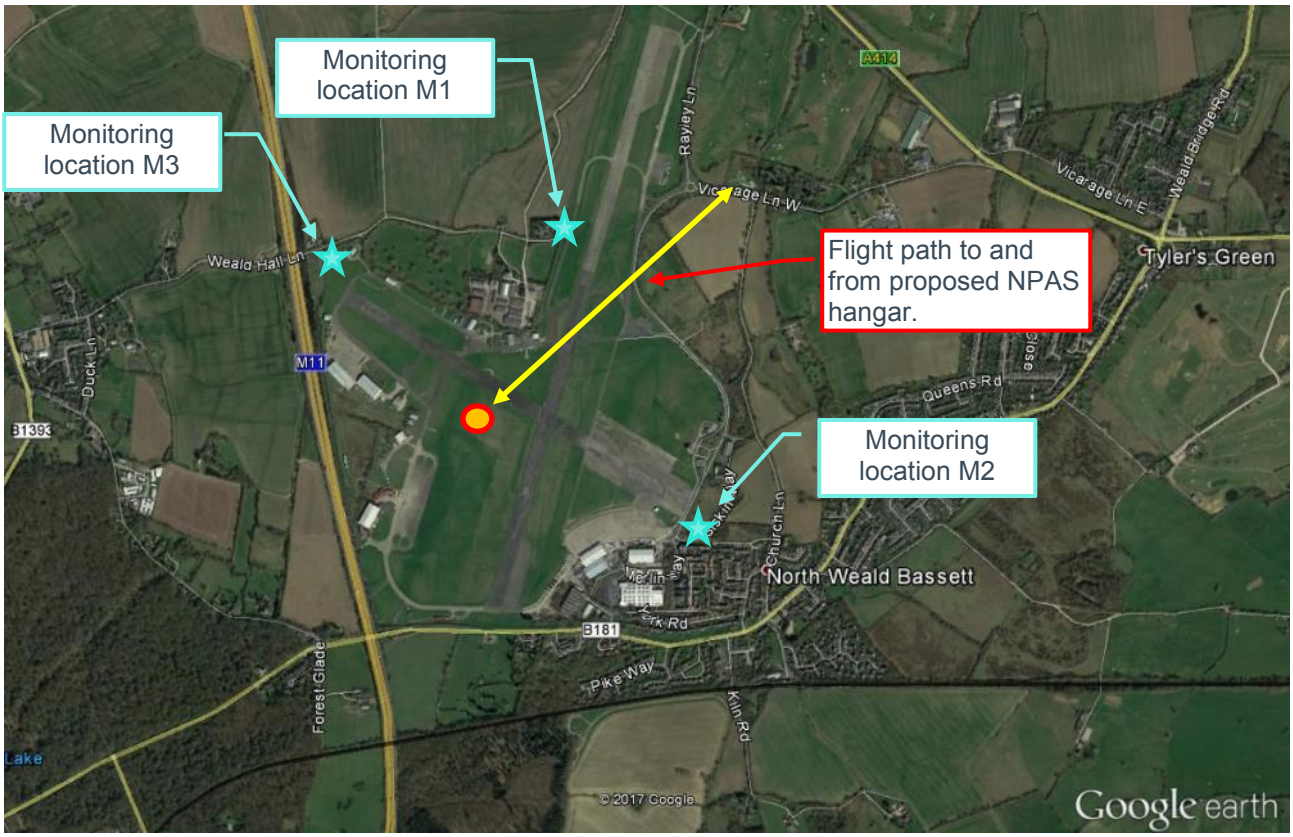


Table 3-4 Northeast Flight Path Noise Levels

Monitoring Location	Noise Parameter (dB)	Take-off	Landing
M1	SEL	79 – 80	82
	L_{Amax}	70 - 70	72
M2	SEL	70-73	70
	L_{Amax}	62-67	60
M3	SEL	-	-
	L_{Amax}	-	-

Note: Noise levels during take-off and landing using the northeast flight path was not above ambient noise levels at location M3.

3.4.2. South Flight Path to and from Proposed NPAS Hangar Location

Noise levels were measured at 1 second intervals at all three monitoring locations during two “clear area” profile take-offs and two landings using the south flight path as shown in Figure 3-4. The time history of the measured noise levels during the take-off and landings are presented in Appendix E, Figure E-3 (monitoring location M2). Noise measurements during VTOL profile take-offs and landings are presented in Appendix E, Figure E-4 (monitoring location M2).

The noise levels at location M1 and M3 were not above the ambient noise levels during take-off and landing using the south flight path.

The determined maximum noise level and SEL during each landing and take-off have been summarised in Table 3-5.

Figure 3-4 South Flight Path and Monitoring Locations

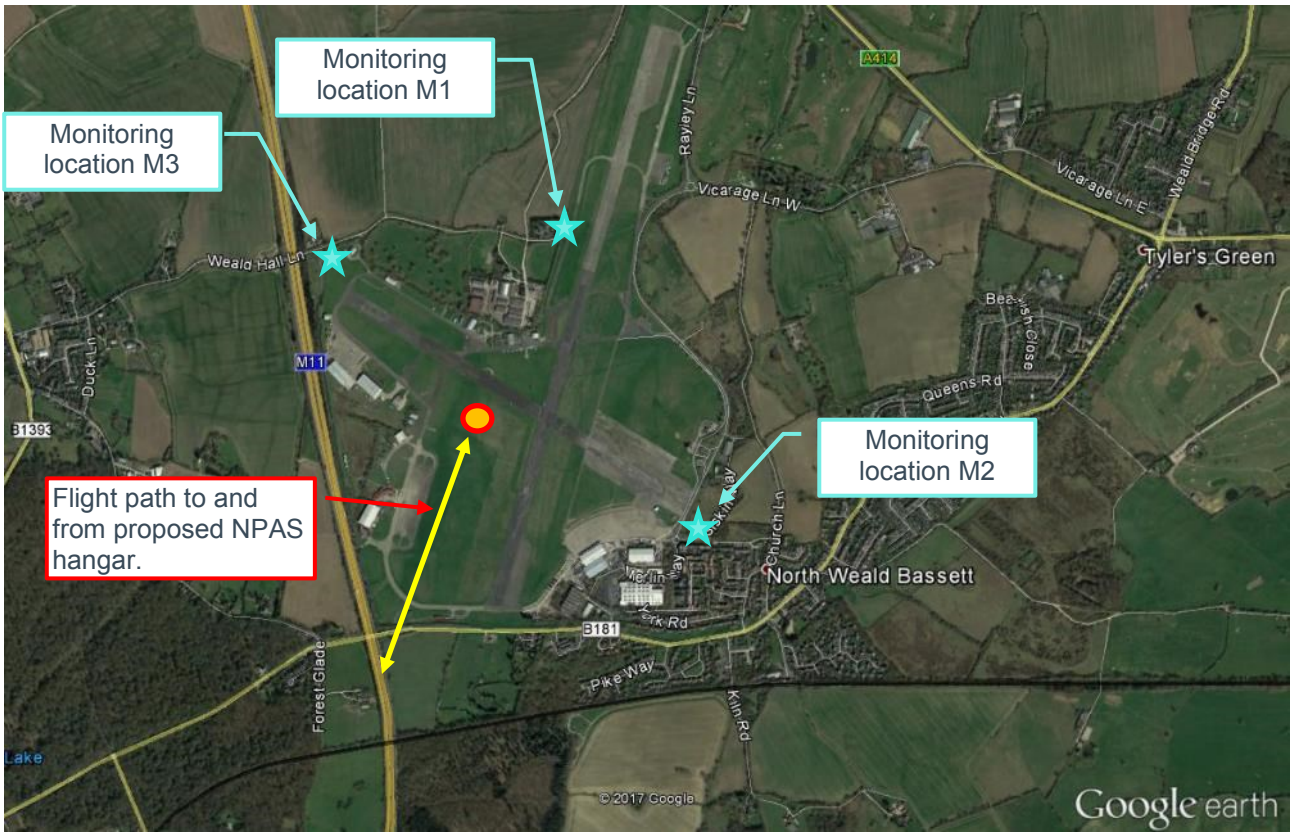


Table 3-5 South Flight Path Noise Levels

Monitoring Location	Noise Parameter (dB)	Take-off	Landing
M1	SEL	-	-
	L_{Amax}	-	-
M2	SEL	60 - 64	67 - 69
	L_{Amax}	50 - 54	56 - 59
M3	SEL	-	-
	L_{Amax}	-	-

Note: Noise levels during take-off and landing using the south flight path was not above ambient noise levels at locations M1 and M3.

3.4.3. West Flight Path to and from Proposed NPAS Hangar Location

Noise levels were measured at 1 second intervals at all three monitoring locations during two “clear area” profile take-offs and two landings using the west flight path as shown in Figure 3-3. The time history of the measured noise levels during take-off and landings is presented in Appendix E, Figure E-5 (monitoring location M3).

The noise levels at location M1 and M2 were not above the ambient noise levels during take-off and landing using the west flight path.

The determined maximum noise level and SEL during each landing and take-off have been summarised in Table 3-6.

Figure 3-5 West Flight Path and Monitoring Locations

Table 3-6 West Flight Path Noise Levels

Monitoring Location	Noise Parameter (dB)	Landing	Take-off
M1	SEL	-	-
	L_{Amax}	-	-
M2	SEL	-	-
	L_{Amax}	-	-
M3	SEL	85 - 89	84 – 85
	L_{Amax}	77 - 78	77 - 78

Note: Noise levels during take-off and landing using the west flight path was not above ambient noise levels at locations M1 and M2.

3.4.4. Helicopter Ground Run

A noise level of 78 dB L_{Aeq} was measured at 50m from the helicopter during a ground run. The ground run was undertaken slightly to the south of the proposed NPAS hangar location as shown in Figure 3-2. The measured noise levels at the three monitoring locations were not noticeable above the ambient noise levels. Predicted noise levels at the nearest sensitive receptors based on the measured noise level at 50m from the helicopter during the ground run was around 50 dB L_{Aeq}, which is at or below the measured baseline noise levels.

4. Assessment

A noise assessment has been undertaken based on the forecasted helicopter movements in Section 1.3. The assessment below has assumed a typical situation where the future NPAS helicopter movements during a certain day and night would be split on two flight paths and a worst case where all movements would be utilising the same flight path.

On average NPAS would have 19 movements per 24 hour day, of which 8 movements would be during night-time. Based on the noise measurements during helicopter movements along the recommended flight paths the predicted contributions to the nearest receptors to each flight path is presented in Table 4-1.

Table 4-1 Predicted Future Helicopter Noise Levels

Flight Path	Receptor	Period	dB $L_{Aeq,T}$ [1]	dB $L_{AFmax,T}$
Northeast	M1 Nearest receptor to the northeast flight path	Day	39-42 (42-45)	70-72
		Night	40-43 (43-46)	70-72
	M2 Nearest receptor to the south flight path	Day	30-33 (33-36)	60-67
		Night	31-34 (34-37)	60-67
South	M2 Nearest receptor to the south flight path[2]	Day	20-29 (23-32)	50-59
		Night	21-30 (24-33)	50-59
West	M3 Nearest receptor to the west flight path	Day	44-49 (47-52)	77-78
		Night	45-50 (48-53)	77-78

[1] Values outside brackets represent a typical situation where flight movements would be split on two or more flight paths during the day and night periods. Values in brackets are a worst case if all helicopter movements on a certain day and night would be forced to utilise only one flight path.

[2] There are also receptors to the south of Epping Road that are closer horizontally to the south flight path, however the helicopter will be at an altitude more than 500ft above local ground before passing over the Epping Road. Therefore, these receptors would not be more exposed to helicopter noise than that predicted for location M2.

4.1. Daytime

The predicted future NPAS helicopter operations are well below the existing daytime ambient noise levels at all receptors adjacent to the North Weald Airfield. They are also below the LOAEL criteria in Table 2-4 for all receptors adjacent to all flight paths.

4.2. Night-time

4.2.1. Northeast flight path

For the northeast flight path, the predicted L_{Aeq} noise levels at the nearest receptor M1 (the nursing home at the end of Weald Hall Lane) was 40-43 dB L_{Aeq} during the night-time period which is just above the LOAEL criterion of 40 dB L_{Aeq} (refer to Table 2-4), however, below the existing ambient noise levels of 44-48 dB L_{Aeq}.

The predicted L_{Amax} noise levels at the M1 receptor was 70-72 dB L_{Amax} which is above the LOAEL criterion of 60 dB L_{Amax}, however, for less than 10-15 times per night as recommended by the WHO guidelines.

The predicted L_{Aeq} noise level for the M2 receptor (nearest point towards the North Weald Bassett residential area) when using the northeast flight path was 31-34 dB L_{Aeq} which is well below the LOAEL criterion of 40 dB

L_{Aeq} for this receptor. The predicted L_{Amax} noise level for the M2 receptor was 60-67 dB L_{Amax} which is above the LOAEL criterion of 60 dB L_{Amax}, however, for less than 10-15 times per night as recommended by the WHO guidelines.

The predicted night-time noise levels (both L_{Aeq} and L_{Amax}) are well below the SOAEL criteria in Table 2-4 for all receptors due to helicopter movements using the northeast flight path.

4.2.2. South flight path

All receptors are predicted to be below the the LOAEL (both L_{Aeq} and L_{Amax}) criteria in Table 2-4 due to helicopter movements using the southern flight path during night-time.

4.2.3. West flight path

The predicted L_{Aeq} noise level for the M3 receptor (Smith Caravan site) when using the west flight path is 45-50 dB L_{Aeq} during the night-time period which is above the LOAEL criterion of 40 dB L_{Aeq}, however, below the existing ambient noise levels of 51-61 dB L_{Aeq}.

The predicted L_{Amax} noise levels at the M3 receptor was 77-78 dB L_{Amax} which is above the LOAEL criterion of 60 dB L_{Amax}, however, for less than 10-15 times per night as recommended by the WHO guidelines.

There is only one receptor adjacent to the west flight path, this is the Smith Caravan site. This receptor is located near the M11 motorway and exposed to significant road traffic noise during both day and night. The predicted future helicopter noise levels at this receptor are below existing ambient road traffic noise levels.

The predicted night-time noise levels (both L_{Aeq} and L_{Amax}) are below the SOAEL criteria in Table 2-4 for all receptors due to helicopter movements using the west flight path.

5. Noise Management Measures

To manage and minimise any potential future noise nuisance due to NPAS operations the management measures described below should be considered:

- Spread the helicopter movements on more then one flight path as far as possible.
- Use the recommended three flight paths in Figure 1-2, which have been determined to:
  - Maximise offset distance to the nearest receptors.
  - Avoid any densly populated areas.
  - For helicopters to fly above the M11 motorway (the M11 motorway would help mask aircraft noise) where possible.
- During night-time movements utilise the following order of preferred flight paths:
  - Preferred flight path is the southern for which the LOAEL criteria are predicted to be achieved for all receptors.
  - The second preferred flight path is the western flight path which has only one receptor, the Smith caravan site receptor, before the flight path is above the M11 motorway.
  - The third preferred flight path is the northeastern flight path, since this flight path exposes the most number of sensitive receptors to potential noise levels above the LOAEL criteria.
- Only undertake ground runs during published aerodrome operating hours.

6. Summary

Atkins noise and vibration (ANV) was commissioned to undertake a helicopter noise assessment for a proposed relocation of the National Police Air Service (NPAS) operations to the North Weald Airfield.

To assess the proposed NPAS operations at the North Weald Airfield, noise measurements were undertaken at the North Weald Airfield during helicopter operations representative of the proposed NPAS operations.

Both baseline noise monitoring and noise measurements during helicopter operations were undertaken at locations determined to be representative of the nearest sensitive receptors to each of the three recommended flight paths.

The noise measurements and assessment shows that there are no predicted noise levels above the LOAEL criterion of 50 dB L_{Aeq} during daytime.

During the night-time, there are a few exceedance of the LOAEL criteria (40 dB L_{Aeq} and 60 dB L_{Amax}) due to helicopter movements along the northeast and west flight paths. The south flight path has no exceedances of the LOAEL criteria. There are no predicted exceedances of the SOAEL criteria (55 dB L_{Aeq} and 80 dB L_{Amax}) at any receptors due to any proposed NPAS operations.

With the appropriate noise management and control measures, as outlined in Section 5, there are no anticipated adverse noise effects from the proposed NPAS operations at North Weald Airfield.

Appendices

Appendix A. Glossary of Acoustic Terms

Ambient Noise

Totally encompassing sound in a given situation at a given time usually composite of sounds from many sources near and far.

A-weighting, dB(A)

The most widely used weighting mechanism that best corresponds to the response of the human ear is the 'A'-weighting scale. This is widely used for environmental noise measurement, and the levels are denoted as dB(A) or L_{Aeq}, L_{A90} etc., according to the parameter being measured.

Decibel (dB)

A logarithmic scale for comparing the ratios of two quantities, including sound pressure and sound power. The decibel can also be used to measure absolute quantities by specifying a reference value that fixes one point on the scale. For sound pressure, the reference value is 20μPa.

Noise Level Indices

Noise levels usually fluctuate over time, so it is often necessary to consider an average or statistical noise level. This can be done in several ways, so a number of different noise indices have been defined, according to how the averaging or statistics are carried out.

Free-field

No reflective surfaces, other than the ground, within 3.5 metres of the microphone position.

$L_{eq,T}$

A noise level index called the equivalent continuous noise level over the time period T. This is the level of a notional steady sound that would contain the same amount of sound energy as the actual, possibly fluctuating, sound that was recorded.

$L_{max,T}$

A noise level index defined as the maximum noise level during the period T. L_{max} is sometimes used for the assessment of occasional loud noises, which may have little effect on the overall L_{eq} noise level but will still affect the noise environment. Unless described otherwise, it is measured using the 'fast' sound level meter response.

$L_{90,T}$

A noise level index. The noise level that is exceeded for 90% of the measurement time interval, T. L_{90} can be considered to be the "average minimum" noise level and is often used to describe the background noise

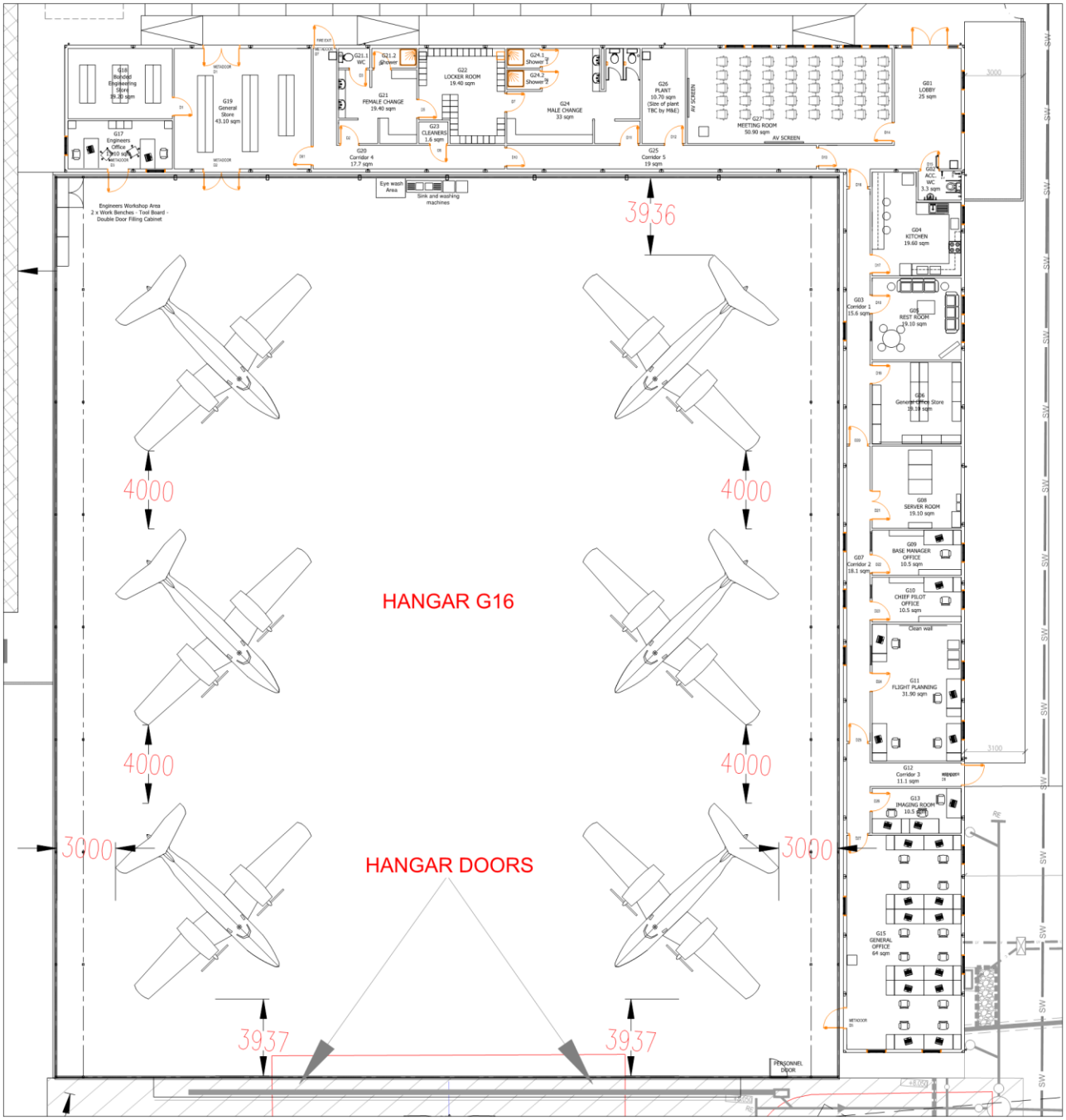
SEL

The Sound Exposure Level is the A weighted sound pressure level integrated over the duration of the event and normalised to 1 second time period. This is representative of the total sound energy of the event normalised to 1 second time period. This is often used to predict the daytime $L_{Aeq,16hr}$ and night-time $L_{Aeq,8hr}$ when the number of events during daytime and night-time are known.

Appendix B. Epping Forest District Local Plan

Figure 5.15 Site allocations for North Weald Bassett

Appendix C. Example NPAS Hangar



Appendix D. Baseline Noise Monitoring Levels

Figure D-1 Baseline Noise Levels - M1

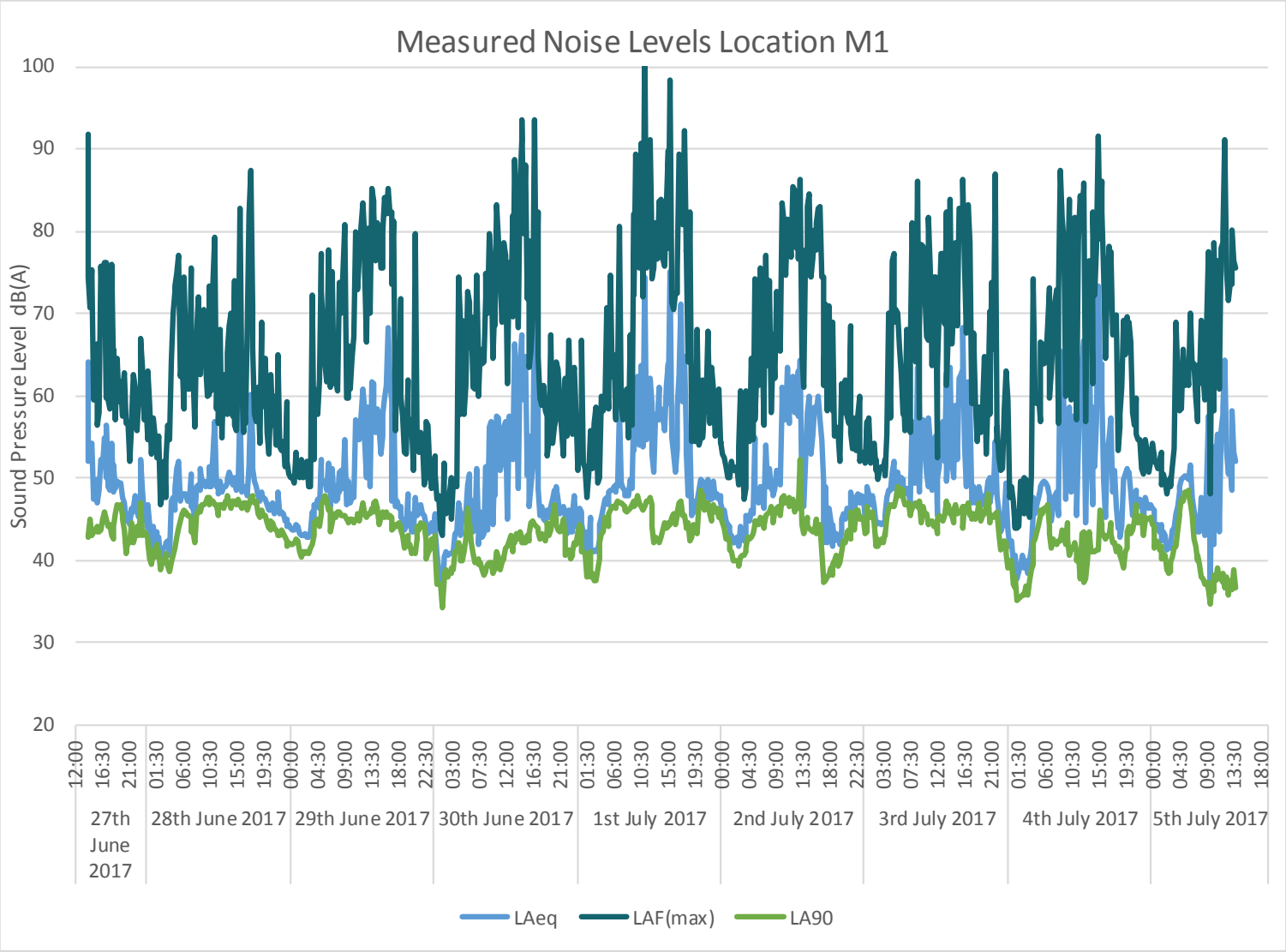


Figure D-2 Baseline Noise Levels – M2

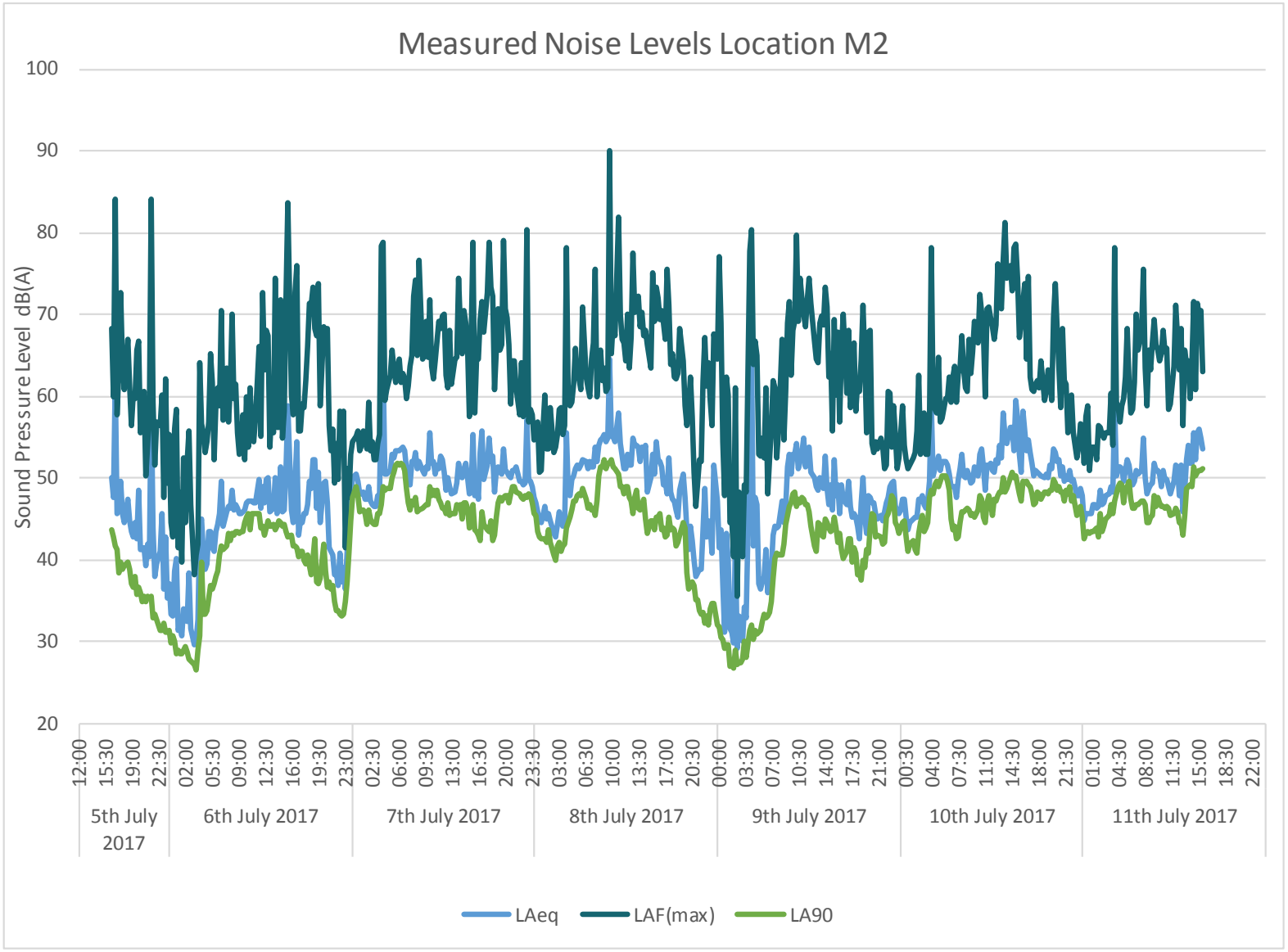


Figure D-3 Baseline Noise Levels – M3

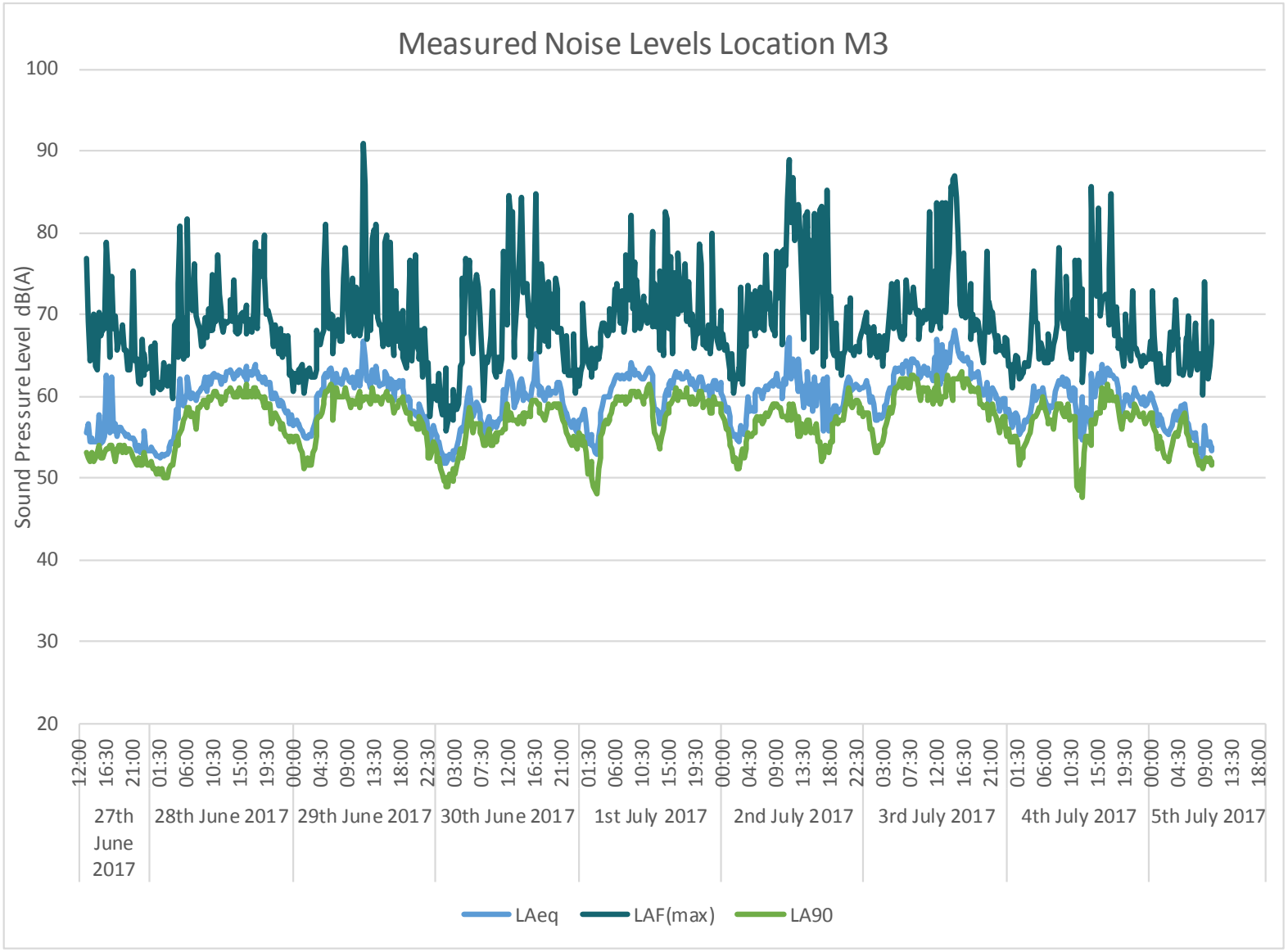


Table D-1 Summary of Baseline Noise Data for Monitoring Location 1

Date	Time Period	Average[1] $L_{Aeq,T}$ dB	Highest $L_{AFmax,T}$ dB	Average[2] $L_{A90,T}$ dB
Tuesday 27th June	Daytime (14:00 to 23:00)	52.4	91.8	44.0
	Night-time (23:00 to 07:00)	46.7	77.0	42.1
Wednesday 28th June	Daytime (07:00 to 23:00)	50.4	87.4	45.9
	Night-time (23:00 to 07:00)	46.6	77.6	43.2
Thursday 29th June	Daytime (07:00 to 23:00)	56.0	85.1	44.4
	Night-time (23:00 to 07:00)	44.4	74.4	40.3
Friday 30th June	Daytime (07:00 to 23:00)	57.7	93.6	41.9
	Night-time (23:00 to 07:00)	47.6	80.6	42.5
Saturday 1st July	Daytime (07:00 to 23:00)	62.2	102.9	45.4
	Night-time (23:00 to 07:00)	46.5	75.5	42.8
Sunday 2nd July	Daytime (07:00 to 23:00)	55.9	91.5	43.1
	Night-time (23:00 to 07:00)	48.0	77.3	45.2
Monday 3rd July	Daytime (07:00 to 23:00)	56.6	87.0	45.5
	Night-time (23:00 to 07:00)	45.6	74.1	40.3
Tuesday 4th July	Daytime (07:00 to 23:00)	59.4	91.5	42.3
	Night-time (23:00 to 07:00)	46.9	70.0	43.5

[1] Logarithmic average of $L_{Aeq,T}$.

[2] Arithmetic average of $L_{A90,15min}$ during day and night periods.

Table D-2 Summary of Baseline Noise Data for Monitoring Location 2

Date	Time Period	Average[1] $L_{Aeq,T}$ dB	Highest $L_{AFmax,T}$ dB	Average[2] $L_{A90,T}$ dB
Wednesday 5th July	Daytime (16:00 to 23:00)	51.0	84.0	36.9
	Night-time (23:00 to 07:00)	41.0	70.5	32.2
Thursday 6th July	Daytime (07:00 to 23:00)	48.2	83.7	41.4
	Night-time (23:00 to 07:00)	53.1	78.7	46.7
Friday 7th July	Daytime (07:00 to 23:00)	51.4	80.3	46.4
	Night-time (23:00 to 07:00)	49.0	78.2	44.5
Saturday 8th July	Daytime (07:00 to 23:00)	52.8	89.9	44.4
	Night-time (23:00 to 07:00)	50.8	80.4	30.7
Sunday 9th July	Daytime (07:00 to 23:00)	49.3	79.6	43.2
	Night-time (23:00 to 07:00)	49.9	78.2	45.5
Monday 10th July	Daytime (07:00 to 23:00)	51.9	81.2	47.0
	Night-time (23:00 to 07:00)	50.0	78.1	45.8
Tuesday 11th July	Daytime (07:00 to 23:00)	51.7	75.5	47.1

[1] Logarithmic average of $L_{Aeq,T}$.

[2] Arithmetic average of $L_{A90,15min}$ during day and night periods.

Table D-3 Summary of Baseline Noise Data for Monitoring Location 3

Date	Time Period	Average[1] $L_{Aeq,T}$ dB	Highest $L_{AFmax,T}$ dB	Average[2] $L_{A90,T}$ dB
Tuesday 27th June	Daytime (14:00 to 23:00)	56.2	78.7	52.9
	Night-time (23:00 to 07:00)	56.9	81.7	53.0
Wednesday 28th June	Daytime (07:00 to 23:00)	61.8	79.6	59.2
	Night-time (23:00 to 07:00)	59.2	80.9	55.7
Thursday 29th June	Daytime (07:00 to 23:00)	61.4	90.9	58.7
	Night-time (23:00 to 07:00)	56.1	76.8	52.9
Friday 30th June	Daytime (07:00 to 23:00)	59.8	84.7	56.9
	Night-time (23:00 to 07:00)	58.8	73.7	54.8
Saturday 1st July	Daytime (07:00 to 23:00)	61.7	82.6	59.1
	Night-time (23:00 to 07:00)	58.7	73.5	55.3
Sunday 2nd July	Daytime (07:00 to 23:00)	61.1	88.9	57.3
	Night-time (23:00 to 07:00)	61.0	73.9	57.6
Monday 3rd July	Daytime (07:00 to 23:00)	63.6	86.9	60.3
	Night-time (23:00 to 07:00)	58.6	75.3	56.0
Tuesday 4th July	Daytime (07:00 to 23:00)	60.6	85.5	57.1
	Night-time (23:00 to 07:00)	57.9	72.8	55.3

[1] Logarithmic average of $L_{Aeq,T}$.

[2] Arithmetic average of $L_{A90,15min}$ during day and night periods.

Appendix E. Helicopter Noise Levels

Figure E-1 Northeast Flight Path "clear area" profile - M1 Noise Levels

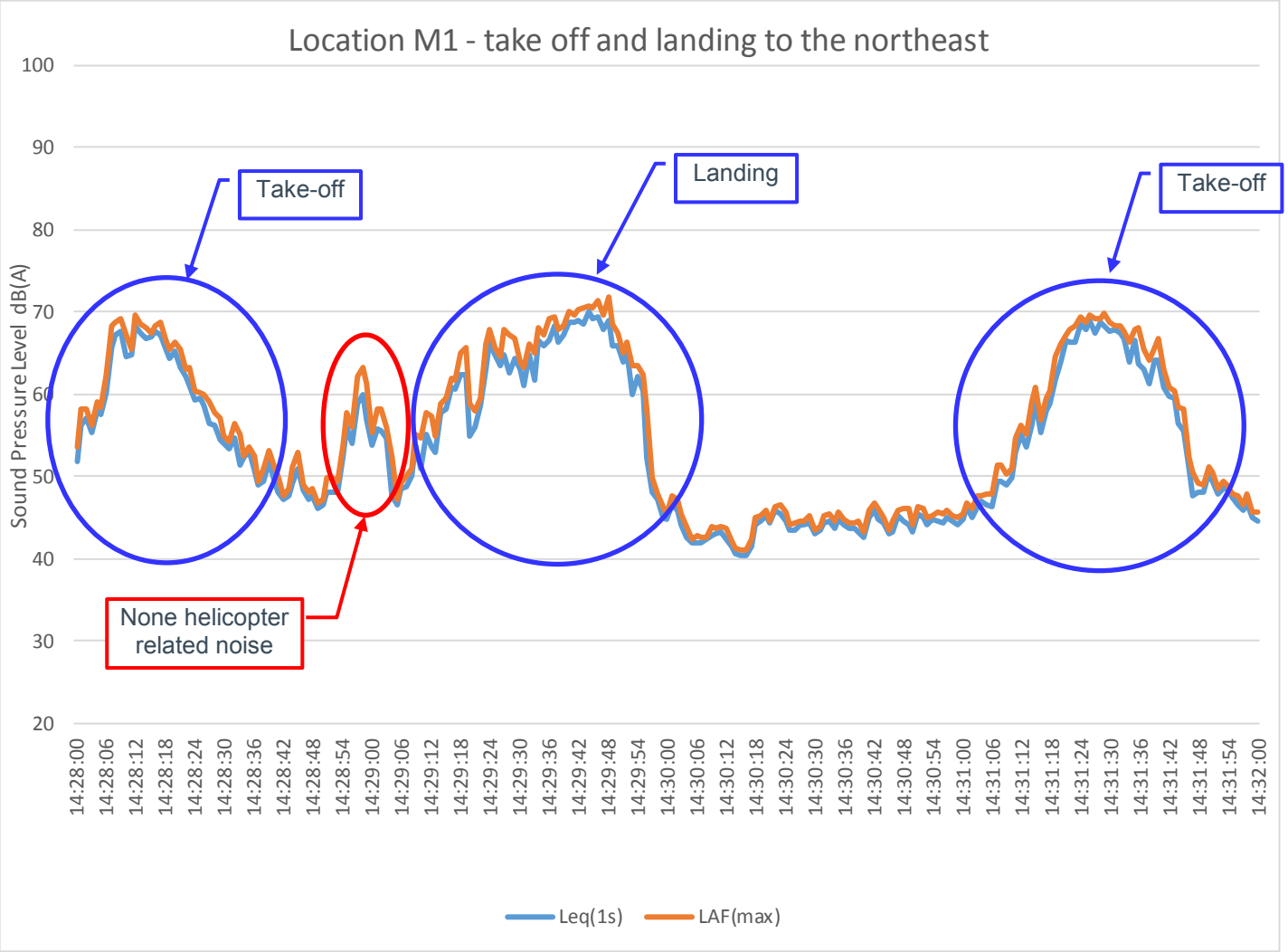


Figure E-2 Northeast Flight Path "clear area" profile – M2 Noise Levels

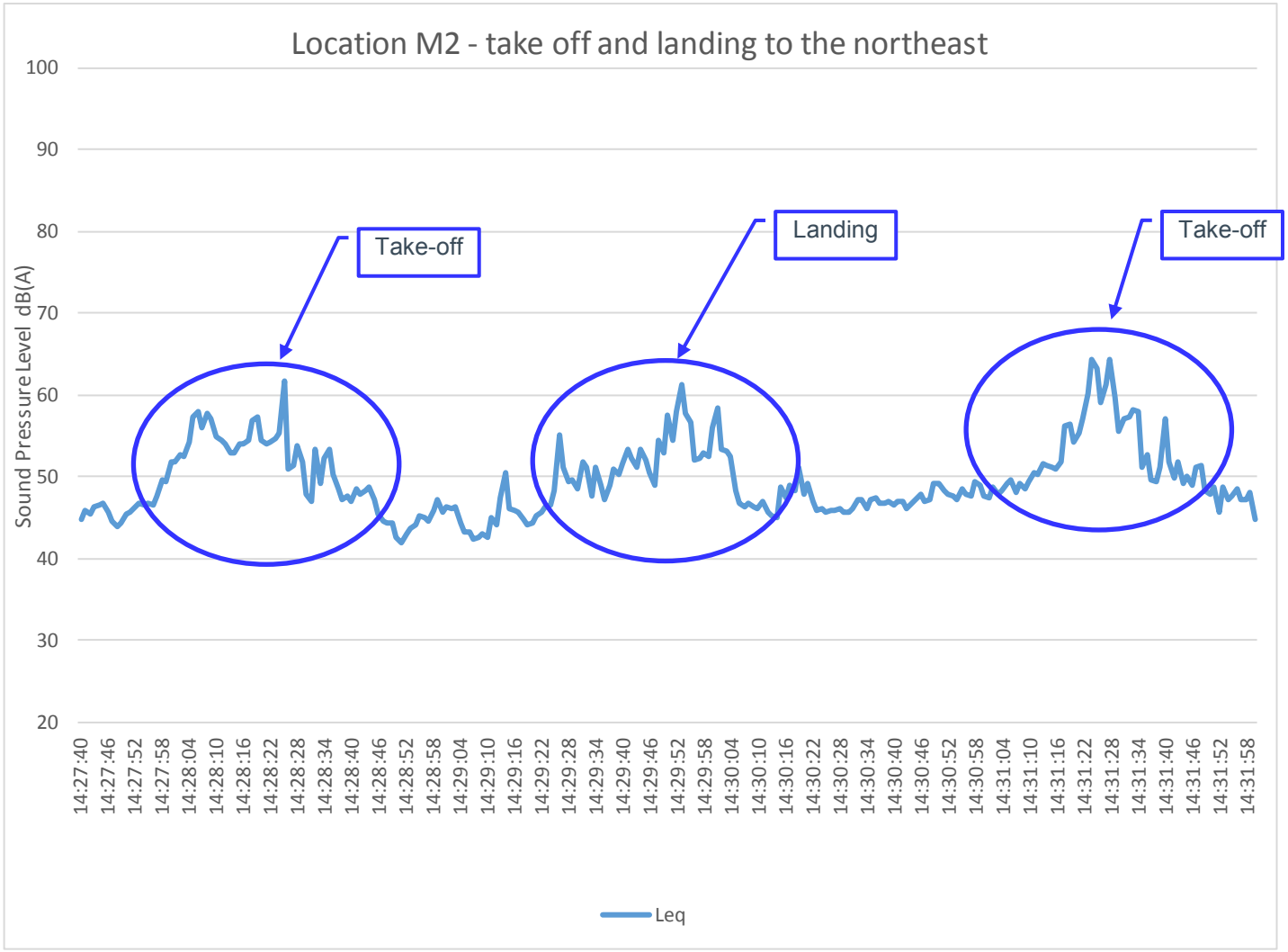


Figure E-3 South Flight Path "clear area" profile – M2 Noise Levels

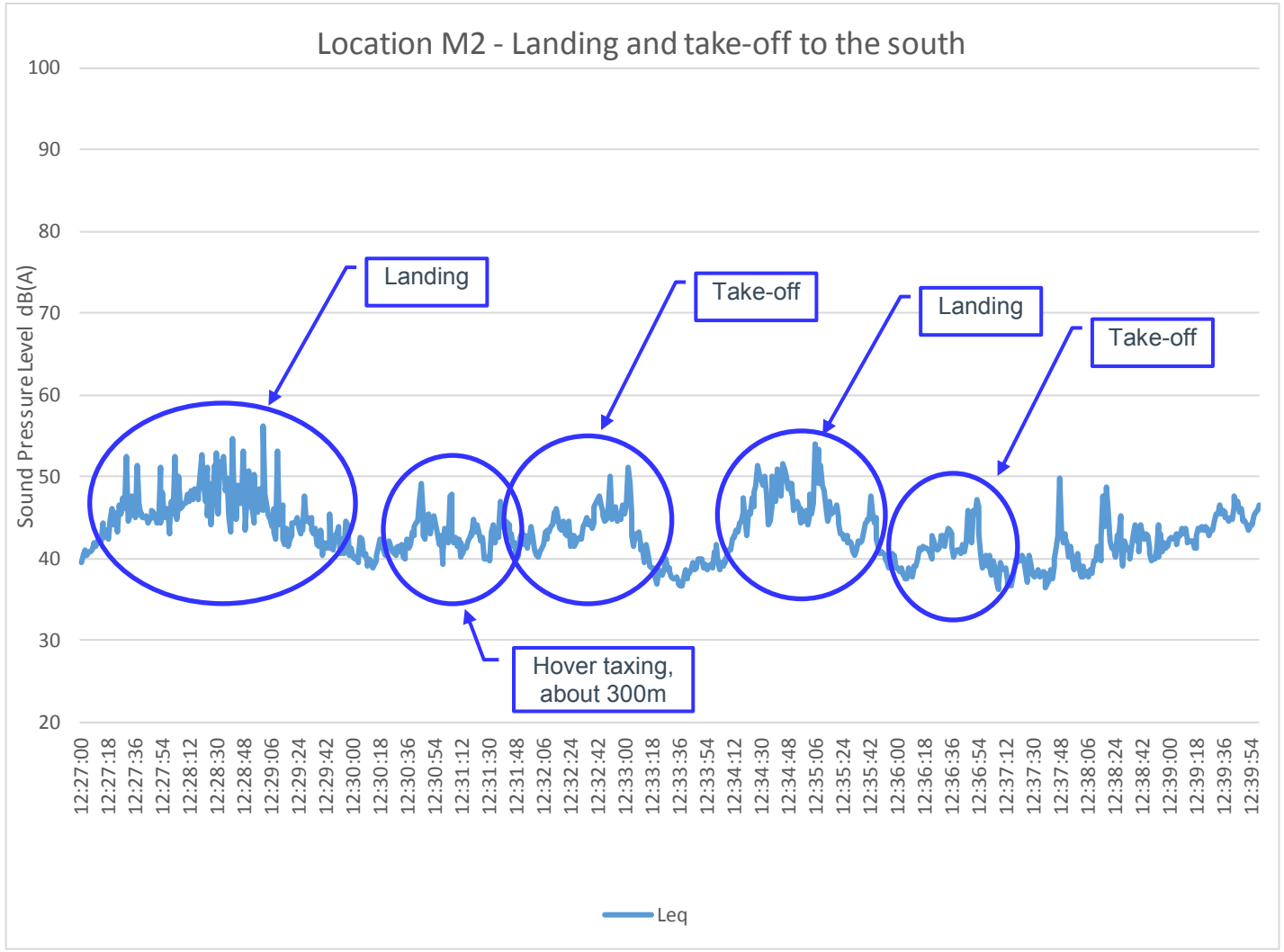


Figure E-4 South Flight Path VTOL profile – M2 Noise Levels

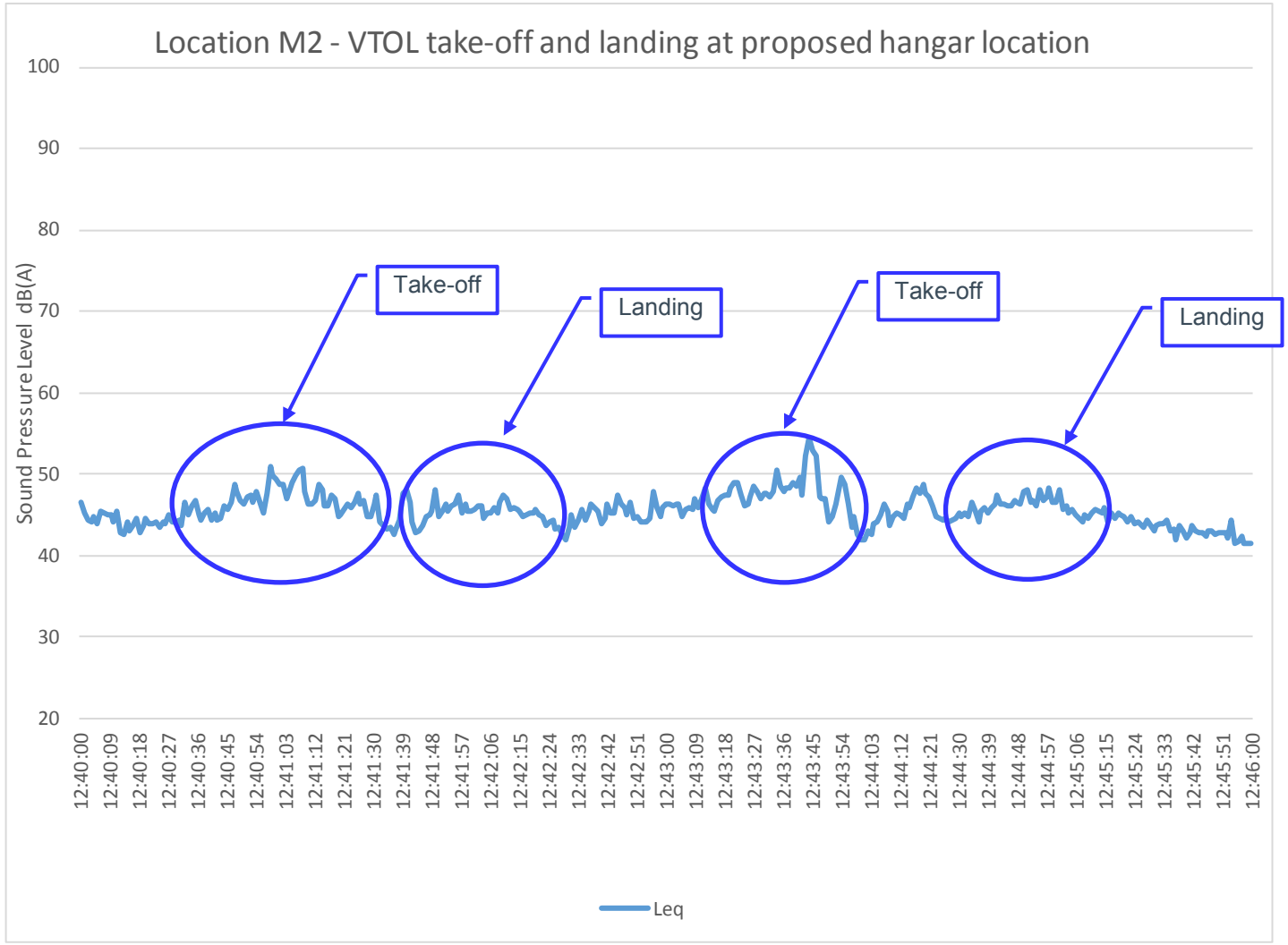


Figure E-5 West Flight Path "clear area" profile – M3 Noise Levels