Luton Rising
Our airport.
Our community.
Our planet.

January 2024

London Luton Airport Expansion

Planning Inspectorate Scheme Ref: TR020001

Volume 5 Environmental Statement and Related Documents **5.02 Appendix 16.1 Noise and Vibration Information (Tracked Change Version)**

Application Document Ref: TR020001/APP/5.02
APFP Regulation: 5(2)(a)

The Planning Act 2008

The Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations 2009

London Luton Airport Expansion Development Consent Order 202x

5.02 ENVIRONMENTAL STATEMENT APPENDIX 16.1 NOISE AND VIBRATION INFORMATION (TRACKED CHANGE VERSION)

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Issue 01	February 2023	Application issue
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Inset 12.1: Daytime DM, Core, SG and FG LOAEL Contour Areas (with illustrative linear fleet transition)

Inset 12.2: Night-time DM, Core, SG and FG LOAEL Contour Areas (with illustrative linear fleet transition)

1 INTRODUCTION

1.1.1 Luton Rising (a trading name of London Luton Airport Limited (the 'Applicant')), is proposing to expand London Luton Airport (the airport) through an application for development consent for works that would allow growth from the current permitted capacity of 18 million passengers per annum (mppa) to accommodate 32 mppa (hereon referred to as the 'Proposed Development').

1.1.2 This document is an ~~a~~Appendix to the Noise and Vibration assessment reported in **Chapter 16** of the **Environment Statement (ES) [TR020001/APP/5.01]** submitted as part of the application for development consent. It provides supplementary information to be read in conjunction with **Chapter 16** Noise and vibration of this **ES [TR020001/APP/5.01]**. Table 1.1 contains a description of each section of this ~~a~~Appendix and which section in **Chapter 16** of the **ES [TR020001/APP/5.01]** that the ~~a~~Appendix section relates to.

Table 1.1: Appendix Guide

Section	Name	Description
2	Human Hearing and Acoustic Terminology	Provides information on acoustic terminology used in the noise and vibration assessment and the human response to noise.
3	Local Planning Policy	Provides additional information on relevant local planning policy summarised in Section 16.2 of **Chapter 16** of the **ES [TR020001/APP/5.01]**.
4	Baseline Ambient Sound Survey	Provides further details on ambient sound surveys that were undertaken to define baseline conditions as described in Section 16.5 and Section 16.7 of **Chapter 16** of the **ES [TR020001/APP/5.01]**.
5	Construction/ Earthworks Noise and Vibration Assessment	Provides details on the assessment methodology, the detailed calculation methodology and results for the construction noise and vibration assessment presented in Section 16.9 of **Chapter 16** of the **ES [TR020001/APP/5.01]**.
6	Air Noise Modelling and Validation Process	Provides details on the validation process and the prediction methodology used in the air noise assessment in Section 16.9 of **Chapter 16** of the **ES [TR020001/APP/5.01]**.
7	Air Noise Assessment	Provides details on the assessment methodology, noise model results and supplementary noise metrics used in the air noise assessment in Section 16.9 of **Chapter 16** of the **ES [TR020001/APP/5.01]**.
8	Ground Noise Assessment	Provides details on the assessment methodology, the ground noise prediction methodology and results used in the ground noise assessment in Section 16.9 of **Chapter 16** of the **ES [TR020001/APP/5.01]**.

Section	Name	Description
9	Surface Access Assessment	Provides details on the assessment methodology, the surface access noise prediction methodology and noise model results that were used for the surface access noise assessment in Section 16.9 of **Chapter 16** of the **ES [TR020001/APP/5.01]**.
10	Control of Noise from Fixed Plant	Provides details on the methodology and the control of noise from fixed plant that relates to the fixed plant noise assessment in Section 16.9 of **Chapter 16** of the ES **[TR020001/APP/5.01]**.
11	Sensitivity Testing	Provides detailed analysis of the sensitivity test scenarios that are summarised in Section 16.9 of **Chapter 16** of the **ES [TR020001/APP/5.01]**.
12	Committed Development Assessment	Contains information on potential effects that may occur at committed developments that have been identified in **Chapter 21** In-Combination and Cumulative Effects of this **ES [TR020001/APP/5.01].** This assessment has been undertaken following statutory consultation feedback that requested consideration of how increases in air noise may impact on committed developments.

2 HUMAN HEARING AND ACOUSTIC TERMINOLOGY

2.1.1 Sound is the sensation caused in the ear by tiny variations in air pressure. The rate of these variations is expressed as the frequency of the sound and is measured in Hertz, abbreviated to Hz. A frequency of 1Hz is equivalent to one variation in air pressure per second. Human hearing has a frequency range from 16Hz to 16,000Hz.

2.1.2 The pressure range detected by the human ear as sound covers an extremely large range. In practice the decibel (dB) unit is used to condense this range into a manageable scale by taking the logarithm of the ratio of the sound pressure to a reference sound pressure. The resulting quantity is termed the Sound Pressure Level (SPL) and is given the symbol L_p. Generally sound units measured in decibels are given the symbol L with a subscript used to identify the specific quantity. Expressed as SPL, the threshold of hearing would be an L_p of 0dB and the threshold of pain is taken to be an L_p of 140dB.

2.1.3 Human hearing sensitivity varies with the frequency of the sound; it is at its greatest between 2,000Hz and 5,000Hz. When measuring sound an 'A' weighting is often applied to the dB value. This weighting is a bias built into the frequency response of the sound level meter that aims to match the frequency sensitivity of the meter to that of the human ear. An SPL that has been 'A' weighted is indicated by the symbol L_{Ap}.

2.1.4 When two sound sources at the same level are combined the resulting level will be 3 dB higher than the single source. A 3 dB change in noise is usually considered just discernible; a 5 dB change in noise is usually considered as 'clearly discernible. When two sounds differ by 10 dB the higher will generally be perceived as being twice as loud as the lower.

2.1.5 A summary of acoustic terminology used in the assessment are presented in Table 2.1.

Table 2.1: Acoustic Terminology

Term	Definition
Decibel (dB)	The range of audible sound pressures is approximately 2 x 10^{-5} Pa to 200 Pa. Using decibel notation presents this range in a more manageable form, 0dB to 140dB. Mathematically Sound Pressure level = 20 log {p(t)/p0} Where P0 = 2 x 10^{-5} Pa.
"A" Weighting (dB(A))	The human ear does not respond uniformly to different frequencies. "A" weighting is commonly used to simulate the frequency response of the ear.
'Slow' time weighting	A sound level meter setting with a 1-second response time
'Fast' time weighting	A sound level meter setting with a 125-millisecond response time. Provides a better resolution for very short noise events that may be missed by a 'slow' response time.

Term	Definition
Frequency (Hz)	The number of cycles per second, for sound this is subjectively perceived as pitch.
Frequency Spectrum	Analysis of the relative contributions of different frequencies that make up a sound.
Ambient Sound	Totally encompassing sound in a given situation at a given time usually composed of sound from many sources near and far. The ambient sound comprises the residual sound and the specific sound when present.
Background Sound Level $L_{A90,T}$	A-weighted sound pressure level that is exceeded at the assessment location for 90% of a given time interval, T, measured using time weighting F.
$L_{A10,T}$	A-weighted sound pressure level that is exceeded at the assessment location for 10% of a given time interval, T, measured using time weighting F.
L_{ASmax}	The maximum sound pressure level using 'slow' sound level meter response time of 1-second and is used to describe the maximum sound pressure level during an aircraft event.
L_{AFmax}	The maximum sound pressure level using 'fast' sound level meter response time of 125-milliseconds and is used in the acoustic design of new residential developments.
Equivalent Continuous A-weighted Sound Pressure Level $L_{Aeq,T}$	Value of the A-weighted sound pressure level in decibels of continuous steady sound that, within a specified time interval, T = $t_2 - t_1$, has the same mean-squared sound pressure as a sound that varies with time, and is given by the following equation: $$\mathrm{LAeq,T} = 10 \times \log\left\{\left(\frac{1}{\mathrm{T}}\right)\int_{t_1}^{t_2}\left(\frac{\mathrm{P}_\mathrm{A}^2(t)}{\mathrm{P}_\mathrm{o}^2}\right)\mathrm{dt}\right\}$$ Where p_0 is the reference sound pressure (20µPA); and $P_A(t)$ is the instantaneous A-weighted sound pressure level at time ~~t~~
Sound Exposure Level	The total sound energy for an event that is normalised over a one second period. It is used to calculate $L_{Aeq,T}$ noise contours from multiple noise events with different time durations.
Peak Particle Velocity	The peak speed of particle movement in the ground due to vibration and used to assess impacts from construction activity induced vibration. The Peak Particle Velocity is defined as millimetres per second (mm/s).
Number Above	Nx contours show the locations where the number of events (i.e. flights) exceeds a pre-determined noise level, expressed in dB L_{ASmax}. For example, N65 contours show the number of events where the noise level from those flights exceeds 65 dB L_{ASmax}.
Overflight	An aircraft passing a point on the ground at an elevation angle (between the horizon and the aircraft) of 48.5° up to an altitude of 4,000 feet

3 LOCAL PLANNING POLICY

3.1 Hertfordshire Local Transport Plan 2018-2031 (2018)

3.1.1 The Hertfordshire Local Transport Plan 2018 -2031 (Ref. 1) identifies that a key issue in Hertfordshire is that transport noise negatively impacts on the rural character of the county. Policy 21 seeks to minimise noise issues from transport where practicable to do so.

3.2 Luton Local Plan 2011-2031 (2017)

3.2.1 The Luton Local Plan 2011-31 (Ref. 2) -was adopted by Luton Borough Council on 7 November 2017. It sets out the vision and approach for the sustainable growth of the Luton for the period up to 2031.

3.2.2 Policy LLP6 sets out requirements for airport expansion through the following requirement:

"Proposals for expansion of the airport and its operation, together with any associated surface access improvements, will be assessed against the Local Plan policies as a whole taking account of the wider sub-regional impact of the airport".

Expansion proposal will only be supported where the following requirements relating to noise are met:

a. *"they contribute to achieving national aviation policies;*
b. *they fully assess the impacts of any increase in Air Transport Movements on surrounding occupiers and/or local environment (in terms of noise, disturbance, air quality and climate change impacts), and identify appropriate forms of mitigation in the event significant adverse effects are identified;*
c. achieve further noise reduction or no material increase in day or night-time noise or otherwise cause excessive noise including ground noise at any time of the day or night and in accordance with the airport's most recent Airport Noise Action Plan;
d. *include an effective noise control, monitoring and management scheme that ensures that current and future operations at the airport are fully in accordance with the policies of this Plan and any planning permission which has been granted;*
e. *include proposals that will, over time, result in a significant diminution and betterment of the effects of aircraft operations on the amenity of local residents, occupiers and users of sensitive premises in the area, through measures to be taken to secure fleet modernisation or otherwise"*

3.3 Central Bedfordshire Council Local Plan 2035 (2021)

3.3.1 The Central Bedfordshire Local Plan (Ref. 3) was adopted in July 2021 and is the key strategic planning document to guide and support the delivery of new infrastructure, homes and jobs. It sets out the long-term vision and objectives for the area, what is going to happen, where, and how this will be achieved and delivered over the next 20 years.

3.3.2 Strategic Objective 13 states the commitment to: "

Improving and protecting air and water quality, reducing flood risk and adverse impacts from noise including the safeguarding of quiet areas and reducing the impacts of contaminated land". Noise commitments are made to this strategic objective in the following policies:

a. Policy CC8: Pollution and Land Instability states, in relation to noise, developments will only be permitted if it can be demonstrated that:

b. "Measures can be implemented to minimise the impacts of pollution and land instability to an acceptable level without compromising the quality of life for users and occupiers, which protects health, natural and historic environment, water quality, property, infrastructure and amenity".

c. Policy EE7: The Chilterns Area of Outstanding Natural Beauty states:

d. "Planning permission for any proposal within the AONB, or affecting the setting or appreciation of the AONB, will be restricted to proposals that:1. Conserve and enhance the Chiltern AONB's special qualities, distinctive character, tranquillity and remoteness in accordance with national planning policy and the overall purpose of the AONB designation"

e. Paragraph 15.6.15 states that noise should be a consideration for new developments that may affect tranquillity of an AONB.

3.4 North Hertfordshire Local Plan 2011-2031m (2022)

3.4.1 The North Hertfordshire Local Plan 2011-2031 (Ref. 4) was adopted in November 2022. The Local Plan sets a strategic vision and spatial strategy for the North Herts over the period 2011 to 2031.

3.4.2 Policy D3~~:~~ (Protecting Living Conditions) states:

"Planning permission will be granted for development proposals which do not cause unacceptable harm to living conditions. Where the living conditions of proposed developments would be affected by an existing use or the living conditions of an existing development would be affected by a proposed use, the Council will consider whether there are mitigation measures that can be taken to mitigate the harm to an acceptable level. If the Council is not satisfied that mitigation proposals would address the identified harm, development proposals will not be permitted".

3.4.3 Paragraph 9.19 of Policy D3, identifies the potential for new developments to result in noise impacts. Paragraph 9.22 states that mitigation can either be incorporated on-site or works can be funded off-site to reduce the impact of those affected.

3.4.4 Policy NE3~~:~~ (The Chilterns Area of Outstanding Natural Beauty (AONB)) includes reference to tranquillity, and ~~which should~~ includes details on how developments that affect tranquillity within the AONB, shall be measured~~noise from new developments will affect the AONB~~:

"Planning permission for any proposal within the AONB, or affecting the setting of the AONB, will only be granted provided that it: b) Conserves and where possible enhances the Chilterns AONB's special qualities, distinctive character and biodiversity, tranquillity and remoteness in accordance with national planning policy and the overall purpose of the AONB designation…"

4 BASELINE AMBIENT SOUND SURVEY

4.1 Introduction

4.1.1 Two types of baseline noise monitoring have been undertaken to inform the noise assessment as described in Table 4.1. The monitoring is further described in the referenced subsections.

Table 4.1: Description and purpose of baseline noise monitoring

Baseline noise monitoring	Description	Purpose
Aircraft noise monitoring	Measurement of individual aircraft noise events using LLAOL's permanent and temporary noise monitoring terminals. This is described in further detail in Section 6.	Used to validate the aircraft noise model by comparing measured noise levels of individual aircraft types to those predicted by the aircraft noise model.
Ambient noise monitoring	Measurement of all sound sources (ambient noise) at community locations. Noise monitoring was undertaken at locations agreed with the Noise Working Group (see Section 16.4) and at additional locations identified through 2019 statutory consultation. This is described in further detail in this section.	Used to inform the baseline for the construction noise assessment. Used to validate the baseline road traffic noise levels at key road links in the surface access study area. Used to provide context to the aircraft noise assessment identification of likely significant effects.

4.1.2 Consultation on noise and vibration with relevant local authorities has primarily been through the establishment of a Noise Working Group (NWG), which hwas been set up to facilitate ongoing discussion regarding scope, method and assessment findings. Ambient sound monitoring was undertaken at locations agreed with the NWG and at additional locations identified through the 2019 statutory consultation. Details of consultation with the NWG are presented in Table 16.8 of **Chapter 16** of the ES **[TR020001/APP/5.01].**

4.2 Sound Monitoring Locations and Protocol

4.2.1 Baseline sound surveys were undertaken at locations surrounding the Proposed Development as shown in Figure 16.3 of the ES **[TR020001/APP/5.03]**. The baseline sound survey has been undertaken following the principles contained in BS 7445-1 2003 (Ref. 5).

4.2.2 Long term (minimum of two weeks) unattended monitoring was completed at four locations (ML8, ML18, ML30 and ML31) between 23 August 2018 and 21 September 2018. Long-term monitoring for a minimum of two weeks was also performed at seven locations (ML1, ML7, ML9, ML17, ML19, ML20 and ML22) between 21 September and 2 November 2018 and at a further twelve locations (ML2 to ML5, ML10 to ML16 and ML21) between 16 April and 23 May 2019.

4.2.3 Road traffic noise levels were measured at seven monitoring locations along key surface access routes. These locations were all outside the 2019 Actuals Baseline daytime LOAEL (Lowest Observable Adverse Effect Level) noise contour with the exception of ML26, which was marginally inside. As such, road traffic noise was the main source of noise at these locations. Short-term daytime monitoring was performed over a 3-hour period in accordance with the CRTN 'shortened measurement procedure'. These were performed on 2 (ML23 and ML25), 29 (ML24) and 30 (ML28 and ML29) November 2018, and 23 January 2019 (ML26 and ML27).

4.2.4 In response to feedback during 2019 statutory consultation ~~feedback~~, additional monitoring was undertaken at ML41 to ML44. This allowed road traffic noise levels to be defined at roads with low traffic flows in the Tea Green area where potential significant effects were identified.

4.2.5 Meteorological conditions recorded by the London Luton Airport weather station have been used to identify periods of adverse weather conditions over the unattended monitoring periods i.e. periods of rain and windspeeds greater than 5 m/s. These periods have been removed from the monitoring results. This is typical for unattended noise surveys over a long period of time (the average measurement duration was 21 days) and is not considered to be a material limitation in the ambient sound survey methodology.

4.2.6 The measurement locations are described in Table 4.2 ~~**Table 4.1**~~. Descriptions of the dominant and secondary noise sources have been included from the observations made at the start and end of the measurements.

~~Table 4.1: Baseline sound monitoring locations~~

Table 4.2: Baseline sound monitoring locations

Location	Details	Primary Sound Sources	Secondary Sound Sources	Measurement Format
ML1	Someries Castle, Central Beds	Aircraft	Road traffic	Unattended
ML2	Diamond End, North Herts	Aircraft	Road traffic, dog barking	Unattended
ML3	Langley, North Herts	Aircraft	Road traffic	Unattended
ML4	Breachwood Green, North Herts	Birdcall	Aircraft and road traffic	Unattended

Location	Details	Primary Sound Sources	Secondary Sound Sources	Measurement Format
ML5	Bendish, North Herts	Aircraft	Birdcall	Unattended
ML7	Luton Hoo, Central Beds	Road traffic and aircraft	None noted	Unattended
ML8	Dagnall, Aylesbury Vale	Aircraft	Road traffic, occasional gardening activities	Unattended
ML9	Markyate, Dacorum	Aircraft	None noted	Unattended
ML10	Caddington, Central Beds	Road traffic	Aircraft, birdsong	Unattended
ML11	Woodside, Central Beds	Birdsong	Conversation, aircraft, road traffic	Unattended
ML12	Front Street, Slip End, Luton	Road traffic	Aircraft, processing plant at McClaid Screening	Unattended
ML13	Strathmore Avenue, Luton	Aircraft	Road traffic	Unattended
ML14	Vauxhall Way, Luton	Road traffic	None noted	Unattended
ML15	Eaton Green Road, Luton	Road traffic	Aircraft	Unattended
ML16	Malthouse Green, Luton	Aircraft	Road traffic	Unattended
ML17	Kensworth, Central Beds	Road traffic	Aircraft	Unattended
ML18	Stevenage	Aircraft and road traffic	Occasional dog barking	Unattended
ML19	Flamstead, Dacorum	Aircraft	Road traffic, occasional gardening activities	Unattended
ML20	Jockey End, Dacorum	Aircraft	Occasional gardening activities	Unattended
ML21	Preston, North Herts	Road traffic	Aircraft	Unattended
ML22	Holywell, Central Beds	Aircraft	Occasional gardening activities	Unattended
ML23	A602 Stevenage Road, North Herts	Road traffic	Pedestrians	Attended

Location	Details	Primary Sound Sources	Secondary Sound Sources	Measurement Format
ML24	Hitchin Road, Luton	Road traffic	None	Attended
ML25	A505 Beech Hill, North Herts	Road traffic	Pedestrians	Attended
ML26	A1081 London Road, Central Beds	Road traffic	None	Attended
ML27	A505 Hatters Way, Luton	Road traffic	Pedestrians	Attended
ML28	A6 New Bedford Road, Luton	Road traffic	Birdcall	Attended
ML29	B653 Lower Harpenden Road, Central Beds	Road traffic	Occasional train passbys	Attended
ML30	Pitstone, Aylesbury Vale	Aircraft	Road traffic, occasional gardening activities	Unattended
ML31	St Pauls Walden, North Herts	Aircraft	Road traffic, occasional gardening activities	Unattended
ML37	Breachwood Green JMI School	Aircraft	Road traffic, birdsong, school activities	Unattended
ML41	Brick Kiln Lane, Luton	Road traffic	Road traffic, aircraft, birdsong	Unattended
ML42	Chalk Hill, Luton	Road traffic	Road traffic, aircraft, birdsong	Attended
ML43	Wandon End, Luton	Aircraft	Dog barking, road traffic, aircraft, birdsong	Attended
ML44	Stony Lane, Luton	Aircraft	Road traffic, aircraft, birdsong	Attended

4.2.7 Information relating to the measurement equipment used during the survey is presented in Table 4.3 ~~Table 4.2~~.

Table 4.3: Instrument details

Location	Instrument	Manufacturer	Model	Serial Number
ML1	Sound-level meter	Rion	NL-52	420765
ML2	Sound-level meter	01dB	Duo	12062

Location	Instrument	Manufacturer	Model	Serial Number
ML3	Sound-level meter	Rion	NL-52	743082
ML4	Sound-level meter	Norsonic	Nor 140	1402919
ML5	Sound-level meter	Rion	NL-52	386765
ML7	Sound-level meter	Rion	NL-52	420765
ML8	Sound-level meter	01dB	Duo	12076
ML9	Sound-level meter	01dB	Duo	12081
ML10	Sound-level meter	Rion	NL-52	542906
ML11	Sound-level meter	Rion	NL-52	00529407
ML12	Sound-level meter	Rion	NL-52	420764
ML13	Sound-level meter	Rion	NL-52	00386764
ML14	Sound-level meter	Rion	NL-52	00386763
ML15	Sound-level meter	Rion	NL-52	00386762
ML16	Sound-level meter	Rion	NL-52	420763
ML17	Sound-level meter	01dB	Duo	12081
ML18	Sound-level meter	Rion	NL-52	420765
ML19	Sound-level meter	01dB	Duo	12062
ML20	Sound-level meter	01dB	Duo	12029
ML21	Sound-level meter	Rion	NL-52	420764
ML22	Sound-level meter	01dB	Duo	12062
ML23	Sound-level meter	01dB	Duo	12029
ML24	Sound-level meter	01dB	Duo	12029
ML25	Sound-level meter	01dB	Duo	12029
ML26	Sound-level meter	01dB	Duo	12052
ML27	Sound-level meter	01dB	Duo	12051
ML28	Sound-level meter	01dB	Duo	12029
ML29	Sound-level meter	01dB	Duo	12029
ML30	Sound-level meter	01dB	Duo	12081
ML31	Sound-level meter	01dB	Duo	12062
ML1, ML3, ML8, ML9, ML16, ML18, ML19, ML21, ML22, ML26, ML30, ML31	Calibrator	Rion	NC-74	34304647
ML7, ML10, ML11, ML12, ML17, ML20, ML23, ML24, ML25, ML27, ML28, ML29	Calibrator	Rion	NC-74	35173436

Location	Instrument	Manufacturer	Model	Serial Number
ML2, ML5, ML13, ML14, ML15	Calibrator	Rion	NC-74	34425537
ML4	Calibrator	Norsonic	Nor 1251	31431
ML37, ML41, ML42, ML44	Sound-level meter	Rion	NL-52	809414
ML43	Sound-level meter	Rion	NL-52	809413
ML37, ML42, ML43, ML44	Calibrator	B&K	4231	2642980

4.2.8 All sound level meters were checked through field-calibration at the start and end of monitoring and no significant deviations (greater than ±0.5dB) from the reference value were noted.

4.2.9 The sound level meters were programmed to log a number of indicators including $L_{Aeq,T}$, $L_{A90,T}$, $L_{A10,T}$ and L_{ASmax} values, in 15-minute contiguous intervals with a resolution of 1s at all unattended monitoring locations. For the attended measurements, the sound level meter was programmed to record values in 1-hour contiguous intervals with a 1-second resolution.

4.2.10 Graphs showing the time-history of the measured 15-minute levels over the survey period for each long-term monitoring location are provided in Section 4.4.

4.3 Sound Monitoring Results

4.3.1 A summary of the attended monitoring results is presented in- Table 4.4~~Table 4.3~~.

Table 4.4: Attended Baseline Monitoring Results

Location	Measured Sound Levels (dB)		
	Average $L_{Aeq,1h}$	Average $L_{A10,1h}$	Estimated $L_{Aeq,16h}$
ML23	75	77	75
ML24	67	71	67
ML25	78	81	78
ML26	78	82	78
ML27	79	83	79
ML28	75	77	75
ML29	69	73	69
ML42	55	57	55
ML43	48	47	48
ML44	53	48	53

4.3.2 Monitoring results that are referenced in the construction noise assessment are summarised in Table 4.5~~Table 4.4~~.

Table 4.5: Noise Monitoring Results used in Construction Noise Assessments

Location	Measured Sound Levels (dB)		
	Average $L_{Aeq,12h}$ (07:00-19:00)	Average Daytime $L_{A90,1h}$ (07:00-23:00)	Average Night-time $L_{A90,1h}$ (23:00-07:00)
ML15	66	53	42

4.3.3 A full summary of unattended monitoring results is provided in Table 4.6~~Table 4.5~~. This includes results for the entire unattended monitoring period with periods of adverse weather excluded. The unattended monitoring results have been broken down into day (07:00 hrs to 23:00 hrs and night-time (23:00 hrs to 07:00 hrs) sound levels.

Table 4.6: Unattended Baseline Monitoring Results

Location	Start Date (dd/mm/yy)	End Date (dd/mm/yy)	Day			Night		
			$L_{Aeq,16h}$dB	L_{ASMax}dB	$L_{A90,15min}$dB	$L_{Aeq,8h}$dB	L_{ASMax}dB	$L_{A90,15min}$dB
ML1	19/10/2018	02/11/2018	61	84	45	55	81	43
ML2	16/04/2019	30/04/2019	66	87	33	61	85	23
ML3	23/04/2019	08/05/2019	56	76	38	48	72	32
ML4[1]	16/04/2019	20/05/2019~~1~~	58	81	36	59	81	38
ML5	16/04/2019	30/04/2019	62	81	34	56	79	25
ML7	04/10/2018	19/10/2018	66	90	49	61	87	45
ML8[2]	23/08/2018	19/10/2018~~2~~	60	86	42	56	75	32
ML9	21/09/2018	04/10/2018	56	74	41	51	70	40
ML10[3]	23/04/2019	22/05/2019~~3~~	58	79	48	53	72	45
ML11[3]	23/04/2019	22/05/2019~~3~~	59	79	49	57	78	50
ML12[3]	23/04/2019	23/05/2019~~3~~	66	84	55	60	81	55
ML13	16/04/2019	30/04/2019	61	81	50	57	79	47
ML14	16/04/2019	30/04/2019	72	86	62	68	83	46
ML15	16/04/2019	30/04/2019	65	77	53	60	76	42
ML16	23/04/2019	08/05/2019	52	75	38	46	70	29
ML17[4]	04/10/2018	25/10/2018~~4~~	49	66	39	42	58	32
ML18	23/08/2018	21/09/2018	55	75	42	46	68	37
ML19[5]	19/10/2018	02/11/2018	53	72	35	47	70	34
ML20[6]	21/09/2019	13/10/2019	50	68	33	45	64	28
ML21	23/04/2019	08/05/2019	58	80	38	47	72	30
ML22[6]	21/09/2018	19/10/2018~~6~~	50	68	33	45	64	28
ML30[7]	23/08/2018	21/09/2018	50	67	35	42	63	27

Location	Start Date (dd/mm/yy)	End Date (dd/mm/yy)	Day			Night		
			$L_{Aeq,16h}$dB	L_{ASMax}dB	$L_{A90,15min}$dB	$L_{Aeq,8h}$dB	L_{ASMax}dB	$L_{A90,15min}$dB
ML31[8]	23/08/2018	21/09/2018	53	72	34	48	68	27
ML37	26/02/2020	22/03/2020	58	83	36	55	81	31
ML41	13/07/2021	21/07/2021	51	78	33	40	62	28

$L_{Aeq,T}$ was calculated using the logarithmic average of measurements, L_{ASmax} was calculated using the statistical 90th percentile to remove potentially anomalous measurements that may occur due to noise events in close proximity to the microphone and the $L_{A90,T}$ was calculated as the arithmetic mean.

1 Recorded data are from 23/04 to 30/04 and 08/05 to 20/05

2 Recorded data are from 23/08 to 02/09 and 14/10 to 19/10

3 Recorded data are from 23/04 to 05/05 and 10/05 to 22/05

4 Recorded data are from 04/10 to 12/10 and 19/10 to 25/10

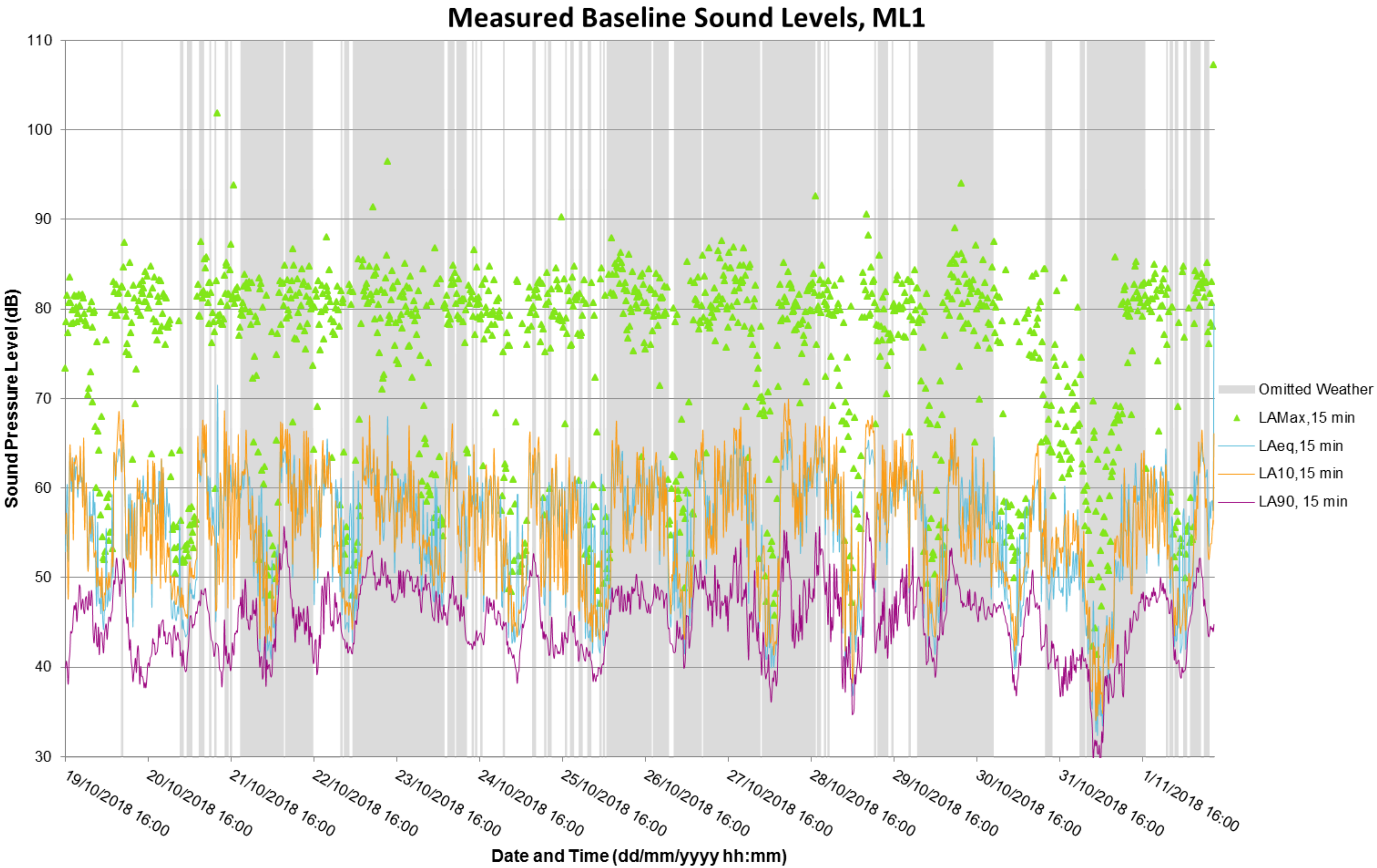
5 Survey period is 9 days instead of 2 weeks.~~,~~ H~~h~~owever, the results are considered to be consistent with a longer time period

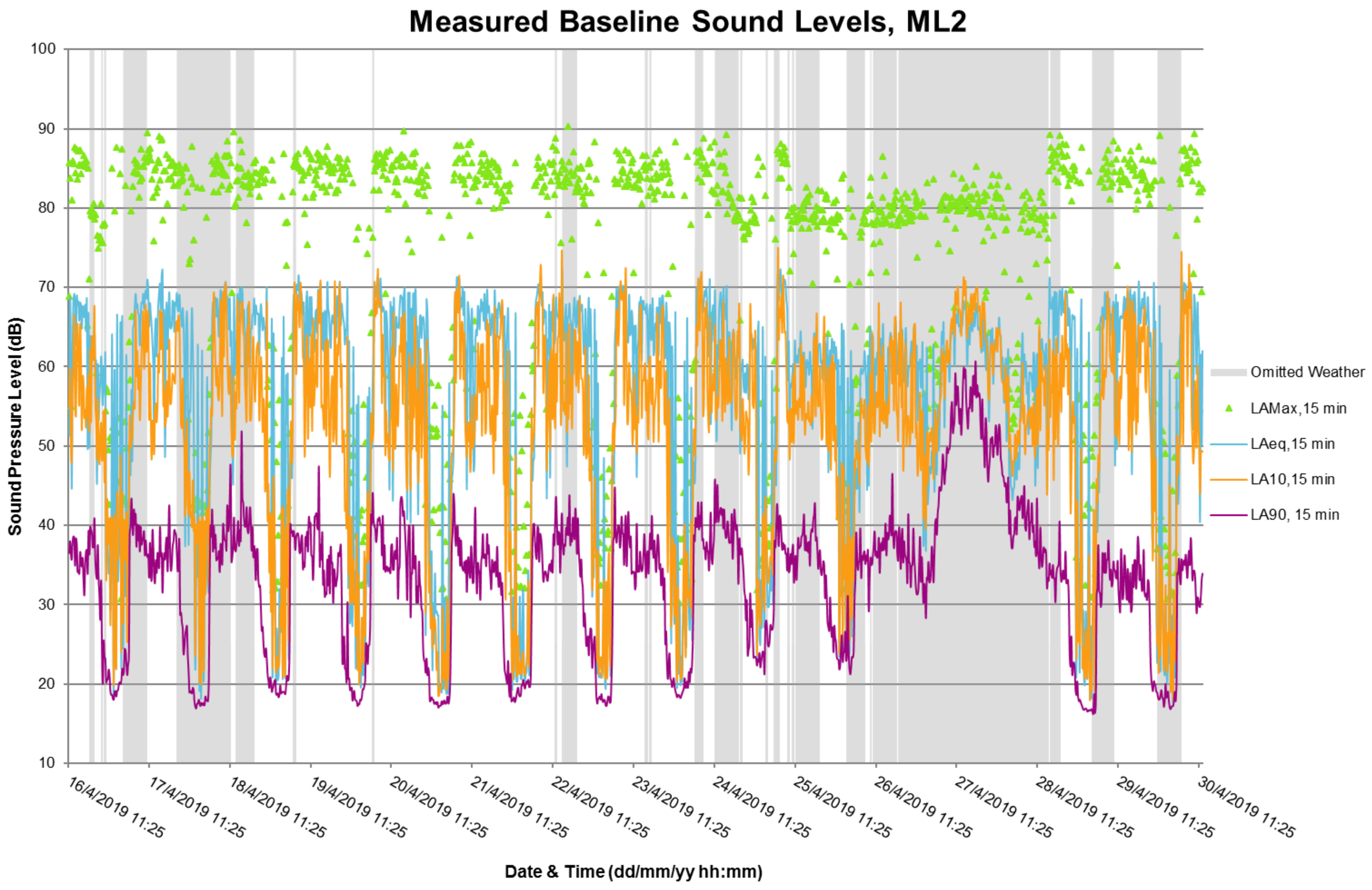
6 Recorded data are from 21/09 to 30/09 and 04/10 to 13/10

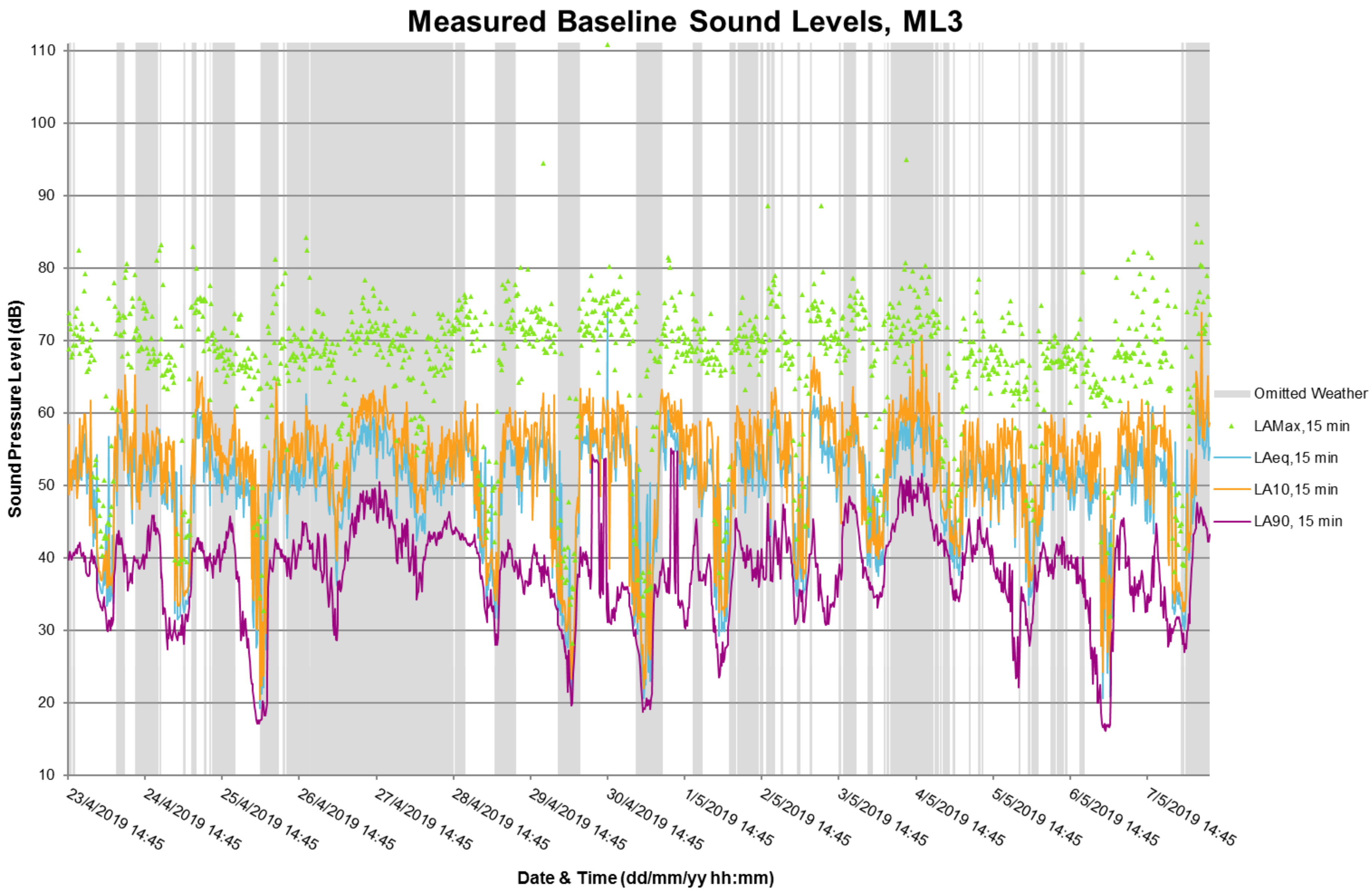
7 Recorded data are from 23/08 to 01/09 and 05/09 to 14/09

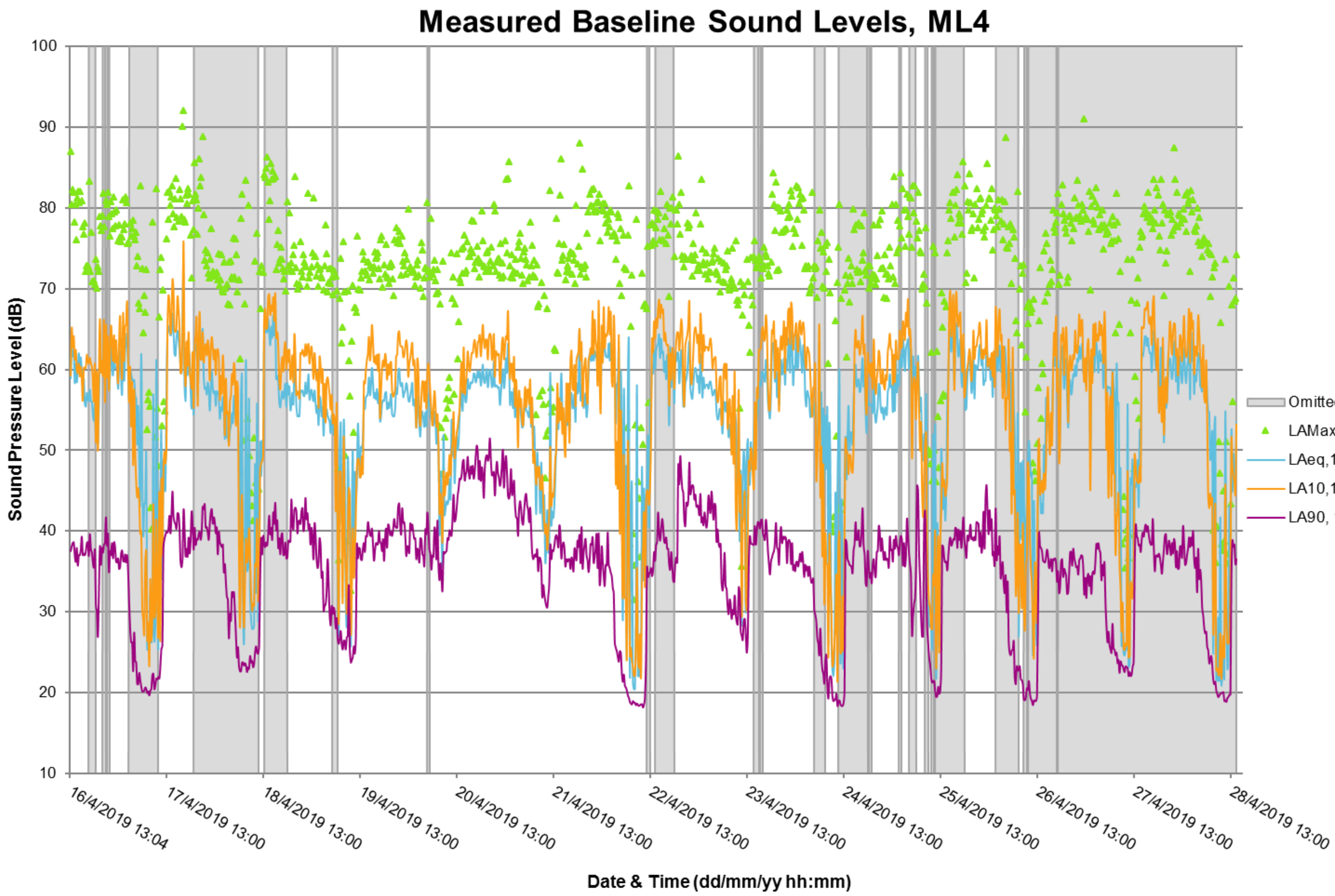
8 Recorded data are from 23/08 to 02/09 and 10/09 to 19/09

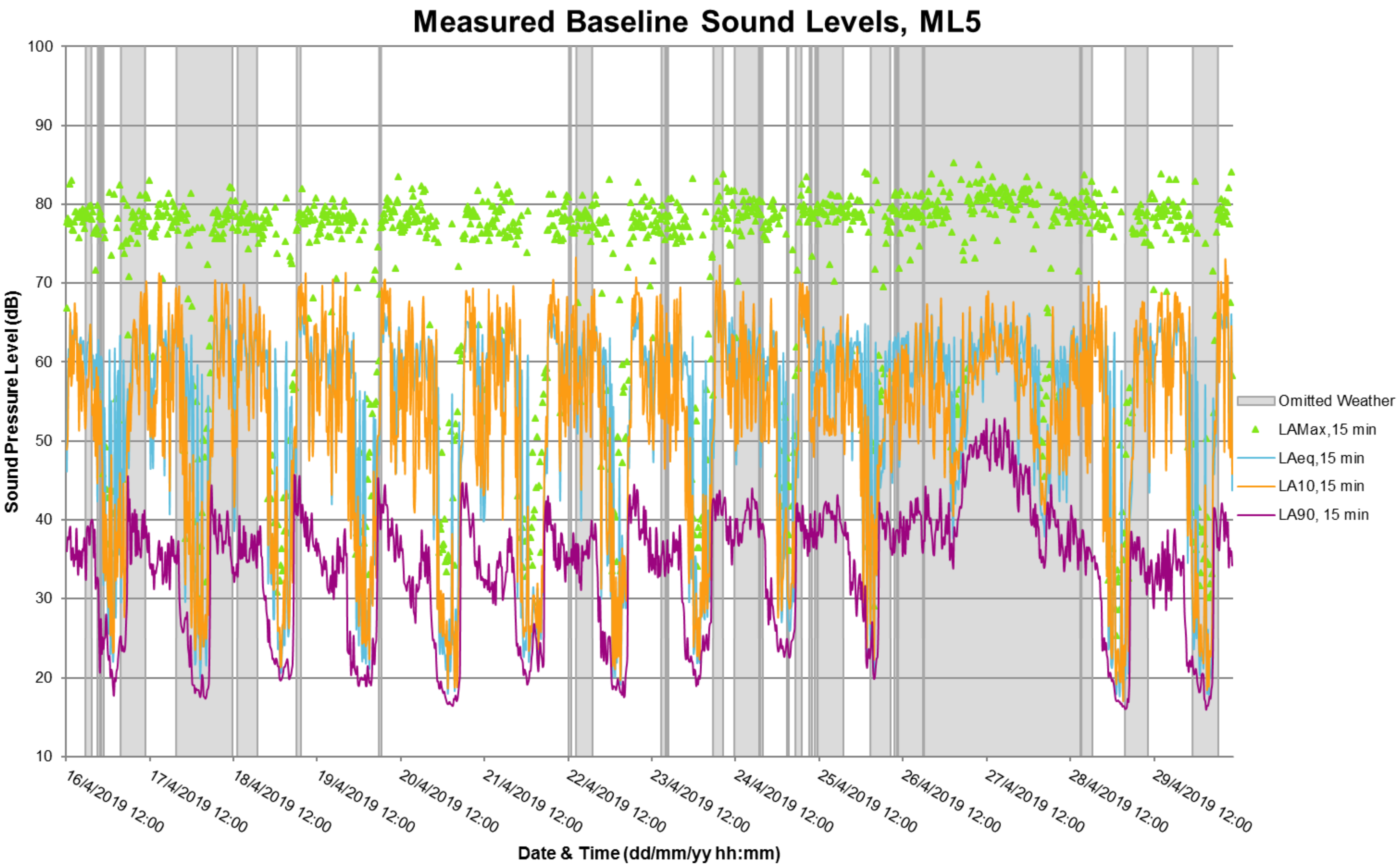
4.4 Sound Monitoring Time Histories

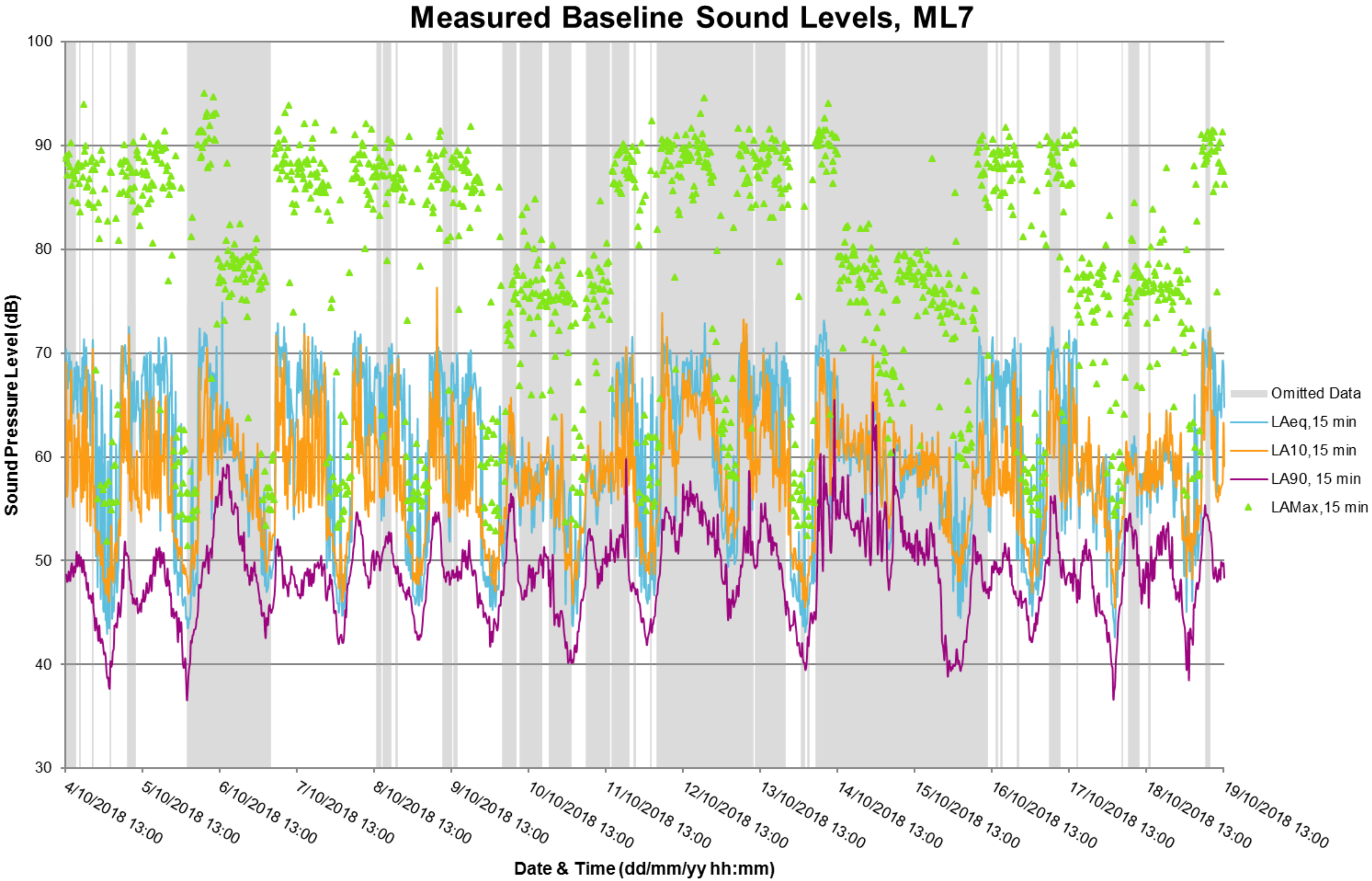


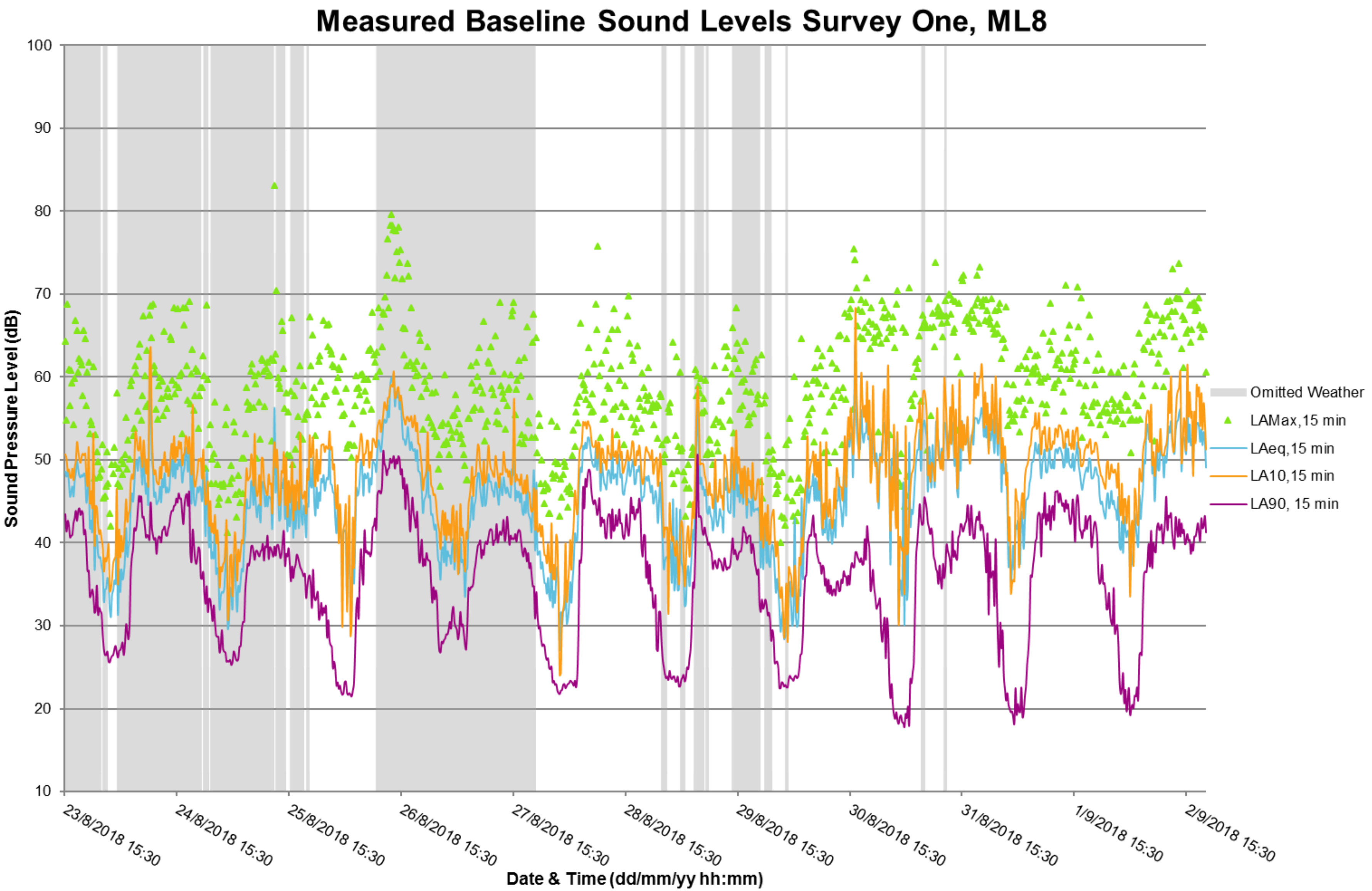

Measured Baseline Sound Levels, ML2
Sound Pressure Level (dB)
100
90
80
70
60
50
40
30
20
10
16/4/2019 11:25
17/4/2019 11:25
18/4/2019 11:25
19/4/2019 11:25
20/4/2019 11:25
21/4/2019 11:25
22/4/2019 11:25
23/4/2019 11:25
24/4/2019 11:25
25/4/2019 11:25
26/4/2019 11:25
27/4/2019 11:25
28/4/2019 11:25
29/4/2019 11:25
30/4/2019 11:25
Date & Time (dd/mm/yy hh:mm)
Omitted Weather
LAMax,15 min
LAeq,15 min
LA10,15 min
LA90, 15 min

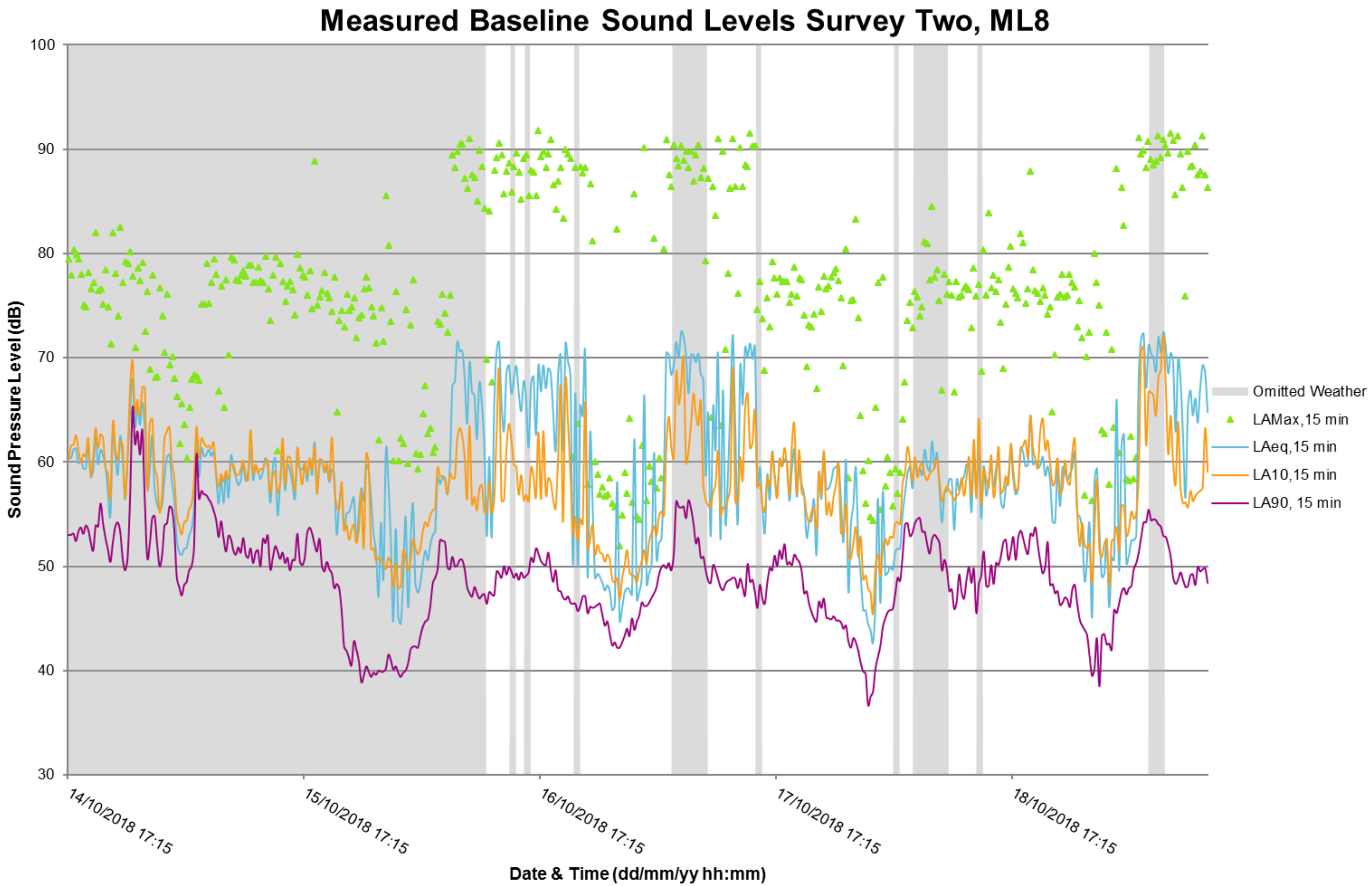

Measured Baseline Sound Levels, ML3
Sound Pressure Level (dB)
110
100
90
80
70
60
50
40
30
20
10
23/4/2019 14:45
24/4/2019 14:45
25/4/2019 14:45
26/4/2019 14:45
27/4/2019 14:45
28/4/2019 14:45
29/4/2019 14:45
30/4/2019 14:45
1/5/2019 14:45
2/5/2019 14:45
3/5/2019 14:45
4/5/2019 14:45
5/5/2019 14:45
6/5/2019 14:45
7/5/2019 14:45
Date & Time (dd/mm/yy hh:mm)
Omitted Weather
LAMax,15 min
LAeq,15 min
LA10,15 min
LA90, 15 min

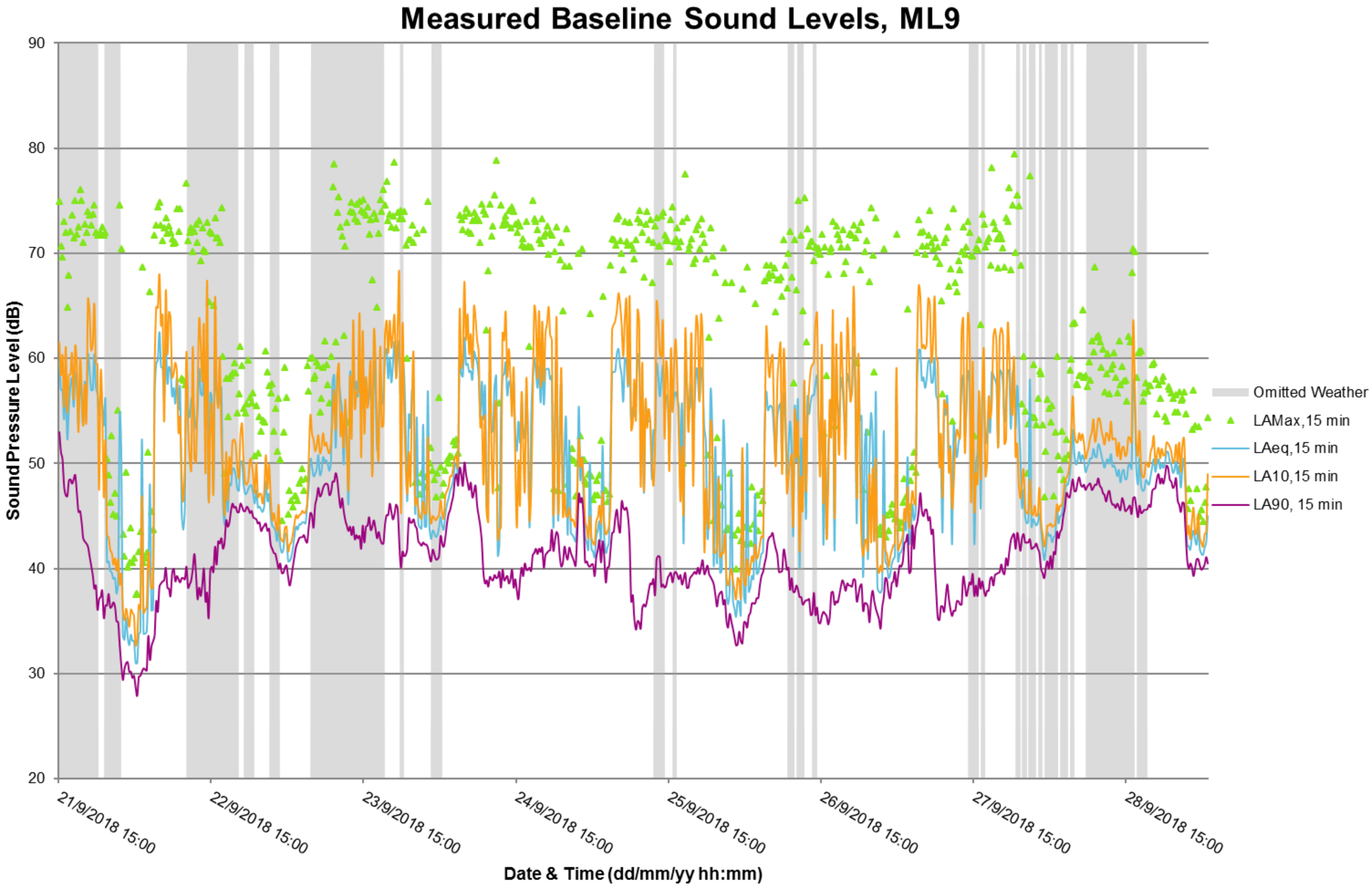

Measured Baseline Sound Levels, ML4
Sound Pressure Level (dB)
100
90
80
70
60
50
40
30
20
10
16/4/2019 13:04
17/4/2019 13:00
18/4/2019 13:00
19/4/2019 13:00
20/4/2019 13:00
21/4/2019 13:00
22/4/2019 13:00
23/4/2019 13:00
24/4/2019 13:00
25/4/2019 13:00
26/4/2019 13:00
27/4/2019 13:00
28/4/2019 13:00
Date & Time (dd/mm/yy hh:mm)
Omitted Weather
LAMax,15 min
LAeq,15 min
LA10,15 min
LA90, 15 min

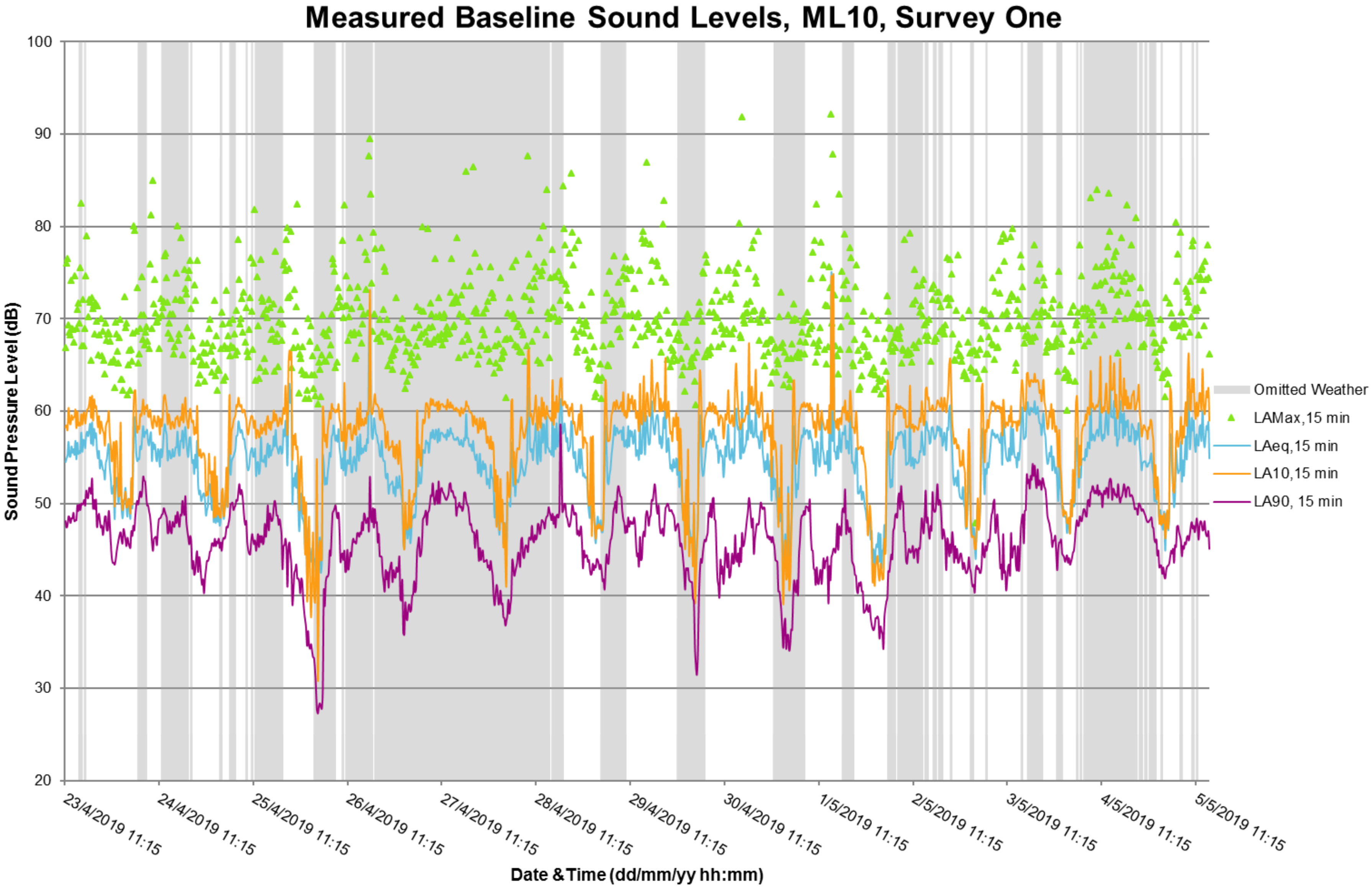

Measured Baseline Sound Levels, ML5
100
90
80
70
60
50
40
30
20
10
Sound Pressure Level (dB)
16/4/2019 12:00
17/4/2019 12:00
18/4/2019 12:00
19/4/2019 12:00
20/4/2019 12:00
21/4/2019 12:00
22/4/2019 12:00
23/4/2019 12:00
24/4/2019 12:00
25/4/2019 12:00
26/4/2019 12:00
27/4/2019 12:00
28/4/2019 12:00
29/4/2019 12:00
Date & Time (dd/mm/yy hh:mm)
Omitted Weather
LAMax, 15 min
LAeq, 15 min
LA10, 15 min
LA90, 15 min

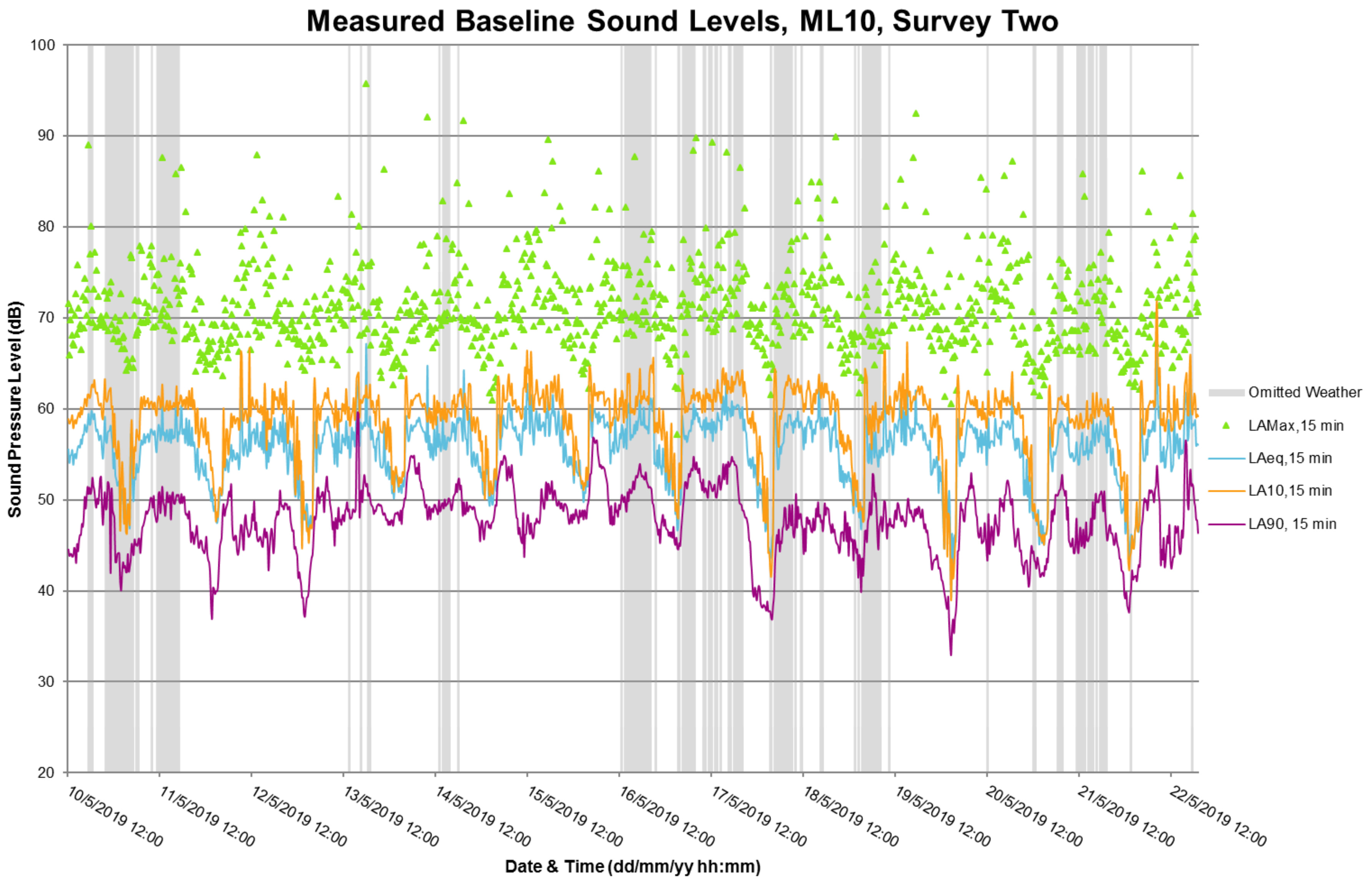

Measured Baseline Sound Levels, ML7
Sound Pressure Level (dB)
100
90
80
70
60
50
40
30
4/10/2018 13:00
5/10/2018 13:00
6/10/2018 13:00
7/10/2018 13:00
8/10/2018 13:00
9/10/2018 13:00
10/10/2018 13:00
11/10/2018 13:00
12/10/2018 13:00
13/10/2018 13:00
14/10/2018 13:00
15/10/2018 13:00
16/10/2018 13:00
17/10/2018 13:00
18/10/2018 13:00
19/10/2018 13:00
Date & Time (dd/mm/yy hh:mm)
Omitted Data
LAeq,15 min
LA10,15 min
LA90, 15 min
LAMax,15 min

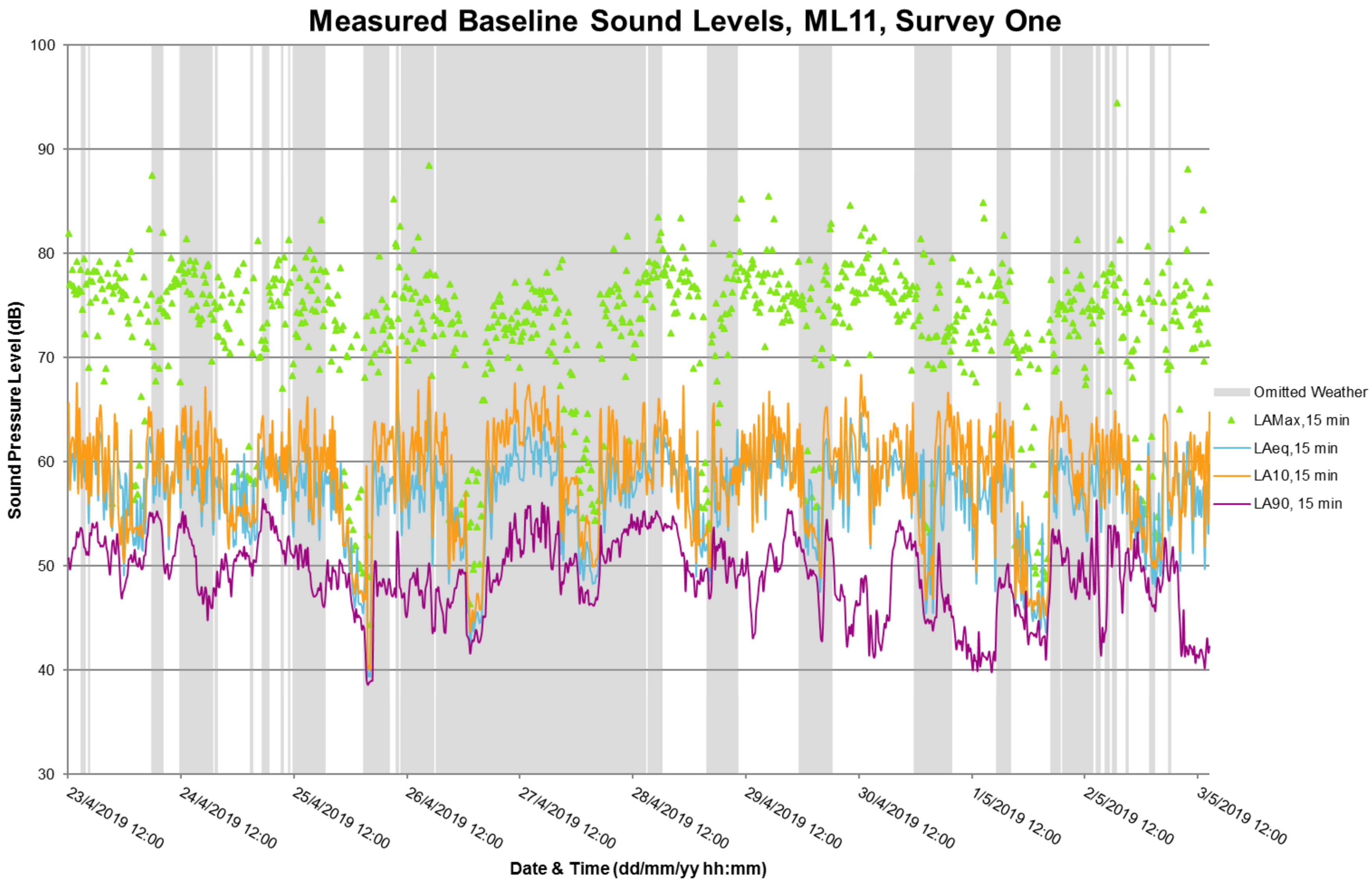

Measured Baseline Sound Levels Survey One, ML8
Sound Pressure Level (dB)
100
90
80
70
60
50
40
30
20
10
23/8/2018 15:30
24/8/2018 15:30
25/8/2018 15:30
26/8/2018 15:30
27/8/2018 15:30
28/8/2018 15:30
29/8/2018 15:30
30/8/2018 15:30
31/8/2018 15:30
1/9/2018 15:30
2/9/2018 15:30
Date & Time (dd/mm/yy hh:mm)
Omitted Weather
LAMax,15 min
LAeq,15 min
LA10,15 min
LA90, 15 min

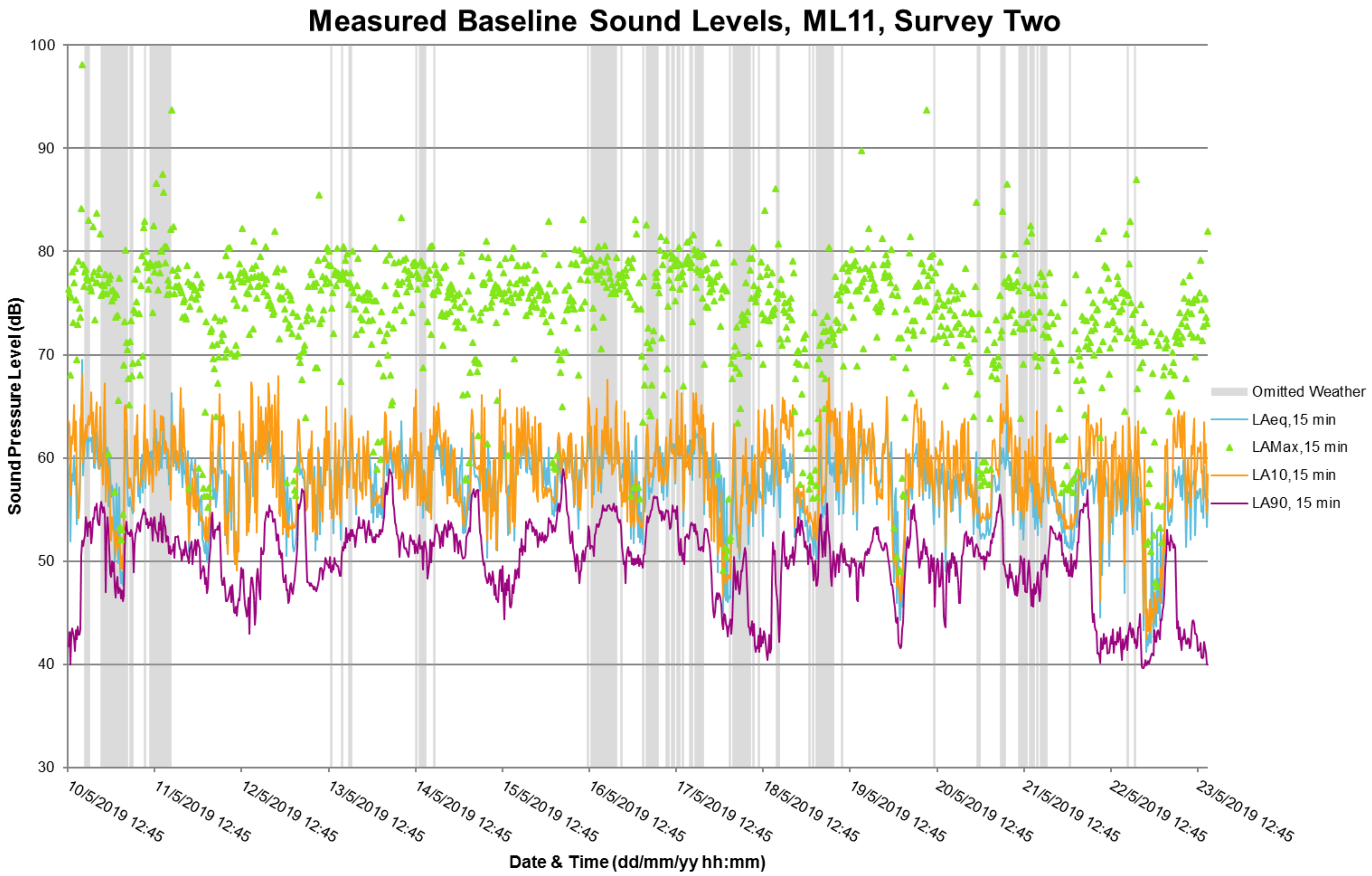

Measured Baseline Sound Levels Survey Two, ML8
100
90
80
70
60
50
40
30
Sound Pressure Level (dB)
14/10/2018 17:15
15/10/2018 17:15
16/10/2018 17:15
17/10/2018 17:15
18/10/2018 17:15
Date & Time (dd/mm/yy hh:mm)
Omitted Weather
LAMax,15 min
LAeq,15 min
LA10,15 min
LA90, 15 min

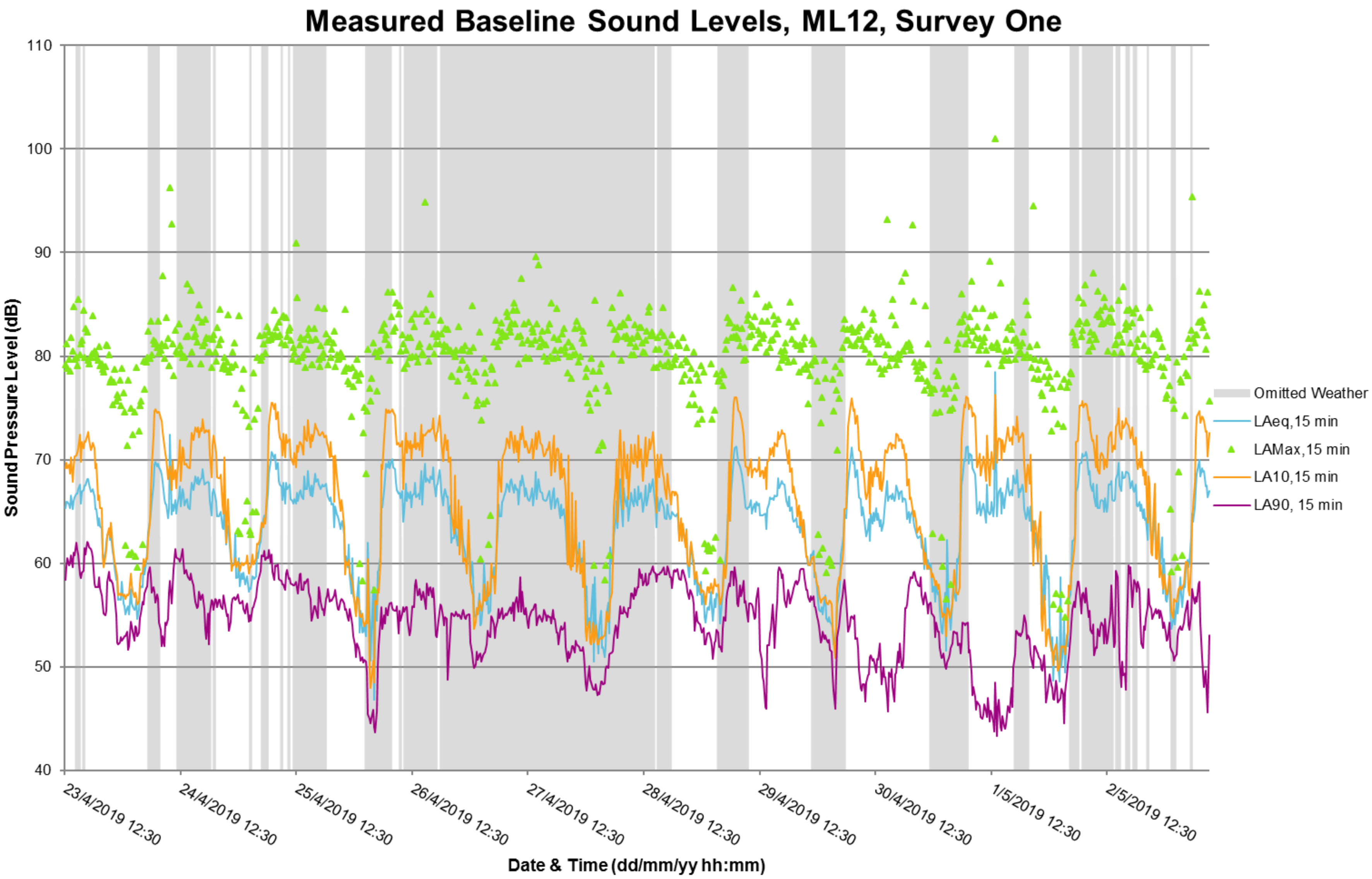

Measured Baseline Sound Levels, ML9
90
80
70
60
50
40
30
20
Sound Pressure Level (dB)
21/9/2018 15:00
22/9/2018 15:00
23/9/2018 15:00
24/9/2018 15:00
25/9/2018 15:00
26/9/2018 15:00
27/9/2018 15:00
28/9/2018 15:00
Date & Time (dd/mm/yy hh:mm)
Omitted Weather
LAMax,15 min
LAeq,15 min
LA10,15 min
LA90, 15 min

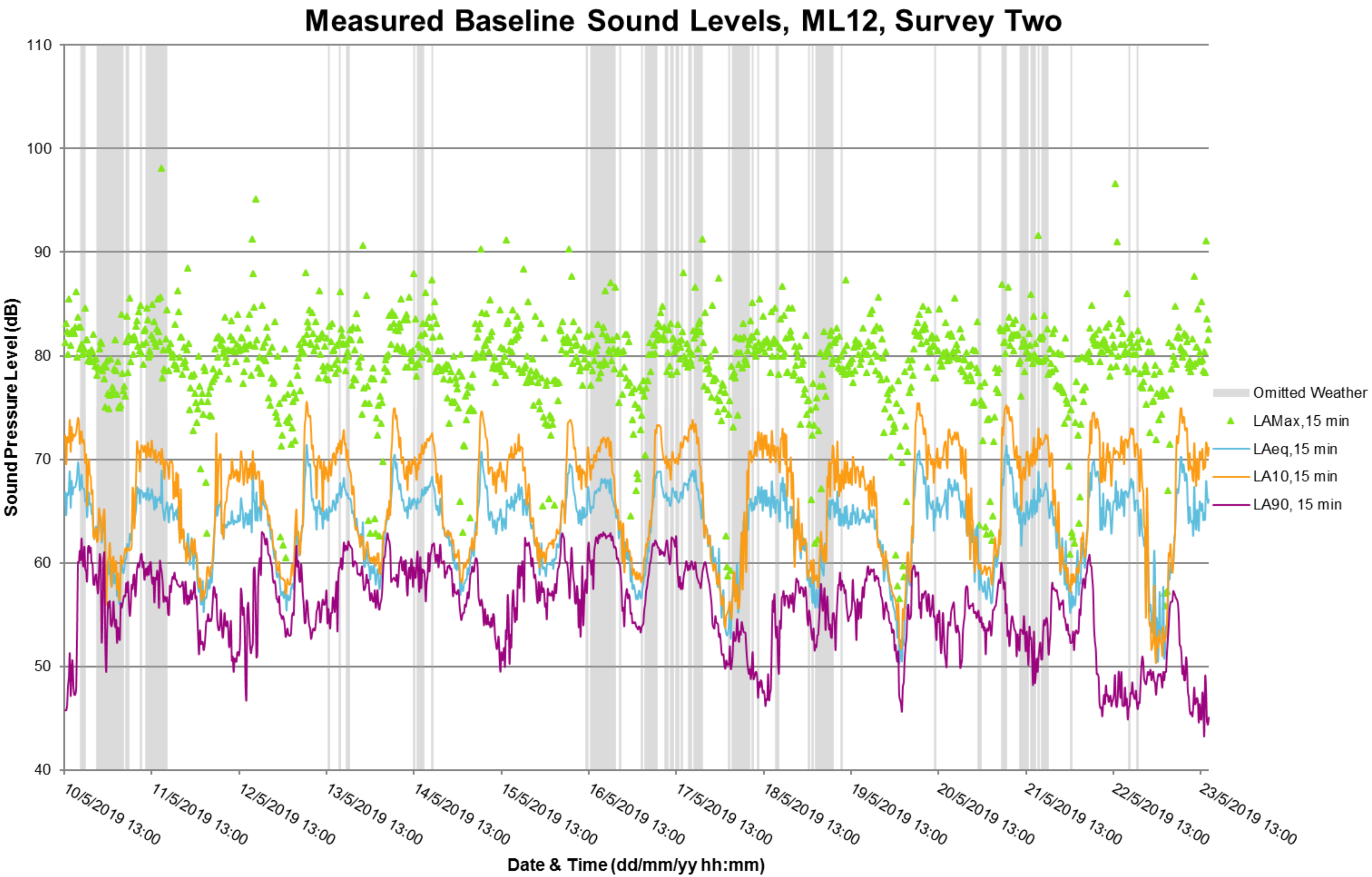

Measured Baseline Sound Levels, ML10, Survey One
Sound Pressure Level (dB)
100
90
80
70
60
50
40
30
20
23/4/2019 11:15
24/4/2019 11:15
25/4/2019 11:15
26/4/2019 11:15
27/4/2019 11:15
28/4/2019 11:15
29/4/2019 11:15
30/4/2019 11:15
1/5/2019 11:15
2/5/2019 11:15
3/5/2019 11:15
4/5/2019 11:15
5/5/2019 11:15
Date & Time (dd/mm/yy hh:mm)
Omitted Weather
LAMax,15 min
LAeq,15 min
LA10,15 min
LA90, 15 min

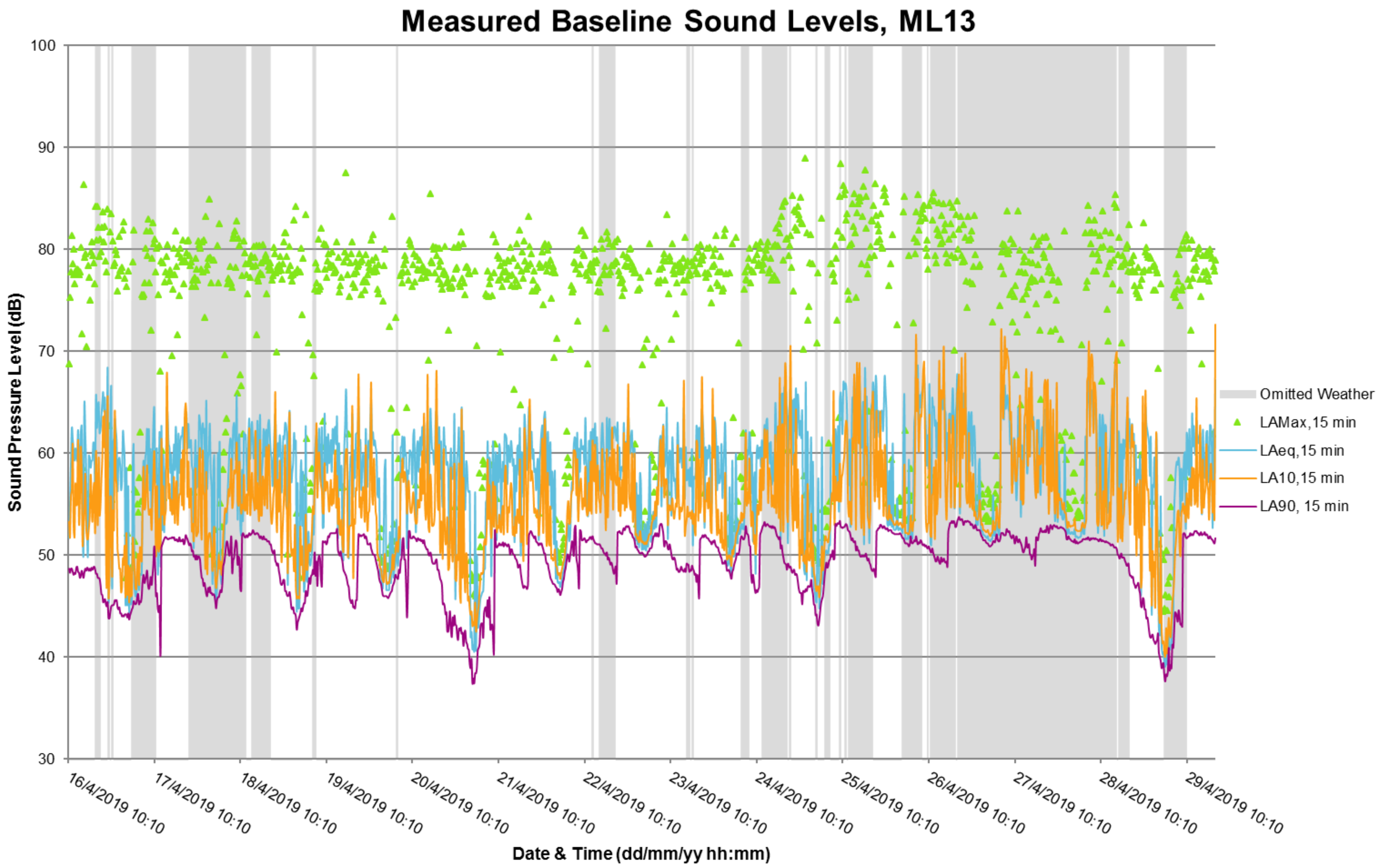

Measured Baseline Sound Levels, ML10, Survey Two
100
90
80
70
60
50
40
30
20
Sound Pressure Level (dB)
10/5/2019 12:00
11/5/2019 12:00
12/5/2019 12:00
13/5/2019 12:00
14/5/2019 12:00
15/5/2019 12:00
16/5/2019 12:00
17/5/2019 12:00
18/5/2019 12:00
19/5/2019 12:00
20/5/2019 12:00
21/5/2019 12:00
22/5/2019 12:00
Date & Time (dd/mm/yy hh:mm)
Omitted Weather
LAMax,15 min
LAeq,15 min
LA10,15 min
LA90, 15 min

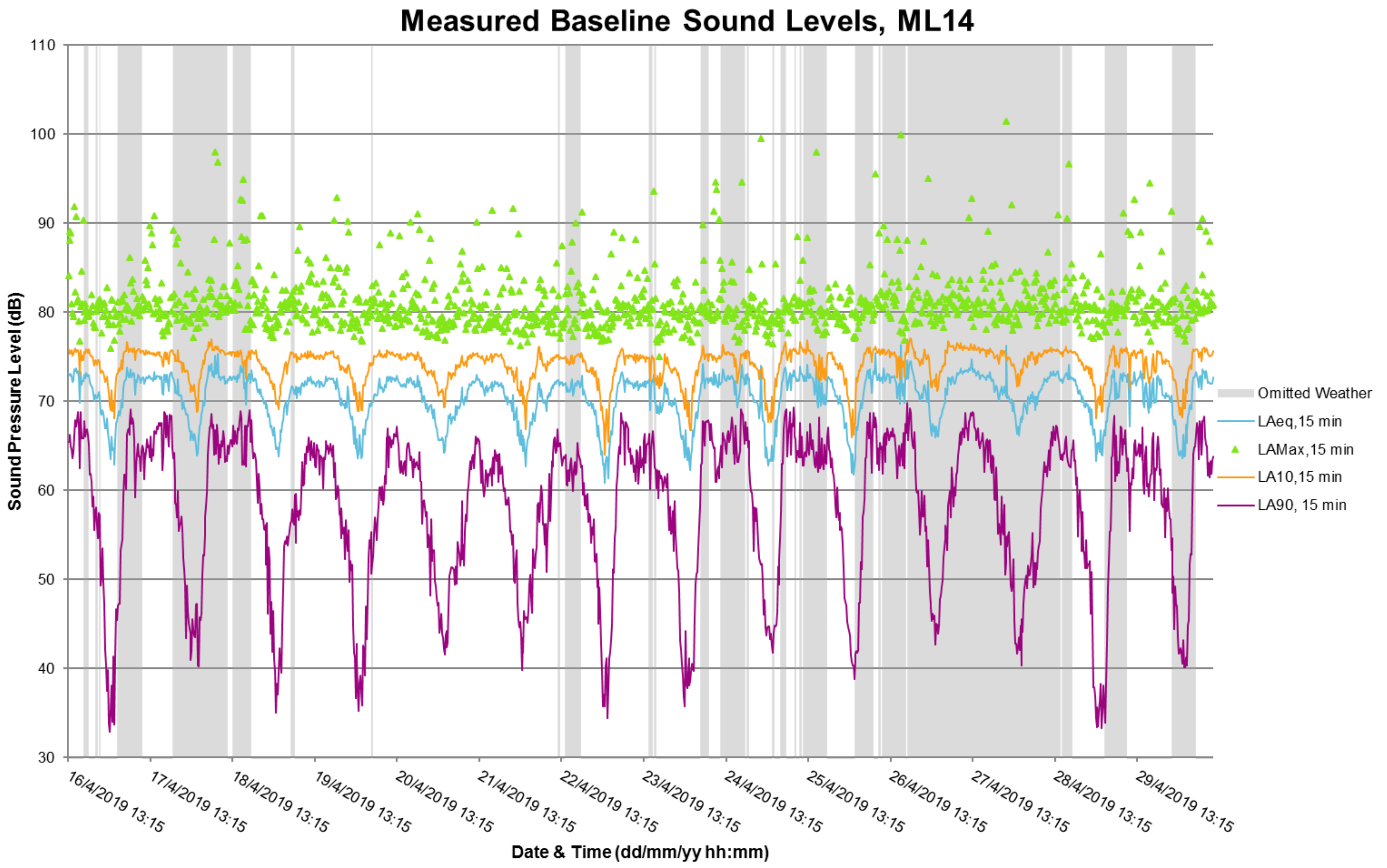

Measured Baseline Sound Levels, ML11, Survey One
Sound Pressure Level (dB)
100
90
80
70
60
50
40
30
23/4/2019 12:00
24/4/2019 12:00
25/4/2019 12:00
26/4/2019 12:00
27/4/2019 12:00
28/4/2019 12:00
29/4/2019 12:00
30/4/2019 12:00
1/5/2019 12:00
2/5/2019 12:00
3/5/2019 12:00
Date & Time (dd/mm/yy hh:mm)
Omitted Weather
LAMax,15 min
LAeq,15 min
LA10,15 min
LA90, 15 min

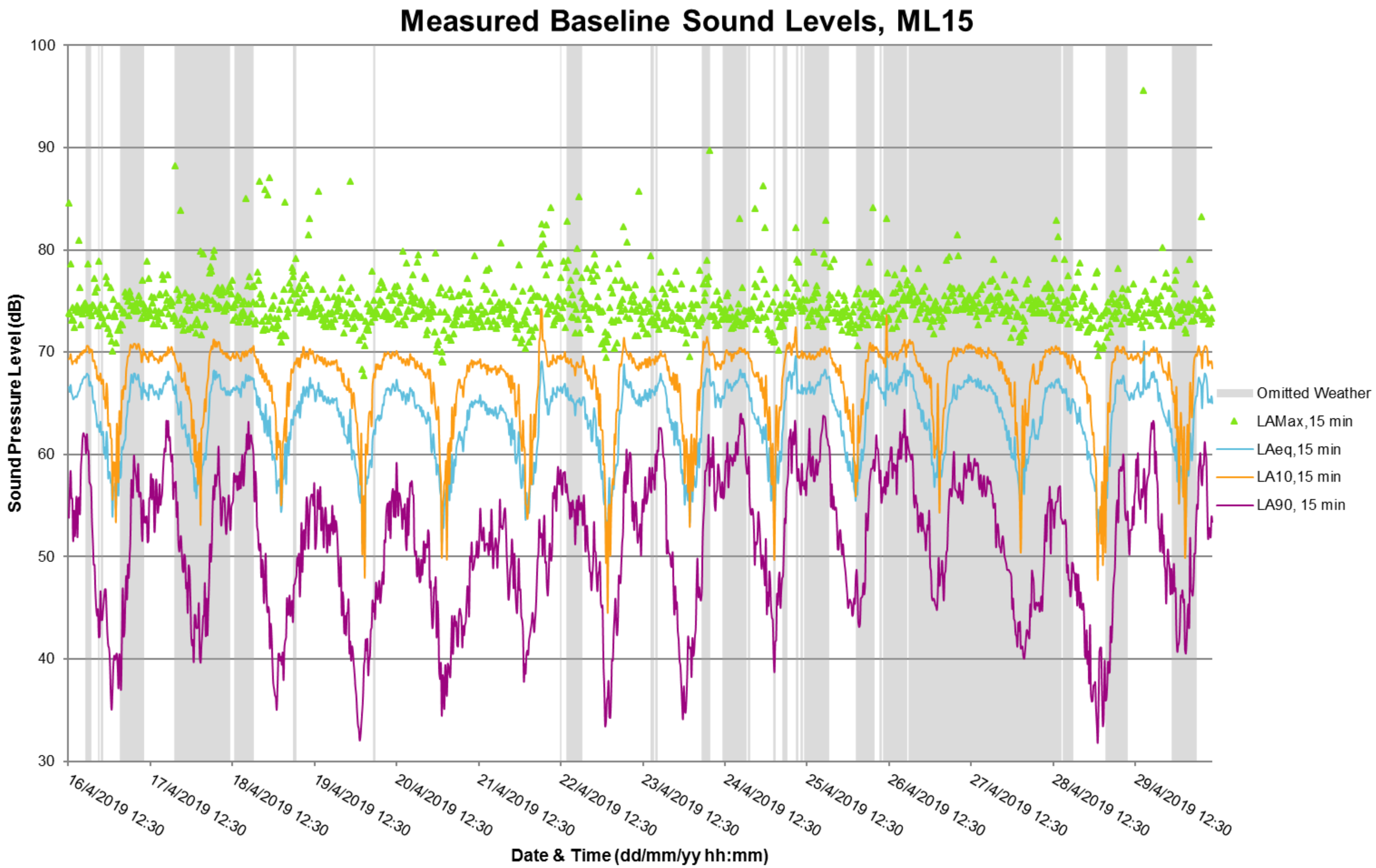

Measured Baseline Sound Levels, ML11, Survey Two
Sound Pressure Level (dB)
100
90
80
70
60
50
40
30
10/5/2019 12:45
11/5/2019 12:45
12/5/2019 12:45
13/5/2019 12:45
14/5/2019 12:45
15/5/2019 12:45
16/5/2019 12:45
17/5/2019 12:45
18/5/2019 12:45
19/5/2019 12:45
20/5/2019 12:45
21/5/2019 12:45
22/5/2019 12:45
23/5/2019 12:45
Date & Time (dd/mm/yy hh:mm)
Omitted Weather
LAeq,15 min
LAMax,15 min
LA10,15 min
LA90, 15 min

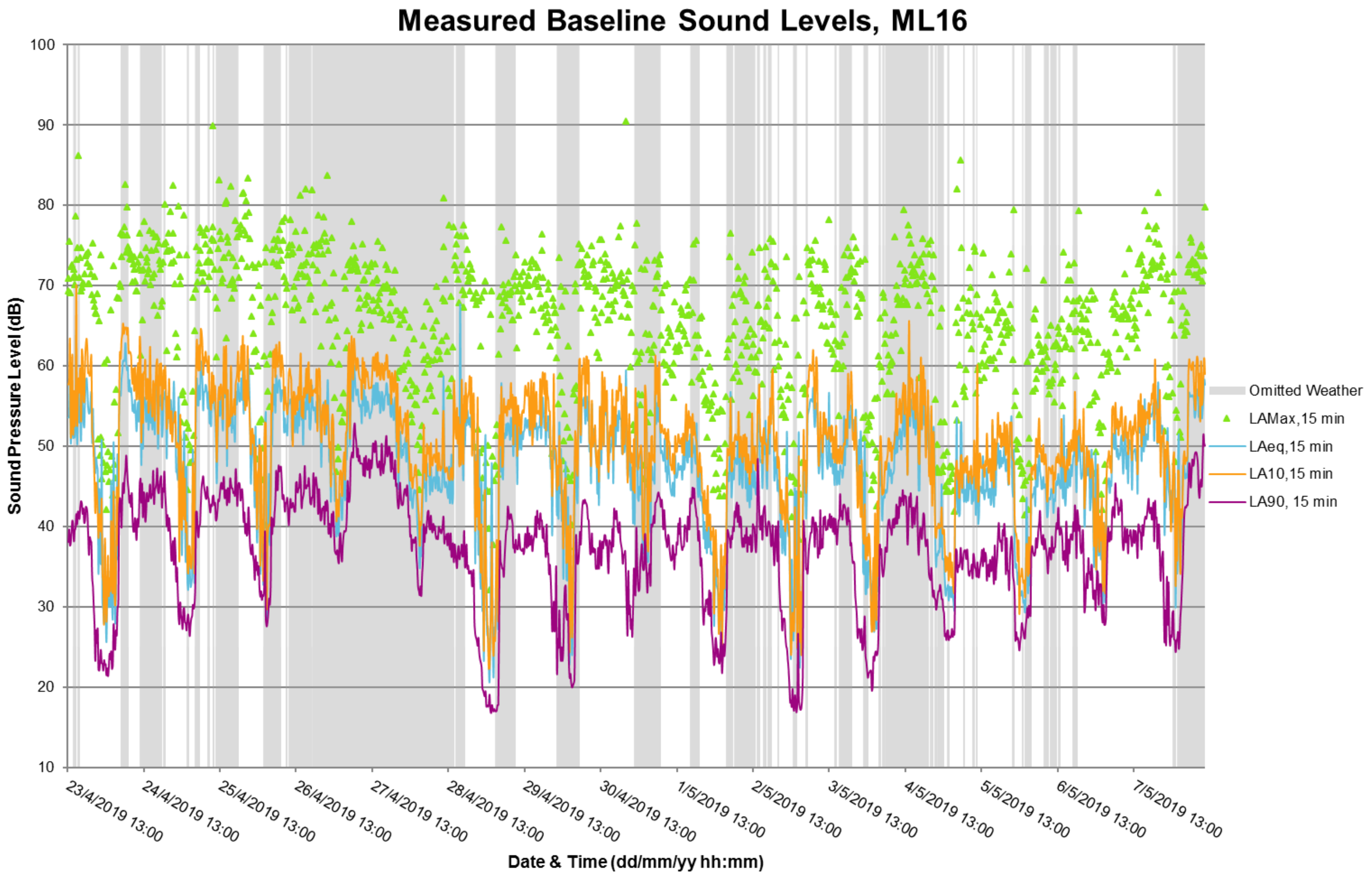

Measured Baseline Sound Levels, ML12, Survey One
Sound Pressure Level (dB)
110
100
90
80
70
60
50
40
23/4/2019 12:30
24/4/2019 12:30
25/4/2019 12:30
26/4/2019 12:30
27/4/2019 12:30
28/4/2019 12:30
29/4/2019 12:30
30/4/2019 12:30
1/5/2019 12:30
2/5/2019 12:30
Date & Time (dd/mm/yy hh:mm)
Omitted Weather
LAeq,15 min
LAMax,15 min
LA10,15 min
LA90, 15 min

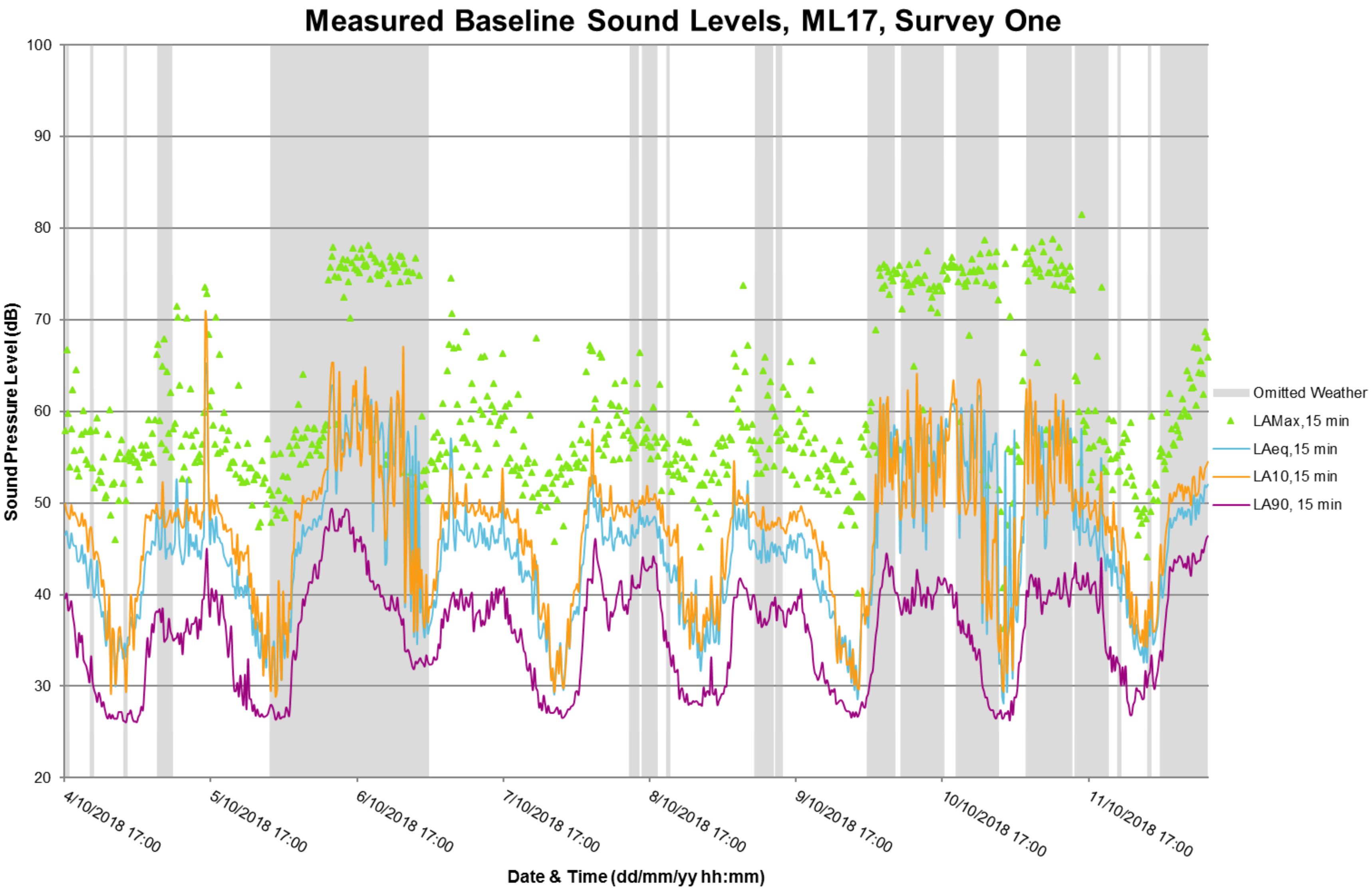

Measured Baseline Sound Levels, ML12, Survey Two
Sound Pressure Level (dB)
110
100
90
80
70
60
50
40
10/5/2019 13:00
11/5/2019 13:00
12/5/2019 13:00
13/5/2019 13:00
14/5/2019 13:00
15/5/2019 13:00
16/5/2019 13:00
17/5/2019 13:00
18/5/2019 13:00
19/5/2019 13:00
20/5/2019 13:00
21/5/2019 13:00
22/5/2019 13:00
23/5/2019 13:00
Date & Time (dd/mm/yy hh:mm)
Omitted Weather
LAMax,15 min
LAeq,15 min
LA10,15 min
LA90, 15 min

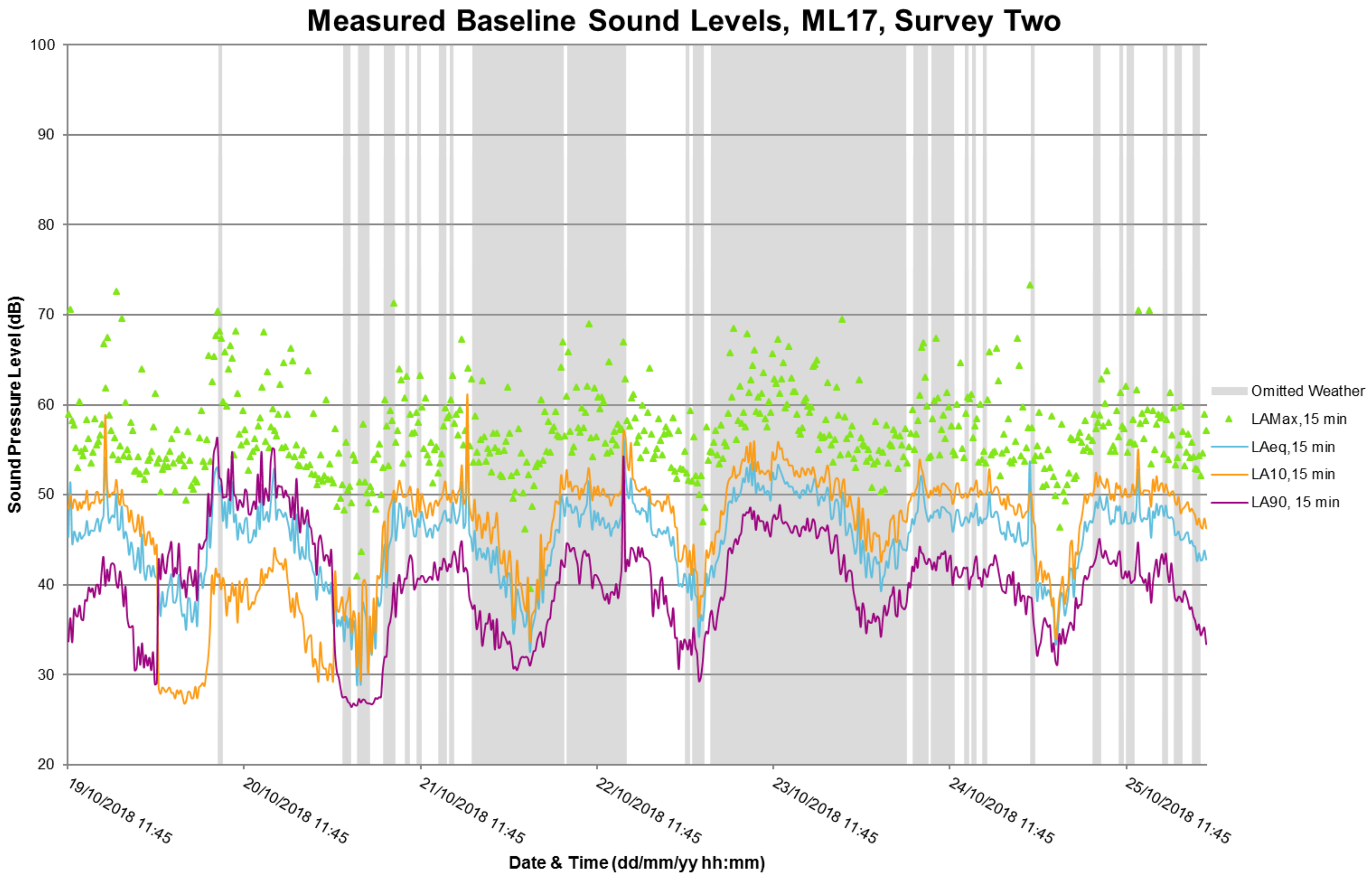

Measured Baseline Sound Levels, ML13
Sound Pressure Level (dB)
100
90
80
70
60
50
40
30
16/4/2019 10:10
17/4/2019 10:10
18/4/2019 10:10
19/4/2019 10:10
20/4/2019 10:10
21/4/2019 10:10
22/4/2019 10:10
23/4/2019 10:10
24/4/2019 10:10
25/4/2019 10:10
26/4/2019 10:10
27/4/2019 10:10
28/4/2019 10:10
29/4/2019 10:10
Date & Time (dd/mm/yy hh:mm)
Omitted Weather
LAMax,15 min
LAeq,15 min
LA10,15 min
LA90, 15 min

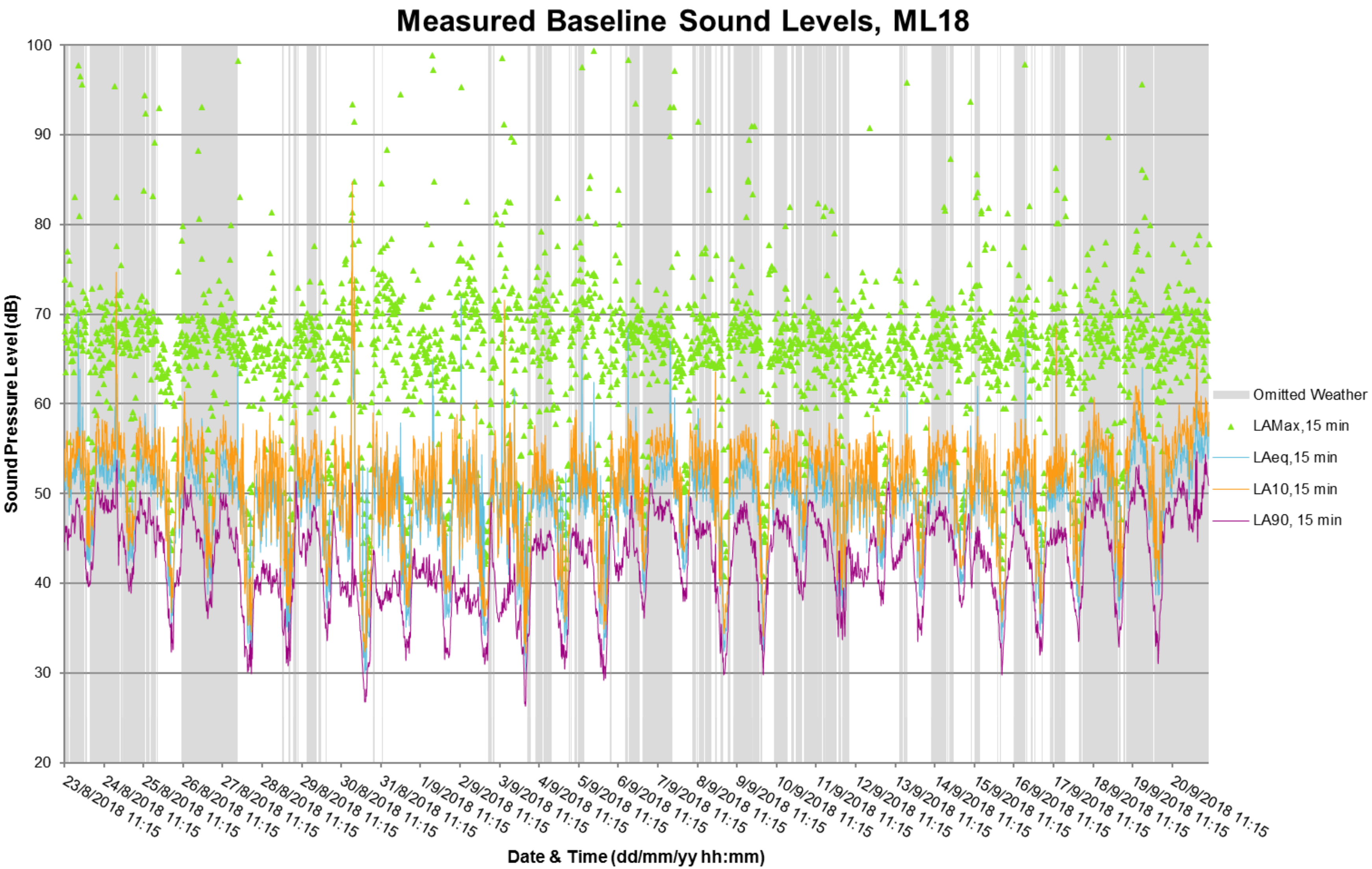

Measured Baseline Sound Levels, ML14
Sound Pressure Level (dB)
110
100
90
80
70
60
50
40
30
16/4/2019 13:15
17/4/2019 13:15
18/4/2019 13:15
19/4/2019 13:15
20/4/2019 13:15
21/4/2019 13:15
22/4/2019 13:15
23/4/2019 13:15
24/4/2019 13:15
25/4/2019 13:15
26/4/2019 13:15
27/4/2019 13:15
28/4/2019 13:15
29/4/2019 13:15
Date & Time (dd/mm/yy hh:mm)
Omitted Weather
LAeq,15 min
LAMax,15 min
LA10,15 min
LA90, 15 min

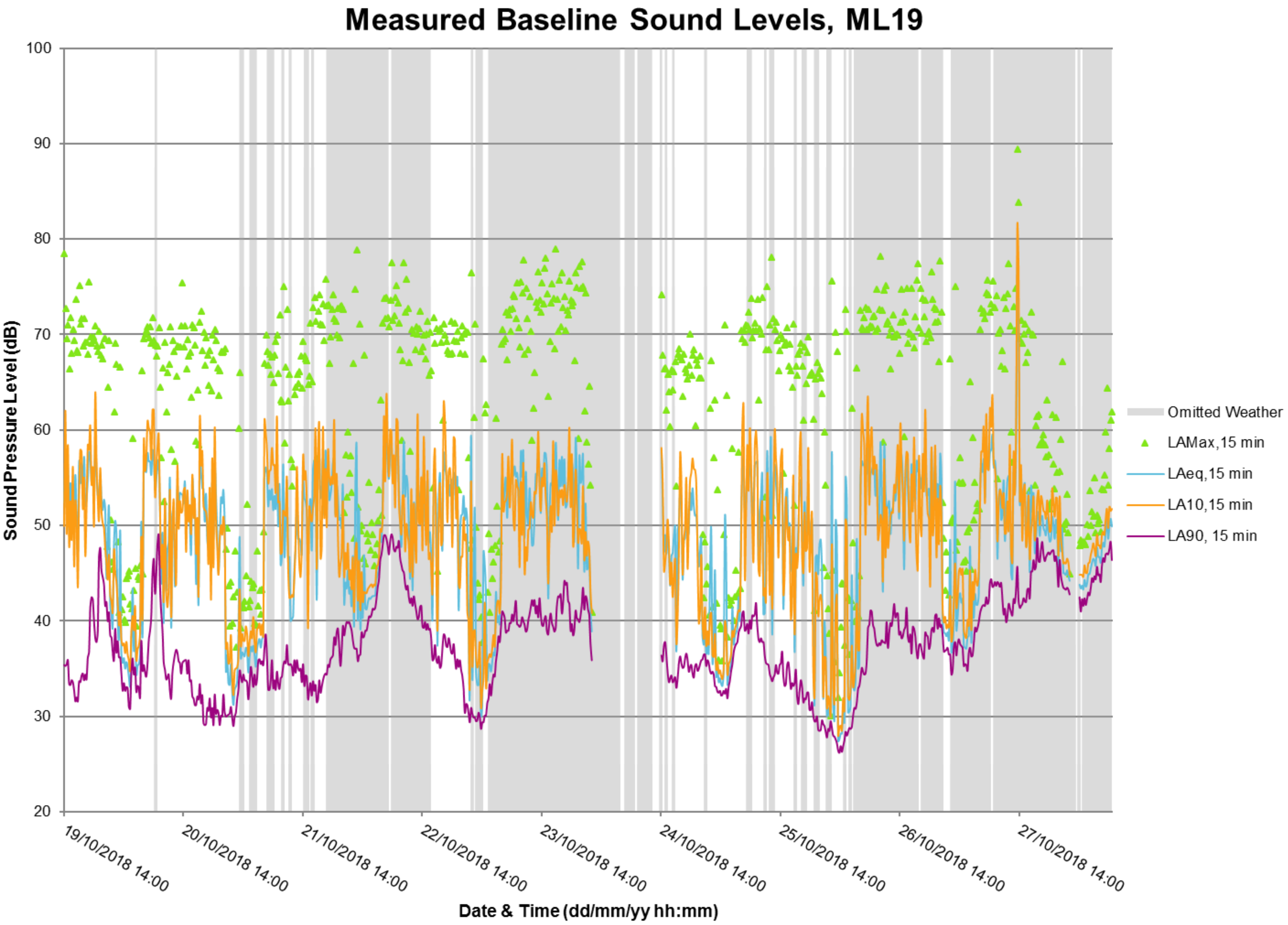

Measured Baseline Sound Levels, ML15
100
90
80
70
60
50
40
30
Sound Pressure Level (dB)
16/4/2019 12:30
17/4/2019 12:30
18/4/2019 12:30
19/4/2019 12:30
20/4/2019 12:30
21/4/2019 12:30
22/4/2019 12:30
23/4/2019 12:30
24/4/2019 12:30
25/4/2019 12:30
26/4/2019 12:30
27/4/2019 12:30
28/4/2019 12:30
29/4/2019 12:30
Date & Time (dd/mm/yy hh:mm)
Omitted Weather
LAMax,15 min
LAeq,15 min
LA10,15 min
LA90, 15 min

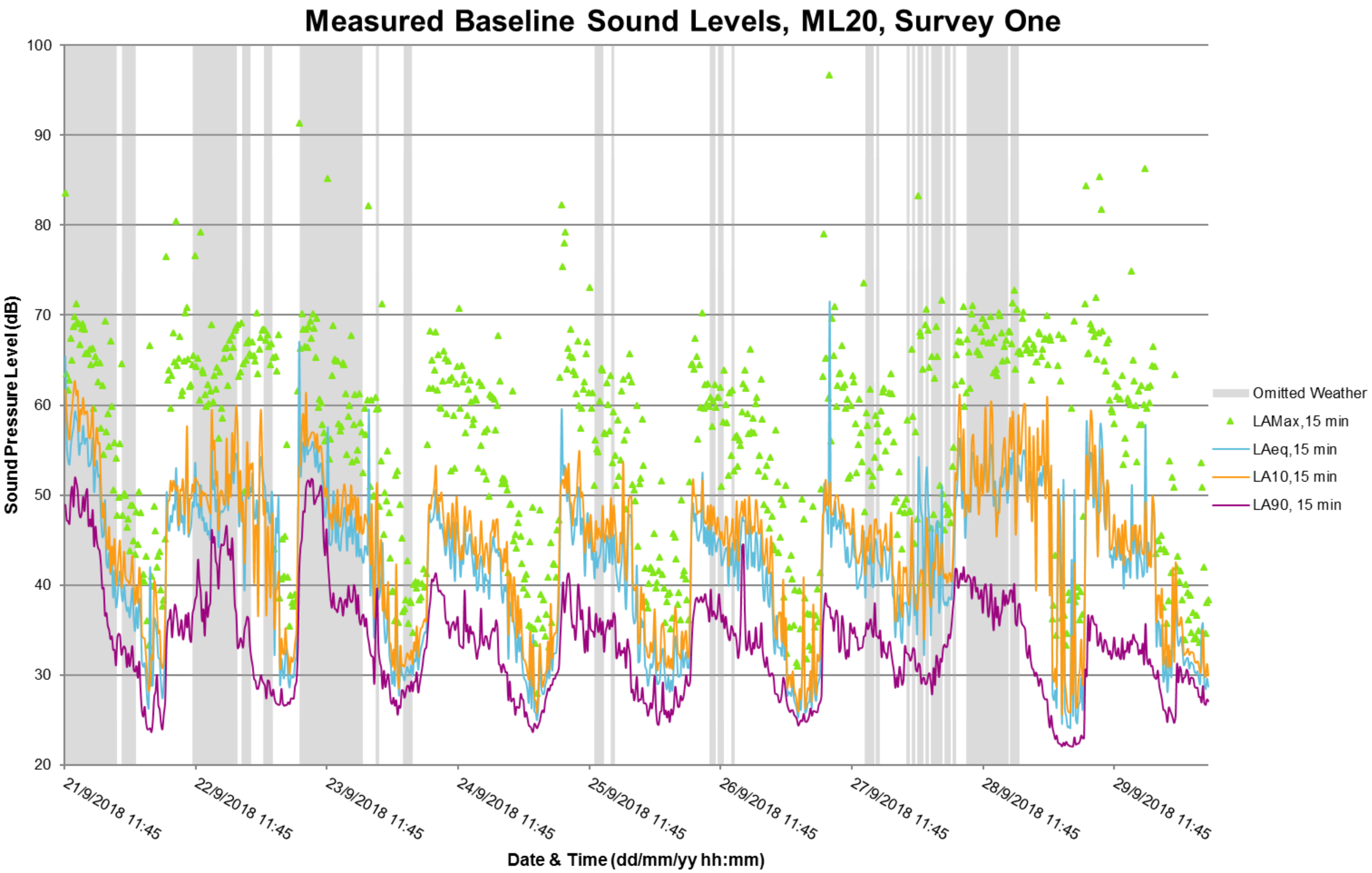

Measured Baseline Sound Levels, ML16
Sound Pressure Level (dB)
100
90
80
70
60
50
40
30
20
10
23/4/2019 13:00
24/4/2019 13:00
25/4/2019 13:00
26/4/2019 13:00
27/4/2019 13:00
28/4/2019 13:00
29/4/2019 13:00
30/4/2019 13:00
1/5/2019 13:00
2/5/2019 13:00
3/5/2019 13:00
4/5/2019 13:00
5/5/2019 13:00
6/5/2019 13:00
7/5/2019 13:00
Date & Time (dd/mm/yy hh:mm)
Omitted Weather
LAMax,15 min
LAeq,15 min
LA10,15 min
LA90, 15 min

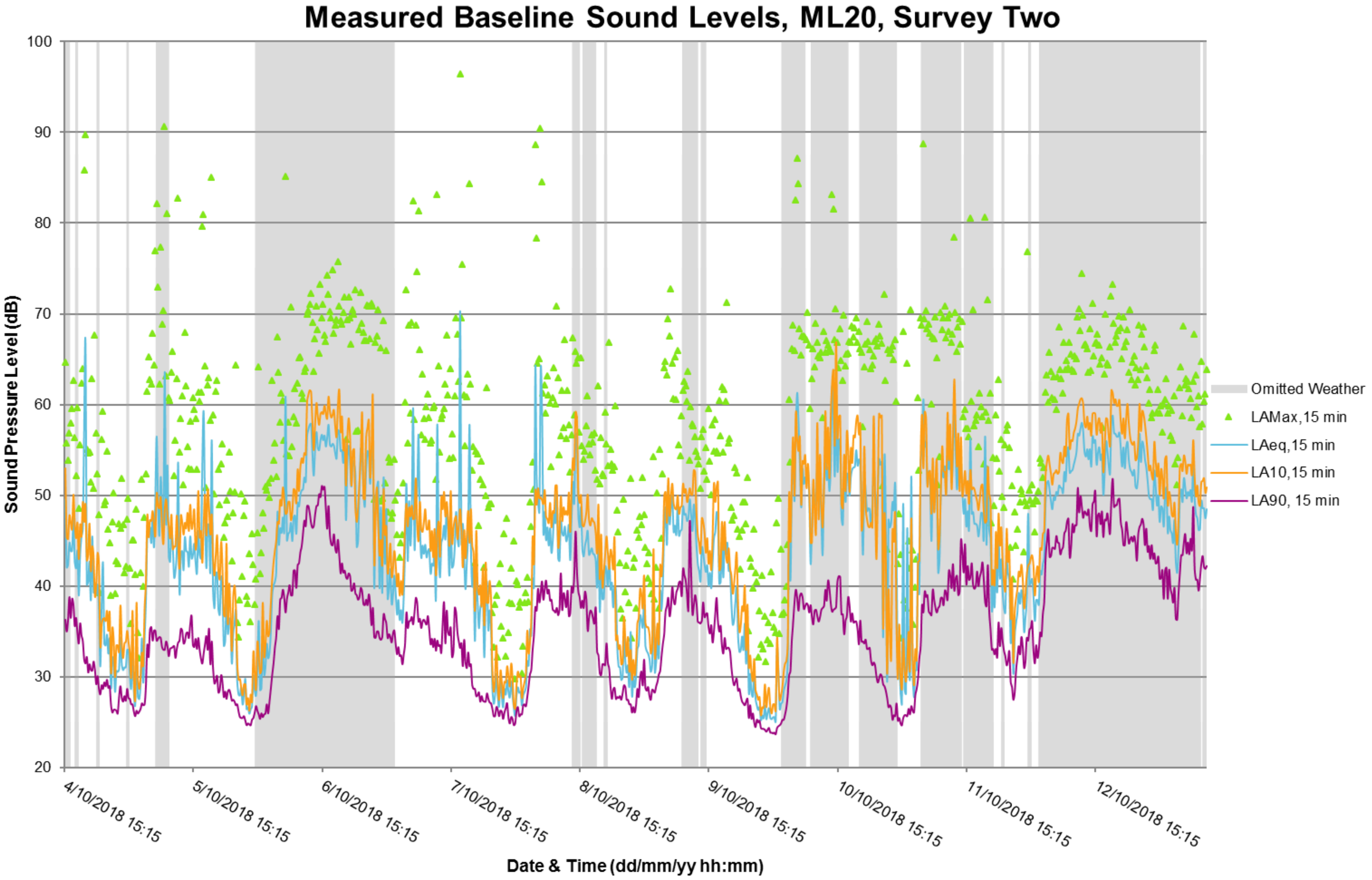

Measured Baseline Sound Levels, ML17, Survey One
100
90
80
70
60
50
40
30
20
Sound Pressure Level (dB)
4/10/2018 17:00
5/10/2018 17:00
6/10/2018 17:00
7/10/2018 17:00
8/10/2018 17:00
9/10/2018 17:00
10/10/2018 17:00
11/10/2018 17:00
Date & Time (dd/mm/yy hh:mm)
Omitted Weather
LAMax,15 min
LAeq,15 min
LA10,15 min
LA90, 15 min

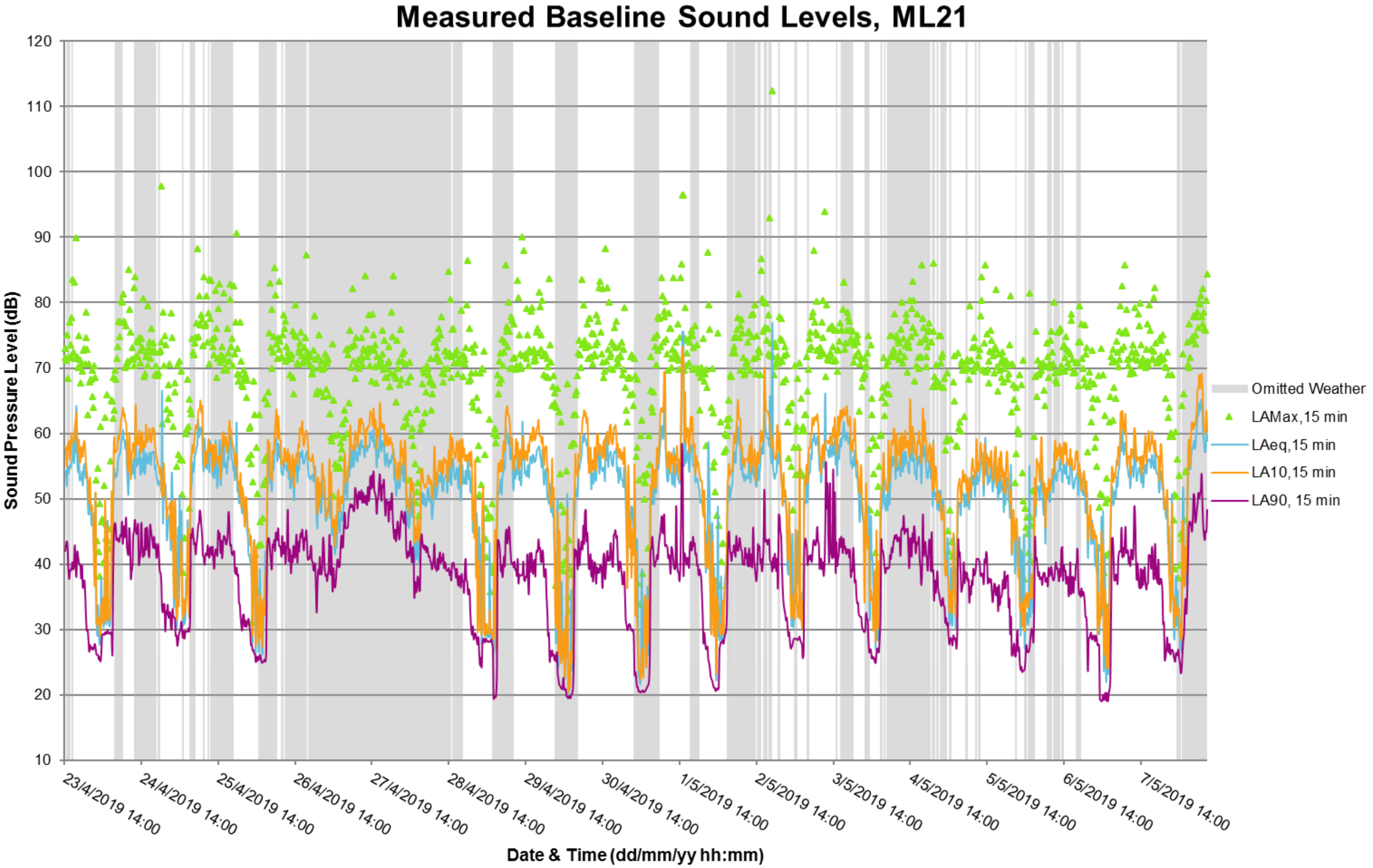

Measured Baseline Sound Levels, ML17, Survey Two
Sound Pressure Level (dB)
100
90
80
70
60
50
40
30
20
19/10/2018 11:45
20/10/2018 11:45
21/10/2018 11:45
22/10/2018 11:45
23/10/2018 11:45
24/10/2018 11:45
25/10/2018 11:45
Date & Time (dd/mm/yy hh:mm)
Omitted Weather
LAMax,15 min
LAeq,15 min
LA10,15 min
LA90, 15 min

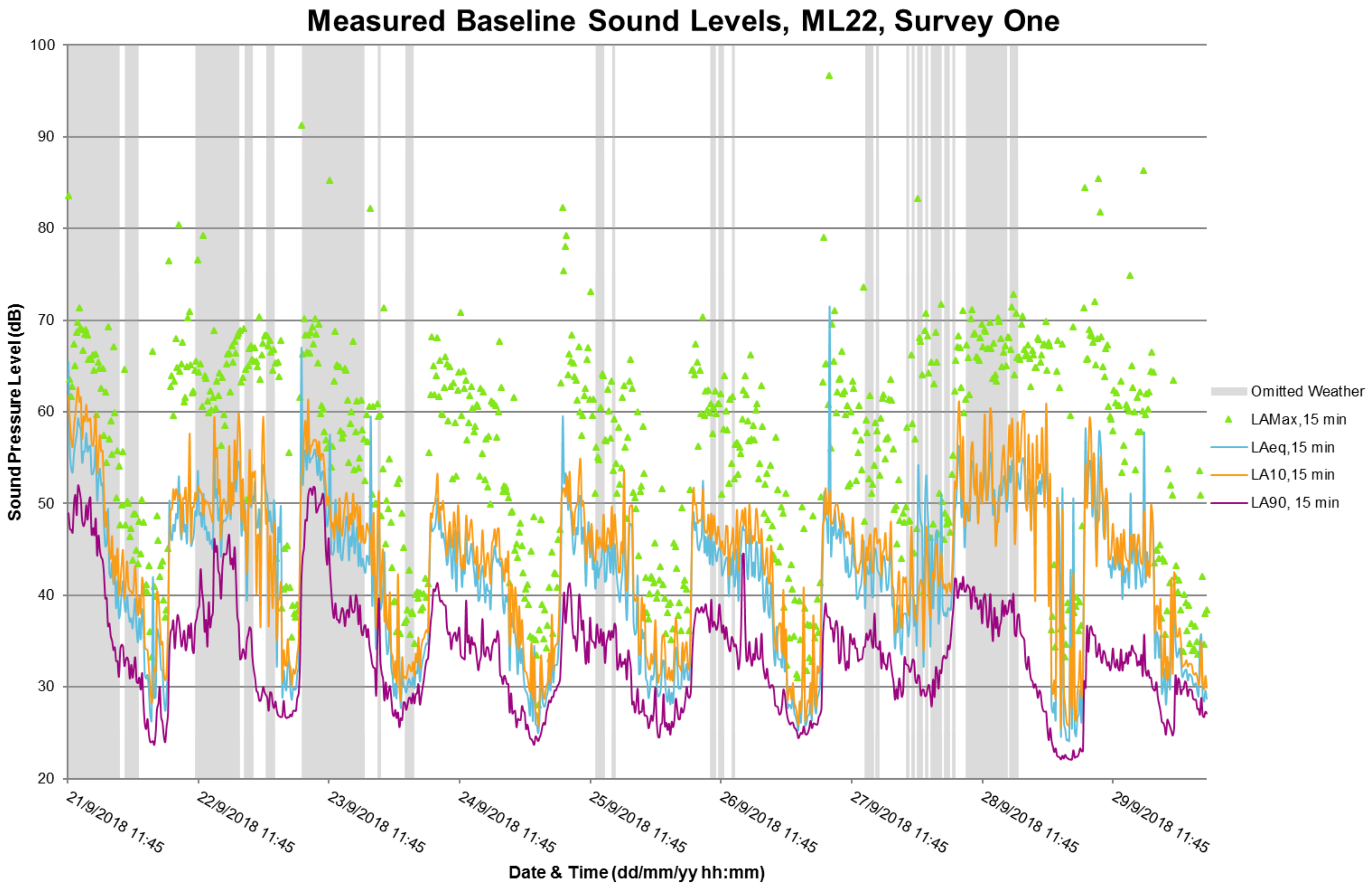

Measured Baseline Sound Levels, ML18
Sound Pressure Level (dB)
100
90
80
70
60
50
40
30
20
23/8/2018 11:15
24/8/2018 11:15
25/8/2018 11:15
26/8/2018 11:15
27/8/2018 11:15
28/8/2018 11:15
29/8/2018 11:15
30/8/2018 11:15
31/8/2018 11:15
1/9/2018 11:15
2/9/2018 11:15
3/9/2018 11:15
4/9/2018 11:15
5/9/2018 11:15
6/9/2018 11:15
7/9/2018 11:15
8/9/2018 11:15
9/9/2018 11:15
10/9/2018 11:15
11/9/2018 11:15
12/9/2018 11:15
13/9/2018 11:15
14/9/2018 11:15
15/9/2018 11:15
16/9/2018 11:15
17/9/2018 11:15
18/9/2018 11:15
19/9/2018 11:15
20/9/2018 11:15
Date & Time (dd/mm/yy hh:mm)
Omitted Weather
LAMax,15 min
LAeq,15 min
LA10,15 min
LA90, 15 min

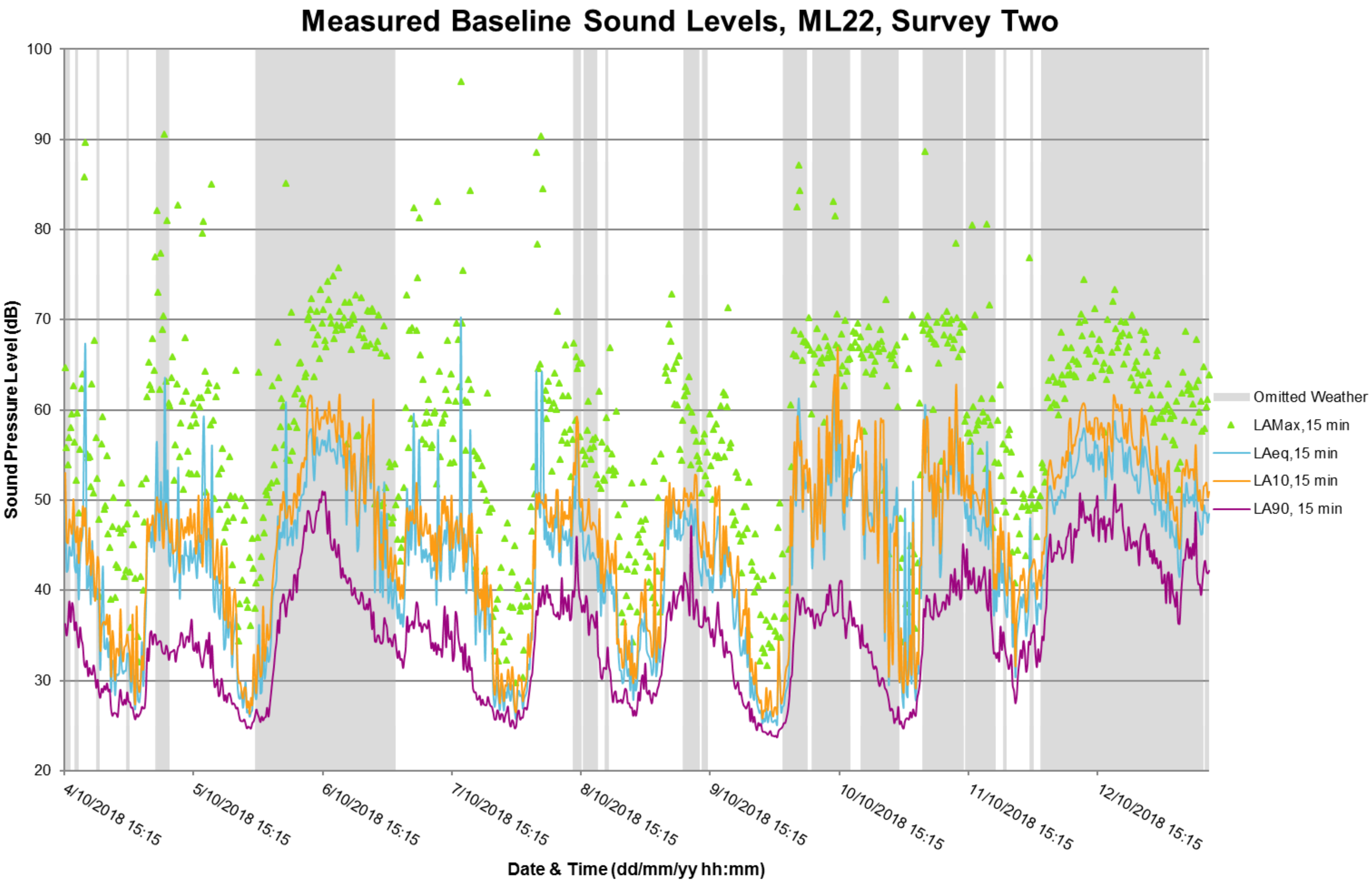

Measured Baseline Sound Levels, ML19
Sound Pressure Level (dB)
100
90
80
70
60
50
40
30
20
19/10/2018 14:00
20/10/2018 14:00
21/10/2018 14:00
22/10/2018 14:00
23/10/2018 14:00
24/10/2018 14:00
25/10/2018 14:00
26/10/2018 14:00
27/10/2018 14:00
Date & Time (dd/mm/yy hh:mm)
Omitted Weather
LAMax,15 min
LAeq,15 min
LA10,15 min
LA90, 15 min

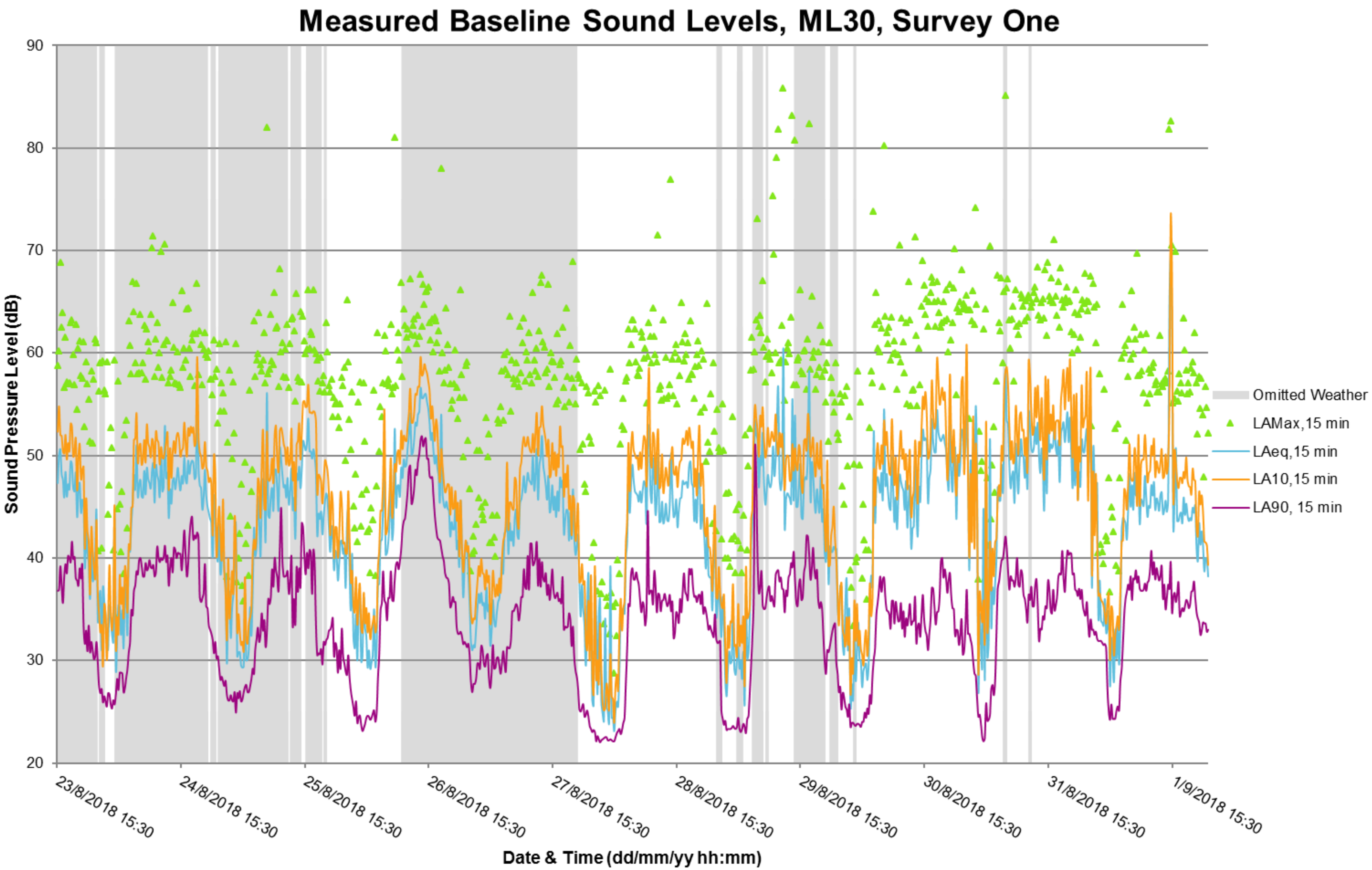

Measured Baseline Sound Levels, ML20, Survey One
Sound Pressure Level (dB)
100
90
80
70
60
50
40
30
20
21/9/2018 11:45
22/9/2018 11:45
23/9/2018 11:45
24/9/2018 11:45
25/9/2018 11:45
26/9/2018 11:45
27/9/2018 11:45
28/9/2018 11:45
29/9/2018 11:45
Date & Time (dd/mm/yy hh:mm)
Omitted Weather
LAMax,15 min
LAeq,15 min
LA10,15 min
LA90, 15 min

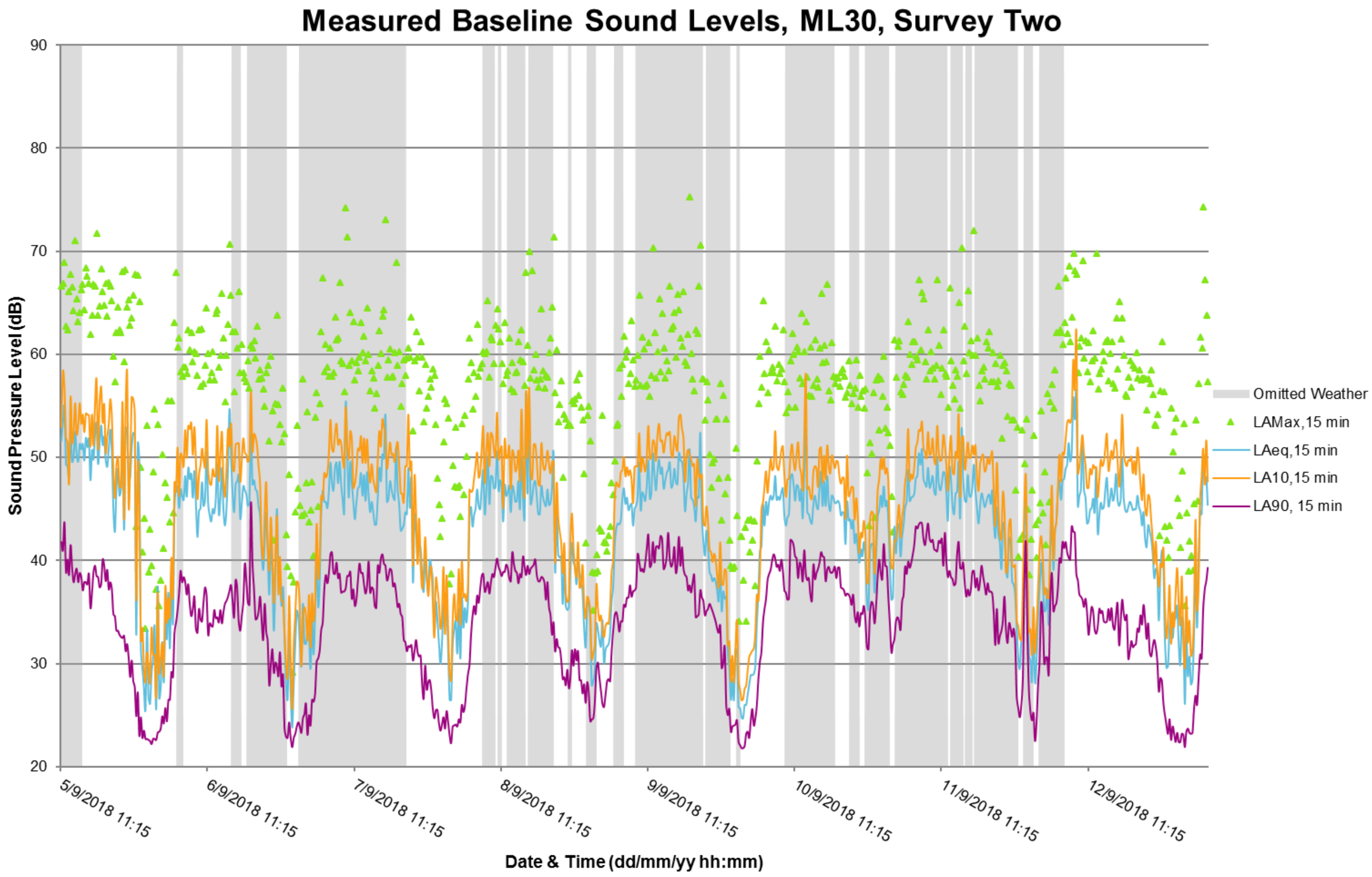

Measured Baseline Sound Levels, ML20, Survey Two
Sound Pressure Level (dB)
100
90
80
70
60
50
40
30
20
4/10/2018 15:15
5/10/2018 15:15
6/10/2018 15:15
7/10/2018 15:15
8/10/2018 15:15
9/10/2018 15:15
10/10/2018 15:15
11/10/2018 15:15
12/10/2018 15:15
Date & Time (dd/mm/yy hh:mm)
Omitted Weather
LAMax,15 min
LAeq,15 min
LA10,15 min
LA90, 15 min

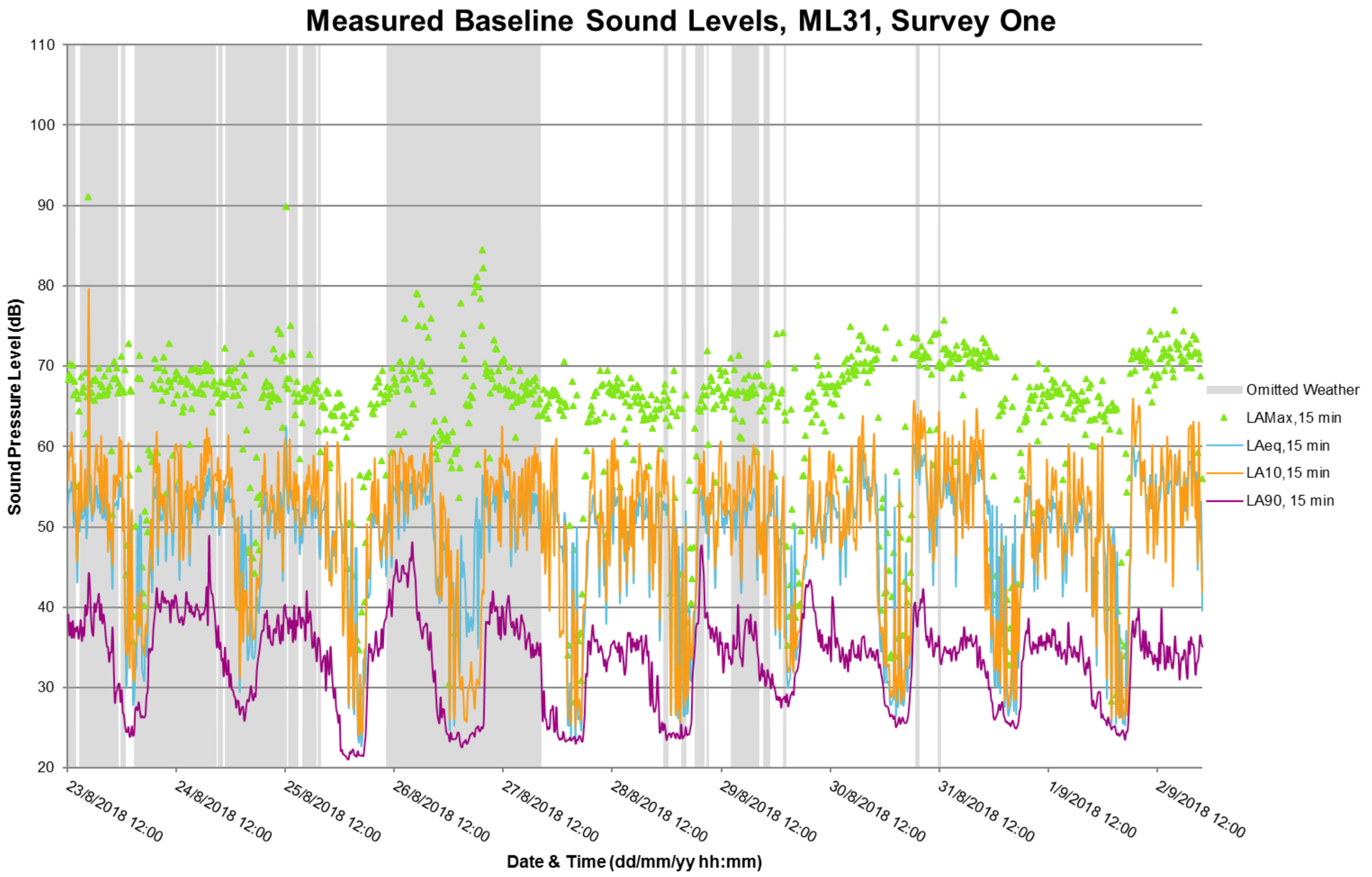

Measured Baseline Sound Levels, ML21
120
110
100
90
80
70
60
50
40
30
20
10
Sound Pressure Level (dB)
23/4/2019 14:00
24/4/2019 14:00
25/4/2019 14:00
26/4/2019 14:00
27/4/2019 14:00
28/4/2019 14:00
29/4/2019 14:00
30/4/2019 14:00
1/5/2019 14:00
2/5/2019 14:00
3/5/2019 14:00
4/5/2019 14:00
5/5/2019 14:00
6/5/2019 14:00
7/5/2019 14:00
Date & Time (dd/mm/yy hh:mm)
Omitted Weather
LAMax,15 min
LAeq,15 min
LA10,15 min
LA90, 15 min

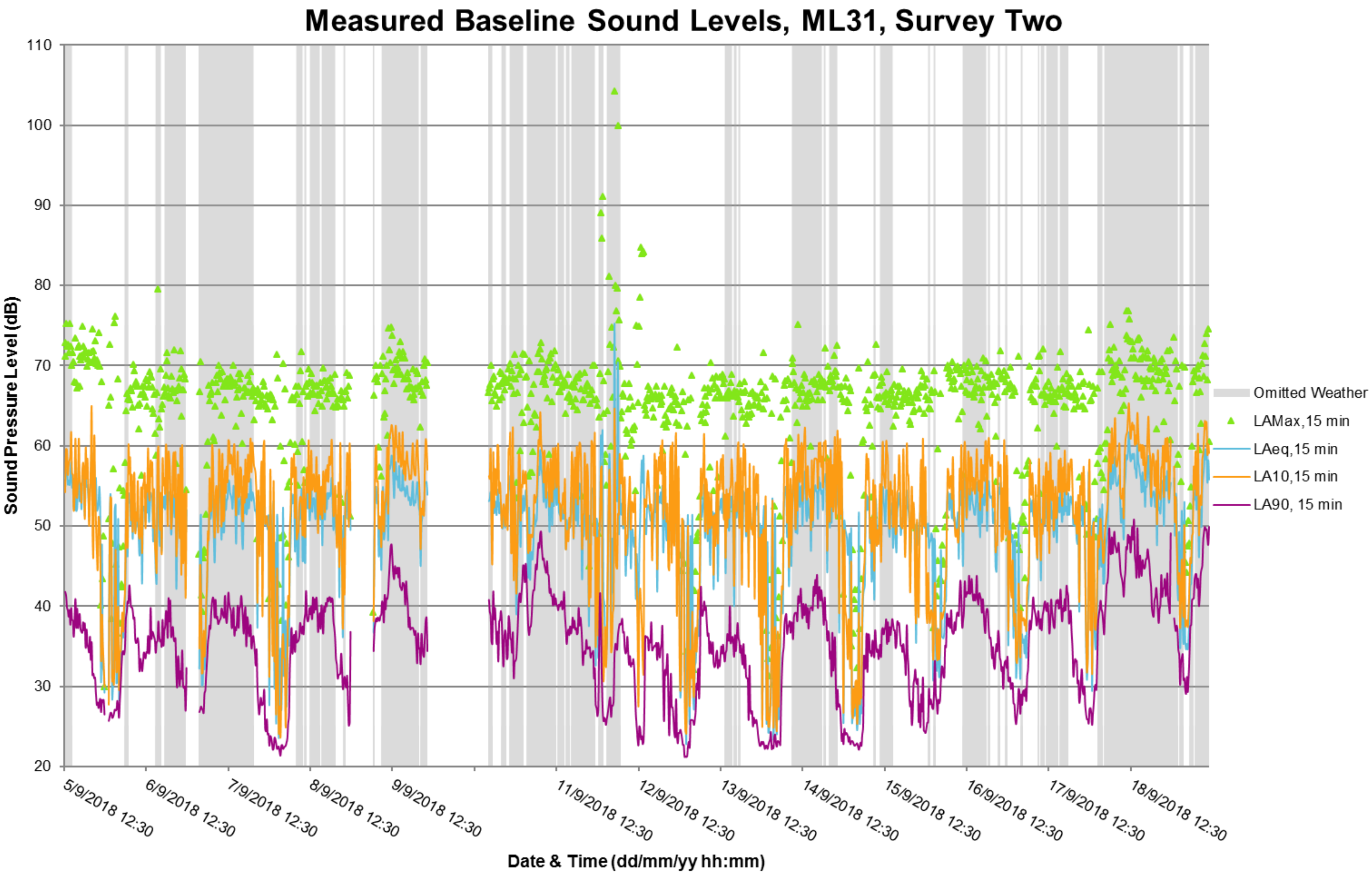

Measured Baseline Sound Levels, ML22, Survey One
Sound Pressure Level (dB)
100
90
80
70
60
50
40
30
20
21/9/2018 11:45
22/9/2018 11:45
23/9/2018 11:45
24/9/2018 11:45
25/9/2018 11:45
26/9/2018 11:45
27/9/2018 11:45
28/9/2018 11:45
29/9/2018 11:45
Date & Time (dd/mm/yy hh:mm)
Omitted Weather
LAMax,15 min
LAeq,15 min
LA10,15 min
LA90, 15 min

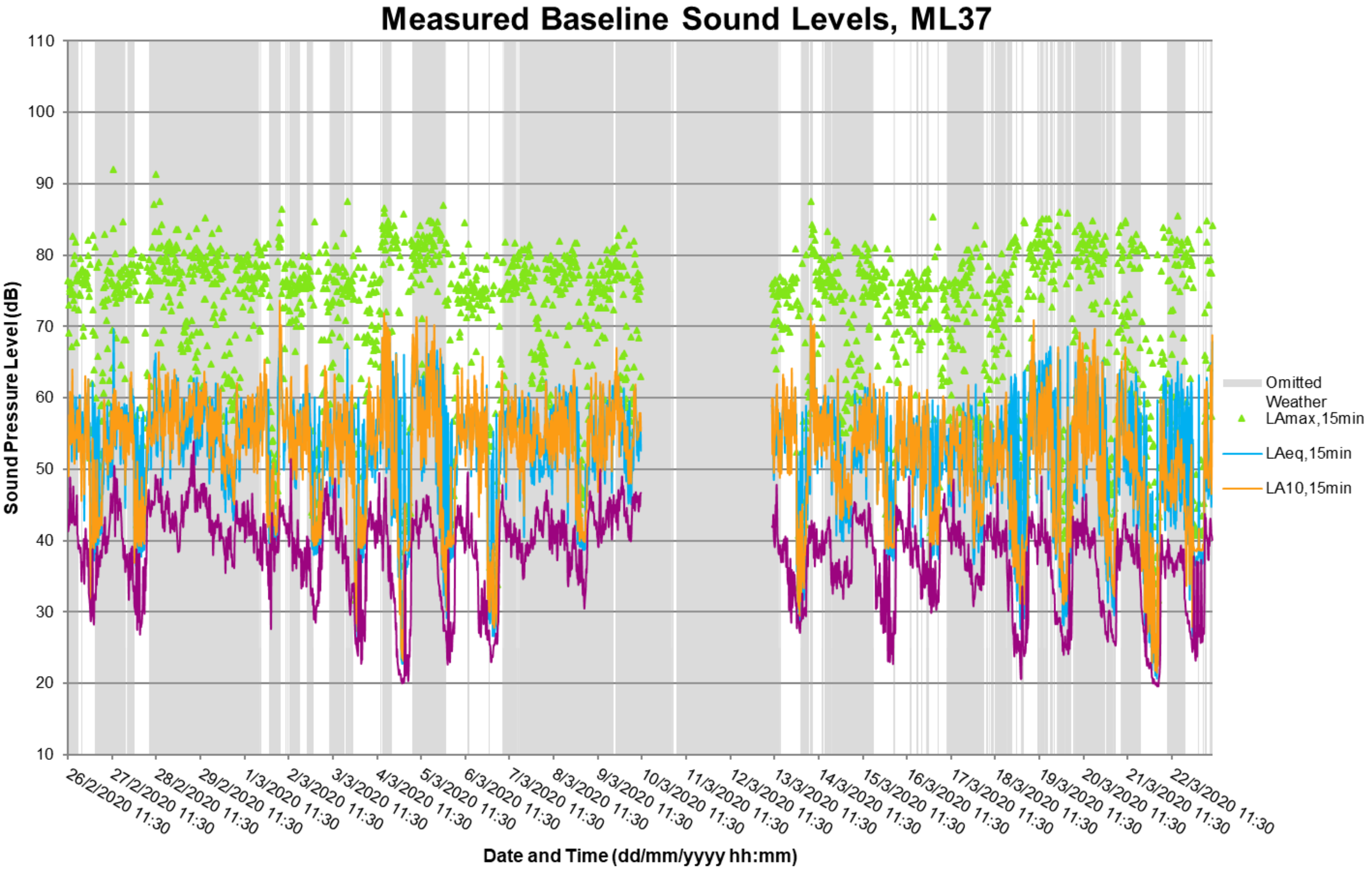

Measured Baseline Sound Levels, ML22, Survey Two
Sound Pressure Level (dB)
100
90
80
70
60
50
40
30
20
4/10/2018 15:15
5/10/2018 15:15
6/10/2018 15:15
7/10/2018 15:15
8/10/2018 15:15
9/10/2018 15:15
10/10/2018 15:15
11/10/2018 15:15
12/10/2018 15:15
Date & Time (dd/mm/yy hh:mm)
Omitted Weather
LAMax,15 min
LAeq,15 min
LA10,15 min
LA90, 15 min


Measured Baseline Sound Levels, ML30, Survey One
Sound Pressure Level (dB)
90
80
70
60
50
40
30
20
23/8/2018 15:30
24/8/2018 15:30
25/8/2018 15:30
26/8/2018 15:30
27/8/2018 15:30
28/8/2018 15:30
29/8/2018 15:30
30/8/2018 15:30
31/8/2018 15:30
1/9/2018 15:30
Date & Time (dd/mm/yy hh:mm)
Omitted Weather
LAMax,15 min
LAeq,15 min
LA10,15 min
LA90, 15 min


Measured Baseline Sound Levels, ML30, Survey Two
Sound Pressure Level (dB)
90
80
70
60
50
40
30
20
5/9/2018 11:15
6/9/2018 11:15
7/9/2018 11:15
8/9/2018 11:15
9/9/2018 11:15
10/9/2018 11:15
11/9/2018 11:15
12/9/2018 11:15
Date & Time (dd/mm/yy hh:mm)
Omitted Weather
LAMax,15 min
LAeq,15 min
LA10,15 min
LA90, 15 min


Measured Baseline Sound Levels, ML31, Survey One
110
100
90
80
70
60
50
40
30
20
Sound Pressure Level (dB)
23/8/2018 12:00
24/8/2018 12:00
25/8/2018 12:00
26/8/2018 12:00
27/8/2018 12:00
28/8/2018 12:00
29/8/2018 12:00
30/8/2018 12:00
31/8/2018 12:00
1/9/2018 12:00
2/9/2018 12:00
Date & Time (dd/mm/yy hh:mm)
Omitted Weather
LAMax,15 min
LAeq,15 min
LA10,15 min
LA90, 15 min


Measured Baseline Sound Levels, ML31, Survey Two
Sound Pressure Level (dB)
110
100
90
80
70
60
50
40
30
20
5/9/2018 12:30
6/9/2018 12:30
7/9/2018 12:30
8/9/2018 12:30
9/9/2018 12:30
11/9/2018 12:30
12/9/2018 12:30
13/9/2018 12:30
14/9/2018 12:30
15/9/2018 12:30
16/9/2018 12:30
17/9/2018 12:30
18/9/2018 12:30
Date & Time (dd/mm/yy hh:mm)
Omitted Weather
LAMax,15 min
LAeq,15 min
LA10,15 min
LA90, 15 min


Measured Baseline Sound Levels, ML37
Sound Pressure Level (dB)
110
100
90
80
70
60
50
40
30
20
10
26/2/2020 11:30
27/2/2020 11:30
28/2/2020 11:30
29/2/2020 11:30
1/3/2020 11:30
2/3/2020 11:30
3/3/2020 11:30
4/3/2020 11:30
5/3/2020 11:30
6/3/2020 11:30
7/3/2020 11:30
8/3/2020 11:30
9/3/2020 11:30
10/3/2020 11:30
11/3/2020 11:30
12/3/2020 11:30
13/3/2020 11:30
14/3/2020 11:30
15/3/2020 11:30
16/3/2020 11:30
17/3/2020 11:30
18/3/2020 11:30
19/3/2020 11:30
20/3/2020 11:30
21/3/2020 11:30
22/3/2020 11:30
Date and Time (dd/mm/yyyy hh:mm)
Omitted Weather
LAmax,15min
LAeq,15min
LA10,15min

5 CONSTRUCTION/-EARTHWORKS NOISE AND VIBRATION ASSESSMENT

5.1 Introduction

5.1.1 Due to the proximity of sensitive receptors to some parts of the Main Application Site, temporary significant effects may occur at sensitive receptors during the construction and earthworks programme. The assessment of noise and vibration considers the following:

a. Direct effects due to construction and earthworks noise emissions from on-site activities;

b. Direct effects due to construction and earthworks vibration emissions from on-site activities; and

c. Indirect effects due to changes in road traffic noise due to construction and earthworks traffic on the local road network.

5.2 Construction/-Earthworks Noise

Construction and Earthworks Noise Assessment Criteria

5.2.1 The method for assessing construction and earthworks noise effects is defined based on the current industry standard approach. Criteria for assessing construction and earthworks noise effects are presented in Table 5.1 and is defined in BS 5228-1 (Ref. 6). Category A criteria in the ABC method are interpreted as LOAEL and Category C criteria are considered equivalent to SOAEL (Significant Observed Adverse Effect Level). The UAEL (Unacceptable Adverse Effect Level) for construction and earthworks noise is based on the trigger level for temporary rehousing as set out in section E.4 of BS 5228-1. The LOAEL and SOAEL for construction and earthworks noise are defined in DMRB (Design Manual for Roads and Bridges) and, although there is currently a lack of evidence relating to health effects due to construction and earthworks noise, this approach has been accepted as appropriate in other consented major schemes[1].

[1] For example, High Speed 2, A14 Cambridge to Huntingdon, Thames Tideway and Manston Airport

Table 5.1: Thresholds of potential effects of construction and earthworks noise at residential buildings

Time Period	Threshold Value ($L_{Aeq,T}$dB)		
	LOAEL	SOAEL	UAEL
Day (07:00 – 19:00) Saturday (07:00 – 13:00)	65	75	85
Evening (19.00 – 23.00) Weekends (13.00–23.00 Saturdays and 07.00–23.00 Sundays)	55	65	75
Night (23.00 – 07.00)	45	55	65
a) These effects are expected to occur if the programme of works indicates that the relevant threshold values are likely to be exceeded over a period of at least one month. The values apply to a location one metre from a residential building façade containing a window, ignoring the effect of the acoustic reflection from that façade.			

Construction/~~-~~Earthworks Noise Calculation Methodology

5.2.2 To assess potential noise effects due to construction and earthworks works, the programme has been broken down into key periods of activity, as presented in Table 5.2. These key periods are considered to represent reasonable worst-case periods of construction and earthworks activities that are likely to generate the highest noise levels during the programme of works.

Table 5.2: Periods of Representative Worst-Case Activities

Stage	Year	Works	Activity
1-1	2025	Wigmore Valley Park works Construction of P6 and P7 car parks Terminal 1 enhancements New stand for temporary engine run-up bay 33kV Substation	Earthworks Car Parks Landside Buildings Airfield Extension Substation
1-2	2026	P5 car park reduced Construction of P6 and P7 car parks Reconfiguring of P9 car park Terminal 1 enhancements New stands NCP Warehouse Terminal1 South Pier	Demolition Car Parks Car Parks Landside Buildings Airfield Extension Landside Buildings Landside Building
1-3	2027	Completion of airfield works	Airfield Extension
2-1	2032	Earthworks Airport ~~a~~Access ~~r~~Road – east section works P1 and P2 car park construction Terminal 2 construction	Earthworks Road works Car Parks Terminal 2

Stage	Year	Works	Activity
2-2	2033	Earthworks Airport ~~a~~Access ~~r~~Road – east section works Airport ~~a~~Access ~~r~~Road – west section works P1 car park construction Terminal 2 construction Luton DART extension	Earthworks Road works Road works Car Parks Bored Piling Luton DART
2-3	2034	Airport ~~a~~Access ~~r~~Road – east section works Airport ~~a~~Access ~~r~~Road – west section works P10 and P11 car park construction Luton DART extension Terminal 2 and west pier construction ETP/STP/Fuel Farm construction Apron and stands construction Alpha taxiway realignment	Road works Road works Car Parks Sheet Piling Terminal 2 Utilities Airfield Extension Airfield Extension
2-4	2035	Landside buildings Terminal 2 and west pier construction Luton DART extension ETP/STP/Fuel Farm Construction Apron and stands construction Alpha taxiway realignment P6 and P7 car park reconfiguration	Landside Buildings Terminal 2 Sheet Piling Utilities Airfield Extension Airfield Extension Car Parks
3-1	2037	Earthworks Fire training ground move	Earthworks Landside Buildings
3-2	2038	Earthworks Terminal 2 extension Airport ~~a~~Access road	Earthworks Terminal 2 Road works
3-3	2039	Airfield works Terminal 2 extension East pier P10 and P11 car park reconfiguration New-century Park buildings P12 car park construction	Airfield Extension Terminal 2 Landside Buildings Car Parks Landside Buildings Car Parks
3-4	2040	Airfield works P10 and P11 car park reconfiguration New-century Park buildings P12 car park construction	Airfield Extension Car Parks Landside Buildings Car Park

5.2.3 For the purposes of assessing noise from construction and earthworks activities, sound power level (Lw) data for representative plant to be used have been sourced from BS 5228-1:2009+A1:2014. Noise predictions of construction activities have been undertaken using Cadna-A noise modelling software.

Cadna-A applies methodologies within BS 5228-1:2009+A1:2014 to predict construction noise.

5.2.4 The calculation method provided in BS 5228-1:2009+A1:2014 is based on the number and type of equipment operating, their associated Sound Power Level, and the distance to sensitive receptors. Sound power data for representative construction plant for each type of activity that have been applied in noise predictions are presented in Table 5.3.

5.2.5 Predicted total A-weighted sound power levels for construction sound sources are presented in Table 5.4**.** Activities are modelled as area sources which demonstrate distributed plants in designated areas. The height of the sources is considered as 1.5 meters except for pilling which is assumed as 4 meters.

Table 5.3: Activity Plant Lists and Sound Power Levels

Activity	Plant	No.	% on-time	Unweighted Octave Band Sound Power Level [LwdB]								Overall Sound Power Level [LwAdB]	Reference
				63	125	250	500	1k	2k	4k	8k		
Utilities	360-hydraulic excavators (20T)	2	75	113	106	105	105	101	99	96	91	107	BS 5228: Tab C.2 #14
	360-hydraulic long reach excavators	2	75	103	104	100	96	93	91	85	77	99	BS 5228: Tab C.2 #21
	Rigid Heavy Goods Vehicles (HGV)	6	75	101	106	106	106	102	101	96	94	108	BS 5228: Tab C.2 #34
	Dumper (9T)	6	75	113	115	105	103	104	101	97	90	109	BS 5228: Tab C.2 #33
	GPS Bulldozer	2	75	111	109	104	105	110	98	93	86	111	BS 5228: Tab C.5 #15
	Soil stabiliser	1	75	108	104	108	107	107	104	98	90	111	Overall A-weighted sound power level from manufacturer. Spectrum from BS 5228: Tab C.1 #10
	Roller	2	75	110	106	95	99	95	92	88	85	101	BS 5228: Tab C.2 #40
	Compressors	4	75	112	101	92	87	85	83	86	75	93	BS 5228: Tab C.5 #5
	Telehandler Forklift	2	75	113	107	97	95	92	90	84	75	99	BS 5228: Tab C.2 #35
	General waste skips	2	75	116	110	102	102	102	101	98	95	107	BS 5228: Tab C.8 #20
	360-hydraulic excavators (40T)	2	75	105	114	108	104	100	98	94	91	107	Overall A-weighted sound power level from manufacturer. Spectrum from BS 5228: Tab C.2 #2
Earthworks	360-hydraulic excavators (20T)	2	75	113	106	105	105	101	99	96	91	107	BS 5228: Tab C.2 #14
	360-hydraulic excavators (40T)	2	75	105	114	108	104	100	98	94	91	107	Overall A-weighted sound power level from manufacturer. Spectrum from BS 5228: Tab C.2 #2
	Rigid Heavy Goods Vehicles (HGV)	4	75	101	106	106	106	102	101	96	94	108	BS 5228: Tab C.2 #34
	All terrain articulated dumper (40T)	10	75	113	115	105	103	104	101	97	90	109	BS 5228: Tab C.2 #33
	GPS Bulldozer	4	75	111	109	104	105	110	98	93	86	111	BS 5228: Tab C.5 #15
	Soil stabiliser	1	75	108	104	108	107	107	104	98	90	111	Overall A-weighted sound power level from manufacturer. Spectrum from BS 5228: Tab C.1 #10
	Roller	2	75	110	106	95	99	95	92	88	85	101	BS 5228: Tab C.2 #40

Activity	Plant	No.	% on-time	Unweighted Octave Band Sound Power Level [LwdB]								Overall Sound Power Level [LwAdB]	Reference
				63	125	250	500	1k	2k	4k	8k		
Airfield extension	360-hydraulic excavators (20T)	2	75	113	106	105	105	101	99	96	91	107	BS 5228: Tab C.2 #14
	Rigid Heavy Goods Vehicles (HGV)	4	75	101	106	106	106	102	101	96	94	108	BS 5228: Tab C.2 #34
	All terrain articulated dumper (40T)	4	75	113	115	105	103	104	101	97	90	109	BS 5228: Tab C.2 #33
	Roller	1	75	110	106	95	99	95	92	88	85	101	BS 5228: Tab C.2 #40
	Compressors	2	75	112	101	92	87	85	83	86	75	93	BS 5228: Tab C.5 #5
	Concrete Paving Machine	1	75	100	105	102	100	99	98	95	88	105	BS 5228: Tab C.5 #31
	Telehandler Forklift	2	75	113	107	97	95	92	90	84	75	99	BS 5228: Tab C.2 #35
	Concrete mixer truck	4	75	108	97	94	98	99	97	92	86	103	BS 5228: Tab C.4 #18
	General waste skips	2	75	116	110	102	102	102	101	98	95	107	BS 5228: Tab C.8 #20
Drainage	360-hydraulic excavators (20T)	2	75	113	106	105	105	101	99	96	91	107	BS 5228: Tab C.2 #14
	Rigid Heavy Goods Vehicles (HGV)	4	75	101	106	106	106	102	101	96	94	108	BS 5228: Tab C.2 #34
	All terrain articulated dumper (40T)	4	75	113	115	105	103	104	101	97	90	109	BS 5228: Tab C.2 #33
	Compressors	4	75	112	101	92	87	85	83	86	75	93	BS 5228: Tab C.5 #5
	Telehandler Forklift	2	75	113	107	97	95	92	90	84	75	99	BS 5228: Tab C.2 #35
	Concrete mixer truck	2	75	108	97	94	98	99	97	92	86	103	BS 5228: Tab C.4 #18
	Mobile Cranes (100T)	1	75	110	105	108	104	94	94	84	78	104	BS 5228: Tab C.4 #48
	General waste skips	2	75	116	110	102	102	102	101	98	95	107	BS 5228: Tab C.8 #20
Demolition	360-hydraulic long reach excavators	2	75	103	104	100	96	93	91	85	77	99	BS 5228: Tab C.2 #21
	Crusher	1	75	119	119	116	115	113	111	106	96	118	BS 5228: Tab C.9 #14
	Rigid Heavy Goods Vehicles (HGV)	4	75	101	106	106	106	102	101	96	94	108	BS 5228: Tab C.2 #34
	Compressors	2	75	112	101	92	87	85	83	86	75	93	BS 5228: Tab C.5 #5
	Telehandler Forklift	2	75	113	107	97	95	92	90	84	75	99	BS 5228: Tab C.2 #35
	General waste skips	2	75	116	110	102	102	102	101	98	95	107	BS 5228: Tab C.8 #20
	Access equipment (cherry pickers / MEWPs)	2	75	113	107	97	95	92	90	84	75	99	BS 5228: Tab C.2 #35
Road Works	360-hydraulic excavators (20T)	3	75	113	106	105	105	101	99	96	91	107	BS 5228: Tab C.2 #14

Activity	Plant	No.	% on-time	Unweighted Octave Band Sound Power Level [LwdB]								Overall Sound Power Level [LwAdB]	Reference
				63	125	250	500	1k	2k	4k	8k		
	Rigid Heavy Goods Vehicles (HGV)	4	75	101	106	106	106	102	101	96	94	108	BS 5228: Tab C.2 #34
	All terrain articulated dumper (40T)	5	75	113	115	105	103	104	101	97	90	109	BS 5228: Tab C.2 #33
	Dumper (9T)	4	75	113	115	105	103	104	101	97	90	109	BS 5228: Tab C.2 #33
	GPS Bulldozer	1	75	111	109	104	105	110	98	93	86	111	BS 5228: Tab C.5 #15
	Roller	1	75	110	106	95	99	95	92	88	85	101	BS 5228: Tab C.2 #40
	Compressors	4	75	112	101	92	87	85	83	86	75	93	BS 5228: Tab C.5 #5
	Asphalt paving machine	1	75	100	105	102	100	99	98	95	88	105	BS 5228: Tab C.5 #31
	Telehandler Forklift	2	75	113	107	97	95	92	90	84	75	99	BS 5228: Tab C.2 #35
	Concrete mixer truck	4	75	108	97	94	98	99	97	92	86	103	BS 5228: Tab C.4 #18
	Mobile Cranes (100T)	1	75	110	105	108	104	94	94	84	78	104	BS 5228: Tab C.4 #48
	General waste skips	5	75	116	110	102	102	102	101	98	95	107	BS 5228: Tab C.8 #20
Car Parks	360-hydraulic excavators (20T)	2	75	113	106	105	105	101	99	96	91	107	BS 5228: Tab C.2 #14
	Rigid Heavy Goods Vehicles (HGV)	4	75	101	106	106	106	102	101	96	94	108	BS 5228: Tab C.2 #34
	All terrain articulated dumper (40T)	5	75	113	115	105	103	104	101	97	90	109	BS 5228: Tab C.2 #33
	Dumper (9T)	4	75	113	115	105	103	104	101	97	90	109	BS 5228: Tab C.2 #33
	GPS Bulldozer	1	75	111	109	104	105	110	98	93	86	111	BS 5228: Tab C.5 #15
	Roller	1	75	110	106	95	99	95	92	88	85	101	BS 5228: Tab C.2 #40
	Compressors	2	75	112	101	92	87	85	83	86	75	93	BS 5228: Tab C.5 #5
	Asphalt paving machine	2	75	100	105	102	100	99	98	95	88	105	BS 5228: Tab C.5 #31
	Telehandler Forklift	4	75	113	107	97	95	92	90	84	75	99	BS 5228: Tab C.2 #35
	Concrete mixer truck	2	75	108	97	94	98	99	97	92	86	103	BS 5228: Tab C.4 #18
	General waste skips	5	75	116	110	102	102	102	101	98	95	107	BS 5228: Tab C.8 #20
Landfill	360-hydraulic excavators (40T)	2	75	105	114	108	104	100	98	94	91	107	Overall A-weighted sound power level from manufacturer. Spectrum from BS 5228: Tab C.2 #2
	360-hydraulic excavators (20T)	2	75	113	106	105	105	101	99	96	91	107	BS 5228: Tab C.2 #14
	All terrain articulated dumper (40T)	2	75	113	115	105	103	104	101	97	90	109	BS 5228: Tab C.2 #33
	Dumper (9T)	2	75	113	115	105	103	104	101	97	90	109	BS 5228: Tab C.2 #33

Activity	Plant	No.	% on-time	Unweighted Octave Band Sound Power Level [LwdB]								Overall Sound Power Level [LwAdB]	Reference
				63	125	250	500	1k	2k	4k	8k		
	GPS Bulldozer	1	75	111	109	104	105	110	98	93	86	111	BS 5228: Tab C.5 #15
	Soil stabiliser	1	75	108	104	108	107	107	104	98	90	111	Overall A-weighted sound power level from manufacturer. Spectrum from BS 5228: Tab C.1 #10
	Roller	1	75	110	106	95	99	95	92	88	85	101	BS 5228: Tab C.2 #40
Luton DART	360-hydraulic excavators (40T)	2	75	105	114	108	104	100	98	94	91	107	Overall A-weighted sound power level from manufacturer. Spectrum from BS 5228: Tab C.2 #2
	360-hydraulic excavators (20T)	2	75	113	106	105	105	101	99	96	91	107	BS 5228: Tab C.2 #14
	Rigid Heavy Goods Vehicles (HGV)	8	75	101	106	106	106	102	101	96	94	108	BS 5228: Tab C.2 #34
	All terrain articulated dumper (40T)	4	75	113	115	105	103	104	101	97	90	109	BS 5228: Tab C.2 #33
	Dumper (9T)	2	75	113	115	105	103	104	101	97	90	109	BS 5228: Tab C.2 #33
	Roller	1	75	110	106	95	99	95	92	88	85	101	BS 5228: Tab C.2 #40
	Compressors	4	75	112	101	92	87	85	83	86	75	93	BS 5228: Tab C.5 #5
	Telehandler Forklift	3	75	113	107	97	95	92	90	84	75	99	BS 5228: Tab C.2 #35
	Mobile Truck Mounted concrete pump	2	75	111	109	106	107	105	102	99	94	110	BS 5228: Tab C.4 #25
	Concrete mixer truck	4	75	108	97	94	98	99	97	92	86	103	BS 5228: Tab C.4 #18
	Mobile Cranes (100T)	2	75	110	105	108	104	94	94	84	78	104	BS 5228: Tab C.4 #48
	General waste skips	10	75	116	110	102	102	102	101	98	95	107	BS 5228: Tab C.8 #20
	Access equipment (cherry pickers / MEWPs)	10	75	113	107	97	95	92	90	84	75	99	BS 5228: Tab C.2 #35
Terminal 2	360-hydraulic excavators (40T)	2	75	105	114	108	104	100	98	94	91	107	Overall A-weighted sound power level from manufacturer. Spectrum from BS 5228: Tab C.2 #2
	360-hydraulic excavators (20T)	4	75	113	106	105	105	101	99	96	91	107	BS 5228: Tab C.2 #14
	Rigid Heavy Goods Vehicles (HGV)	10	75	101	106	106	106	102	101	96	94	108	BS 5228: Tab C.2 #34
	Dumper (9T)	2	75	113	115	105	103	104	101	97	90	109	BS 5228: Tab C.2 #33

Activity	Plant	No.	% on-time	Unweighted Octave Band Sound Power Level [LwdB]								Overall Sound Power Level [LwAdB]	Reference
				63	125	250	500	1k	2k	4k	8k		
	Compressors	6	75	112	101	92	87	85	83	86	75	93	BS 5228: Tab C.5 #5
	Telehandler Forklift	4	75	113	107	97	95	92	90	84	75	99	BS 5228: Tab C.2 #35
	Tower Cranes	4	75	110	105	108	104	94	94	84	78	104	BS 5228: Tab C.4 #48
	Mobile Truck Mounted concrete pump	4	75	111	109	106	107	105	102	99	94	110	BS 5228: Tab C.4 #25
	Concrete mixer truck	4	75	108	97	94	98	99	97	92	86	103	BS 5228: Tab C.4 #18
	Mobile Cranes (100T)	4	75	110	105	108	104	94	94	84	78	104	BS 5228: Tab C.4 #48
	General waste skips	10	75	116	110	102	102	102	101	98	95	107	BS 5228: Tab C.8 #20
	Access equipment (cherry pickers / MEWPs)	20	75	113	107	97	95	92	90	84	75	99	BS 5228: Tab C.2 #35
Landside Buildings	360-hydraulic excavators (20T)	2	75	113	106	105	105	101	99	96	91	107	BS 5228: Tab C.2 #14
	Rigid Heavy Goods Vehicles (HGV)	8	75	101	106	106	106	102	101	96	94	108	BS 5228: Tab C.2 #34
	Dumper (9T)	2	75	113	115	105	103	104	101	97	90	109	BS 5228: Tab C.2 #33
	Compressors	4	75	112	101	92	87	85	83	86	75	93	BS 5228: Tab C.5 #5
	Asphalt paving machine	1	75	100	105	102	100	99	98	95	88	105	BS 5228: Tab C.5 #31
	Roller	2	75	110	106	95	99	95	92	88	85	101	BS 5228: Tab C.2 #40
	Telehandler Forklift	2	75	113	107	97	95	92	90	84	75	99	BS 5228: Tab C.2 #35
	Tower Cranes	2	75	110	105	108	104	94	94	84	78	104	BS 5228: Tab C.4 #48
	Mobile Truck Mounted concrete pump	4	75	111	109	106	107	105	102	99	94	110	BS 5228: Tab C.4 #25
	Concrete mixer truck	4	75	108	97	94	98	99	97	92	86	103	BS 5228: Tab C.4 #18
	Mobile Cranes (100T)	2	75	110	105	108	104	94	94	84	78	104	BS 5228: Tab C.4 #48
	General waste skips	10	75	116	110	102	102	102	101	98	95	107	BS 5228: Tab C.8 #20
	Access equipment (cherry pickers / MEWPs)	10	75	113	107	97	95	92	90	84	75	99	BS 5228: Tab C.2 #35
Bored piling	Bauer BG39 Bored Piling Rig	1	60	108	103	97	103	99	95	89	86	104	BS 5228: Tab C.4 #90
	Kobelco CKE1350-1F	1	30	112	120	109	108	106	104	96	89	111	BS 5228: Tab C.3 #14
	Piling Compressor	1	30	110	108	106	103	104	106	103	97	111	BS 5228: Tab C.11 #4
	MEWP	1	5	103	99	93	98	99	97	90	85	103	BS 5228: Tab C.3 #19

Activity	Plant	No.	% on-time	Unweighted Octave Band Sound Power Level [LwdB]								Overall Sound Power Level [LwAdB]	Reference
				63	125	250	500	1k	2k	4k	8k		
	Concrete wagons	1	60	106	104	90	91	88	87	86	77	95	BS 5228: Tab C.4 #57
	Stihl Saw	1	5	108	97	94	98	99	97	92	86	103	BS 5228: Tab C.4 #18
	Jetwash	2	25	95	112	104	103	103	105	109	108	114	Overall A-weighted sound power level from manufacturer. Spectrum from BS 5228: Tab C.4 #70
Sheet Piling	Road sweeper	1	30	103	103	90	86	83	82	76	68	91	BS 5228: Tab C.3 #13
	13T Excavator	1	30	108	103	97	103	99	95	89	86	104	BS 5228: Tab C.4 #90
	Dumper	1	30	104	101	90	94	90	87	82	77	96	BS 5228: Tab C.3 #20
	Handtools	4	25	110	104	103	102	96	96	92	83	104	BS 5228: Tab C.4 #4
	Delivery lorry	2	5	105	99	93	93	94	94	88	79	99	BS 5228: Tab C.4 #19
	Generators	1	100	105	100	92	88	87	85	82	70	93	BS 5228: Tab C.4 #87
	ABI TM22 Piling Rig	1	60	98	90	90	85	81	80	76	69	88	BS 5228: Tab C.4 #77
	LTR1060	1	50	111	110	107	110	112	110	105	95	116	BS 5228: Tab C.3 #8
	MEWP	1	5	94	93	94	91	93	94	99	99	104	Overall A-weighted sound power level from manufacturer. Spectrum from BS 5228: Tab C.4 #69
	20T Excavator	1	40	111	102	94	97	98	106	88	83	108	BS 5228: Tab C.4 #20
	Dumper	1	30	111	107	106	104	102	99	93	88	107	BS 5228: Tab C.6 #10
	Handtools	4	25	110	104	103	102	96	96	92	83	104	BS 5228: Tab C.4 #4
	Delivery lorry	2	5	108	106	102	103	105	105	106	104	112	Overall sound power level from BS 5228: Tab D.2 #15. Spectrum from BS 5228: Tab C.1 #20
Creation of Haul Roads	30T Excavator	1	25	104	107	103	103	104	101	98	93	108	BS 5228: Tab C.5 #18
	30T Dumper	2	50	113	102	106	101	101	102	95	91	107	BS 5228: Tab C.2 #30
	20T Roller	1	25	108	103	105	100	95	90	82	74	101	BS 5228: Tab C.2 #38
	Delivery Vehicles	5	30	101	106	106	106	102	101	96	94	108	BS 5228: Tab C.2 #34
	D6 Bulldozer	1	50	115	104	106	103	102	108	92	86	111	Overall A-weighted sound power level from manufacturer. Spectrum from BS 5228: Tab C.2 #12
	20T Excavator	1	80	111	107	106	104	102	99	93	88	107	BS 5228: Tab C.6 #10
	14m Grader	1	25	111	100	102	99	98	104	88	82	107	Overall A-weighted sound power level from manufacturer. Spectrum from BS 5228: Tab C.2 # 12

Activity	Plant	No.	% on-time	Unweighted Octave Band Sound Power Level [LwdB]								Overall Sound Power Level [LwAdB]	Reference
				63	125	250	500	1k	2k	4k	8k		
	20T Roller	1	50	108	103	105	100	95	90	82	74	101	BS 5228: Tab C.2 #38
	Delivery Vehicles	1	25	107	99	106	103	106	98	89	83	108	BS 5228: Tab C.4 #74
	D6 Bulldozer	1	10	106	101	102	108	98	96	88	84	106	BS 5228: Tab C.4 #91
33 KV Substation Construction	360-hydraulic excavators (20T)	1	75	113	106	105	105	101	99	96	91	107	BS 5228: Tab C.2 #14
	Rigid Heavy Goods Vehicles (HGV)	1	75	101	106	106	106	102	101	96	94	108	BS 5228: Tab C.2 #34
	Dumper (9T)	1	75	113	115	105	103	104	101	97	90	109	BS 5228: Tab C.2 #33
	Compressors	1	75	112	101	92	87	85	83	86	75	93	BS 5228: Tab C.5 #5
	Asphalt paving machine	1	75	100	105	102	100	99	98	95	88	105	BS 5228: Tab C.5 #31
	Roller	1	75	110	106	95	99	95	92	88	85	101	BS 5228: Tab C.2 #40
	Telehandler Forklift	1	75	113	107	97	95	92	90	84	75	99	BS 5228: Tab C.2 #35
	Tower Cranes	1	75	110	105	108	104	94	94	84	78	104	BS 5228: Tab C.4 #48
	Mobile Truck Mounted concrete pump	1	75	111	109	106	107	105	102	99	94	110	BS 5228: Tab C.4 #25
	Concrete mixer truck	1	75	108	97	94	98	99	97	92	86	103	BS 5228: Tab C.4 #18
	Mobile Cranes (100T)	1	75	110	105	108	104	94	94	84	78	104	BS 5228: Tab C.4 #48
	General waste skips	1	75	116	110	102	102	102	101	98	95	107	BS 5228: Tab C.8 #20
	Access equipment (cherry pickers / MEWPs)	1	75	113	107	97	95	92	90	84	75	99	BS 5228: Tab C.2 #35

Table 5.4: Total Sound Power Level of Activities

Activity	Total Sound Power Level LwdB	Sound Power Level LwdB per Octave Band							
		63Hz	125Hz	250Hz	500Hz	1 kHz	2 kHz	4 kHz	8 kHz
Utilities	120.8	113.0	106.0	105.0	105.0	101.0	99.0	96.0	91.0
Earthworks	121.3	113.0	106.0	105.0	105.0	101.0	99.0	96.0	91.0
Airfield Extension	118.4	113.0	106.0	105.0	105.0	101.0	99.0	96.0	91.0
Drainage	118.1	113.0	106.0	105.0	105.0	101.0	99.0	96.0	91.0
Demolition	118.9	103.0	104.0	100.0	96.0	93.0	91.0	85.0	77.0

Activity	Total Sound Power Level LwdB	Sound Power Level LwdB per Octave Band							
		63Hz	125Hz	250Hz	500Hz	1 kHz	2 kHz	4 kHz	8 kHz
Road Works	121.0	113.0	106.0	105.0	105.0	101.0	99.0	96.0	91.0
Car Parks	120.8	113.0	106.0	105.0	105.0	101.0	99.0	96.0	91.0
Landfill	117.7	105.0	114.0	108.0	104.0	100.0	98.0	94.0	91.0
Luton DART	119.6	105.0	114.0	108.0	104.0	100.0	98.0	94.0	91.0
Terminal 2	122.7	105.0	114.0	108.0	104.0	100.0	98.0	94.0	91.0
Landside Buildings	121.8	113.0	106.0	105.0	105.0	101.0	99.0	96.0	91.0
Bored Piling	113.4	108.0	103.0	97.0	103.0	99.0	95.0	89.0	86.0
Sheet Piling	117.3	103.0	103.0	90.0	86.0	83.0	82.0	76.0	68.0
Creation of Haul Roads	114.8	104.0	107.0	103.0	103.0	104.0	101.0	98.0	93.0
33 KV Substation	115.5	95.3	101.9	105.2	109.4	109.9	109.1	105.1	98.5

Results of Construction and Earthworks Noise Calculations

5.2.6 Results of construction and earthworks noise predictions at assessment locations are presented in: Table 5.5 for assessment Phase 1~~,~~; Table 5.6 for assessment Phase 2a and; Table 5.7 for assessment Phase 2b. Construction and earthworks noise assessment locations are defined in Section 16.7 of **Chapter 16** Noise and Vibration of the ES **[TR020001/APP/5.01]**.

Table 5.5: Assessment Phase 1 Construction and Earthworks Noise Predictions

Assessment Location	Predicted Noise Level $L_{Aeq,T}$dB per Stage			
	1-1	1-2	1-3	Highest Calculated for all Stages
GR1	46	52	43	52
GR2	30	31	22	31
GR3	42	47	38	47
GR4	47	51	44	51
GR5	46	49	42	49
GR6	57	51	43	57
GR7	62	52	41	62
GR8	59	43	36	59
GR9	62	52	42	62
GR10	59	54	42	59
GR11	61	59	44	61
GR12	59	60	47	60
GR13	58	61	48	61
GR14	61	65	48	65
GR15	63	66	48	66
GR16	60	67	44	67
GR17	61	68	45	68
GR18	66	72	47	72
GR19	71	71	43	71
GR20	68	67	46	68
GR21	67	66	37	67
GR22	64	62	43	64
GR23	60	60	44	60
GR24	54	51	32	54

Table 5.6: Assessment Phase 2a Construction and Earthworks Noise Predictions

Assessment Location	Predicted Noise Level $L_{Aeq,T}$dB per Stage				
	2-1	2-2	2-3	2-4	Highest Calculated for all Stages
GR1	46	48	48	49	49
GR2	42	40	32	31	42
GR3	42	44	45	45	45
GR4	47	49	51	51	51
GR5	47	48	49	50	50
GR6	62	62	63	61	62
GR7	52	53	57	55	57
GR8	49	49	56	53	56
GR9	53	53	57	56	57
GR10	52	53	56	55	56
GR11	56	57	58	59	58
GR12	57	58	59	60	60
GR13	57	58	59	61	61
GR14	58	63	63	64	64
GR15	58	65	65	66	66
GR16	51	66	67	66	67
GR17	53	65	66	64	66
GR18	55	65	65	65	65
GR19	54	64	64	64	64
GR20	45	62	62	62	62
GR21	44	61	61	61	61
GR22	54	59	58	59	59
GR23	43	58	56	56	58
GR24	45	47	48	50	50

Table 5.7: Assessment Phase 2b Construction and Earthworks Noise Predictions

Assessment Location	Predicted Noise Level $L_{Aeq,T}$dB per Stage				
	3-1	3-2	3-3	3-4	Highest Calculated for all Stages
GR1	61	46	48	46	61
GR2	33	28	28	26	33
GR3	54	42	44	43	54
GR4	47	49	51	48	51
GR5	46	46	48	48	48
GR6	63	63	58	57	63
GR7	52	54	55	53	55
GR8	51	50	44	51	51
GR9	53	55	55	54	55
GR10	52	55	57	54	57
GR11	54	59	61	59	61
GR12	54	58	62	60	62
GR13	56	59	62	61	62
GR14	54	58	62	62	62
GR15	51	58	64	64	64
GR16	42	50	57	56	57
GR17	44	53	58	57	58
GR18	44	55	59	58	59
GR19	44	54	59	59	59
GR20	41	44	55	56	56
GR21	38	42	51	51	51
GR22	38	54	53	52	54
GR23	36	42	49	48	49
GR24	33	58	41	41	58

5.3 Construction and Earthworks Vibration

Construction and Earthworks Vibration Criteria

5.3.1 Vibration caused by earthworks and construction works has the potential to cause human disturbance or structural damage to nearby buildings and structures. BS 5228-2 'Code of practice for noise and vibration control on construction and open sites. Vibration' (Ref. 7) provides comparable 'best practice' for vibration control, including guidance on the human response to vibration.

5.3.2 When defining assessment criteria, reference has been made to BS 5228-2, which provides descriptions of the impact of vibration in terms of Peak Particle Velocity (PPV) on human receptors Table 5.8 describes the effect due to levels from BS 5228-2.

Table 5.8: BS 5228-2 guidance on effects of vibration levels

Vibration Level	Effects
0.14 mm/s	Vibration might be just perceptible in the most sensitive situations for most vibration frequencies associated with demolition and construction. At lower frequencies, people are less sensitive to vibration.
0.3 mm/s	Vibration might be just perceptible in residential environments.
1.0 mm/s	It is likely that vibration of this level in residential environments will cause ~~complaint, but~~complaint but can be tolerated if prior warning and explanation has been given to residents.
10.0 mm/s	Vibration is likely to be intolerable for any more than a very brief exposure to this level.

5.3.3 For residential receptors and equivalent, the LOAEL has been defined as a PPV of 0.3 mm/s (millimetres per second), this being the point at which construction vibration is likely to become perceptible. The SOAEL has been defined as a PPV of 1.0 mm/s, this being the level at which construction vibration can be tolerated with prior warning. These PPV values are defined as LOAEL and SOAEL in DMRB LA111. The UAEL is defined as 10 mm/s, which is the level at which vibration is likely to be intolerable.

5.3.4 Table 5.9 defines the thresholds for ground-borne vibration with regard to risk of building damage. These criteria are derived from British Standard BS 7385 (Ref. 8) and ensures there is no risk of the lowest damage category ('cosmetic') being exceeded, as defined in BS ISO 4866 (Ref. 9).

Table 5.9: Vibration impact criteria for buildings

Category of Building	Impact criteria: (PPV at building foundation)	
	Transient Vibration	Continuous Vibration
Structurally sound buildings	$\geqslant$12 mm/s	$\geqslant$6 mm/s
Potentially vulnerable buildings[2]	$\geqslant$6 mm/s	$\geqslant$3 mm/s

[2] - BS 7385 highlights that the criteria for aged buildings may need to be lower if the buildings are structurally unsound. The standard also notes that criteria should not be set lower simply because a building is important or historic (e.g. listed). Where information about these structures is not currently known, the more onerous criteria on this row of the table shall be adopted on a precautionary basis until condition surveys have been undertaken.

5.4 Construction and Earthworks Vibration Calculation Methodology

5.4.1 The highest levels of ground-borne vibration during earthworks activities ~~is~~are likely to be generated from vibratory rollers. Additionally, the highest levels of vibration generated during construction activities is likely to be generated by piling activities.

5.4.2 The level of vibration that is transmitted from a vibration source to a receptor is dependent on: the distance to the receptor;~~,~~ the type of ground between the pile and receptor; and the building foundations. Additionally, the levels of vibration experienced at a receptor due to piling activities will depend on the type of pile, the length of pile and the coupling between the pile and the ground. Due to these site-specific factors, there is always some uncertainty in any predicted level of vibration.

5.4.3 For calculating potential levels of vibration at buildings due to earthworks activities, reference has been made to Table E.1 of BS 5228-2. Table E.1 contains a method for calculating the percentage chance of a PPV occurring at distance due to a vibratory roller based on the diameter of the drum and the amplitude of vibration. Vibration calculations have been undertaken assuming a typical vibratory roller that may be used during earthworks is the Tandem Vibratory Roller, which has a drum of 0.72 ~~-~~m and amplitude of vibration of 0.56 ~~-~~mm.

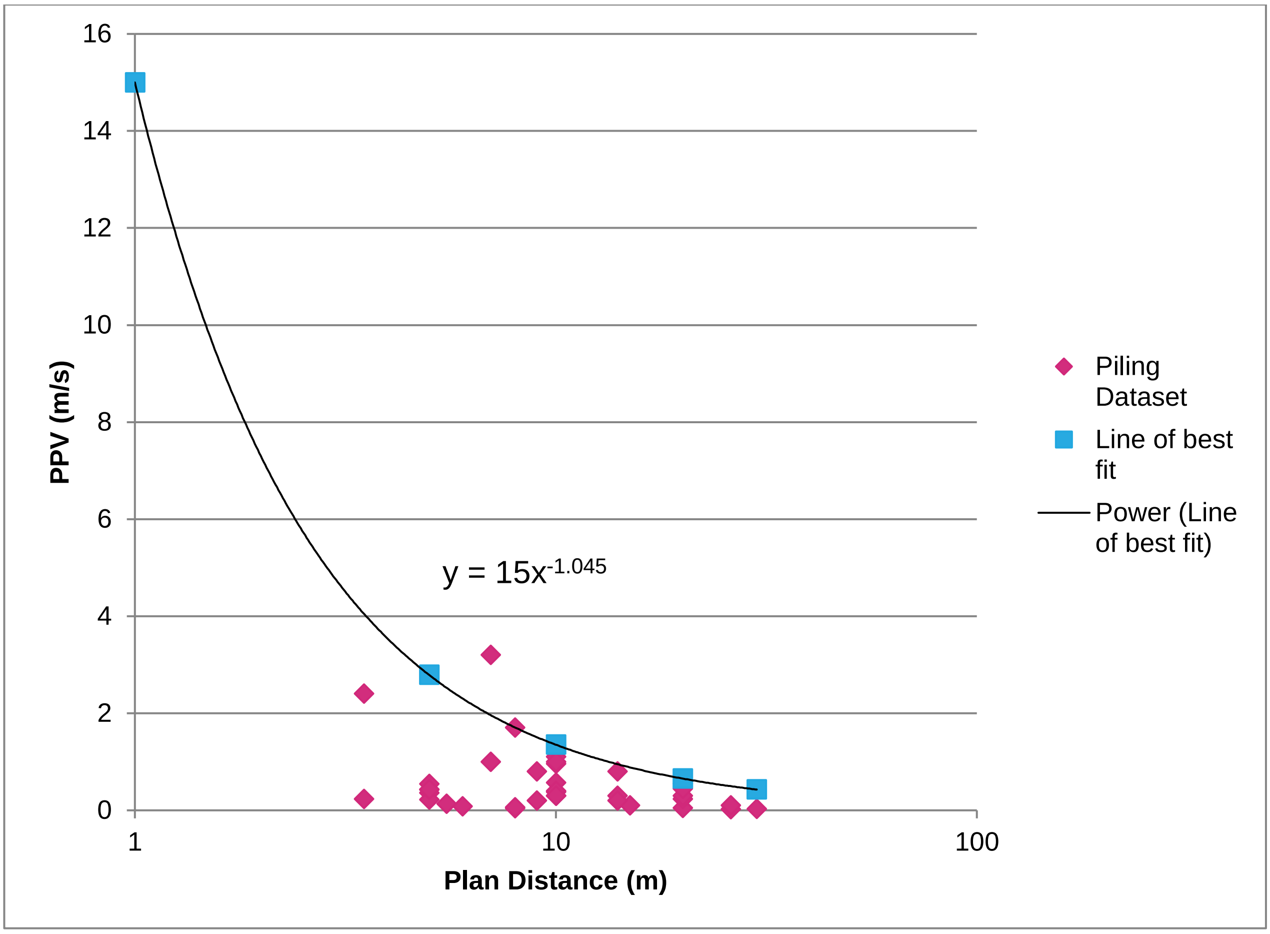
5.4.4 Piling requirements for the Proposed Development~~s~~ will be finalised once a lead contractor has been appointed.~~;~~ H~~h~~owever, at this stage of the Project, it is envisaged that piling requirements will be as follows:

a. Sheet piling:
   i. Luton DART ~~E~~extension – sheet piling is likely to be required for the Luton DART extension to support the sides of the tunnel prior to excavation.
   ii. Airport Access Road (AAR) – some sections of the AAR will be cut into the existing ground and therefore may need some sheet piling to support the ground.

b. Continuous Flight Auger (CFA) piles are likely to be required for the foundations of the:
   i. ~~t~~Terminal building;
   ii. ~~t~~Terminal 2 Piers; and
   iii. Luton DART Station.

5.4.5 For sheet piling, it is assumed that a push-pull hydraulic piling technique will be employed. BS 5228-2 advises that the vibration levels are similar to CFA piling techniques.

5.4.6 Data from CFA piling activities was referenced from BS 5228-2 to determine the likely level of vibration that may be experienced during piling works. Regression analysis was undertaken to determine a formula for calculating the PPV from piling activities. This analysis is presented in Inset 5.1.



Inset 5.1: CFA Piling Data Regression Analysis

Results of Construction and Earthworks Calculations

5.4.7 Using the formula for steady state compaction in Table E.1 of BS 5228-2, the probability for predicted levels of vibration to be exceeded has been calculated in 10 m increments, up to a distance where there is a 5% probability for the LOAEL (0.3 mm/s) to be exceeded are presented in Table 5.10.

Table 5.10: Earthworks Vibratory Roller PPV Predictions

Probability of Predicted PPV Being Exceeded	Predicted PPV （mm/s) at Distance				
	10m	20m	30m	40m	50m
50%	0.9	0.3	0.2	0.1	0.1
33.3%	1.7	0.6	0.4	0.2	0.2
5%	3.3	1.2	0.7	0.4	0.3

5.4.8 Using the formula from regression analysis of piling data (Inset 5.1), the predicted level of vibration has been calculated in 10 m increments up to a distance where the calculated PPV equals the LOAEL of 0.3 mm/s in Table 5.11.

Table 5.11: Piling PPV Predictions

Distance	Predicted PPV （mm/s)
10m	1.4
20m	0.7
30m	0.4
40m	0.3

5.5 Construction Traffic Noise

5.5.1 The Proposed Development has the potential to influence traffic flows on existing roads in the area surrounding the construction sites. Construction traffic noise has been assessed by considering the increase in traffic flows during works through calculation of the Basic Noise Level (BNL), as defined in the 'Calculation of Road Traffic Noise' (CRTN) (Ref. 10). The method for determining the magnitude of impact due to changes in road traffic noise are presented in Table 9.2 in Section 9.1 of this ~~a~~Appendix.

6 AIR NOISE MODELLING AND VALIDATION

6.1 Aircraft Noise Modelling

6.1.1 To understand and assess the likely effects of the Proposed Development, the Applicant has undertaken noise modelling to enable a comparison between noise levels around the airport without the Proposed Development with noise levels around the airport if the Proposed Development is delivered. This modelling allows the expected effects of the Proposed Development on noise around the airport to be isolated so that it is clear how the proposals would affect those who live, work and visit the airport and surrounding area.

6.1.2 Historically, noise at London Luton Airport has been modelled by the airport operator ~~(~~London Luton Airport Operations~~g~~ Limited~~ or~~ (pLLAOL) using the Integrated Noise Model (INM). The 2012 planning consent, which established the current passenger cap for the airport of 18 mppa~~illion passengers per year~~, relied on noise contours generated using INM software which at that time was the industry standard for aviation noise assessments. Consequently, LLAOL have continued to use INM due to the requirement to demonstrate compliance with existing noise planning commitments. The INM-based noise model that LLAOL used for its planning application was validated using measured data.

6.1.3 In 2021, LLAOL submitted a planning application to increase the passenger cap from 18 mppa~~illion~~ to 19 mppa~~illion passengers per annum~~ by varying the condition attached to the 2012 planning consent which limits annual passengers to 18 million. Because LLAOL's application seeks to directly amend the 2012 planning consent, LLAOL has used the same noise modelling approach that was used to support the original application (INM and associated input assumptions). This way direct comparisons can be made between the noise contours associated with the 2012 planning consent and the forecast noise contours which support LLAOL's application to vary that consent.

6.1.4 It is a requirement for the application for ~~D~~development ~~C~~consent, to apply the latest~~,~~ up-to-date methods and standards. Consequently, noise modelling for this ES was undertaken using the Aviation Environmental Design Tool 3e (AEDT).

6.1.5 AEDT is produced by the US Federal Aviation Administration (FAA) and replaced INM, which is now considered to be a legacy tool (as of May 2015). As such, AEDT has received updates of the latest aircraft data from the Aircraft Noise and Performance database. The use of AEDT (along with the Civil Aviation Authority's ANCON, which is their in-house noise modelling software package) is advocated in the CAA's CAP 1616a as "*a recognised and validated noise model"* (Ref. 11). Whilst CAP 1616a is more associated with the modelling of the noise impacts from airspace change, the advice it contains is considered to represent best practice for aircraft noise modelling. As a requirement for a DCO application is to apply the latest methods and standards, air noise modelling has been undertaken using AEDT software and input assumptions, as set out in current industry practice guidance in ECAC Doc 29, 4th Edition (Ref. 12) and ICAO Doc 9911 (Ref. 13).

6.1.6 For the application for ~~D~~development ~~C~~consent, the Applicant ~~has~~ set up a Noise Envelope Design Group (NEDG) with representation from key stakeholders. The NEDG's role ~~i~~was to provide recommendations to Luton Rising on noise control measures that allow predictable growth and benefits of new aircraft technology to be shared between the airport and local communities. These noise control measures ~~will~~ formed a '~~n~~Noise ~~e~~Envelope' that was~~will be~~ submitted as part of the application for development consent. The NEDG recommendations allowed clear performance targets to be set in the ~~n~~Noise ~~e~~Envelope that are tailored to local priorities. The NEDG include~~s~~d representatives from nearby local authorities, airlines, cargo operations, NATS, the Chamber of Commerce, and local community interest groups. The NEDG ~~has~~ agreed that AEDT should be used to model noise contours and used to define noise control values which ~~will~~ comprised the ~~n~~Noise ~~e~~Envelope.

6.1.7 AEDT is developed from the algorithms and frameworks for calculation of aircraft noise outlined in the SAE-AIR-1845 document (Ref. 14). AEDT uses Noise-Power-Distance[3] (NPD) data to estimate noise levels, accounting for the typical operational mode, engine thrust setting, source-to-receiver geometry, acoustic directivity and other environmental factors. AEDT can calculate exposure, maximum-level and time-based noise contours, as well as levels at pre-selected locations. AEDT contains an extensive database of the noise attributes of aircraft and provides flexibility in allowing data from new aircraft or aircraft types to be inserted.

6.1.8 If the DCO was consented, the noise contour outputs from AEDT would be used to define noise contour limits and thresholds and will supersede the existing contour limits based on INM.

6.2 Validation

6.2.1 The aircraft noise validation exercise consists of analysis of measured noise data and radar data provided by LLAOL. Radar data has been provided by LLAOL with the express permission of NATS that it can be shared with specialist consultants for the purpose of noise modelling.~~;~~ H~~h~~owever, NATS do not endorse sharing of radar data any further.

6.2.2 The aim of the validation exercise was to ensure that, at all validation points, average noise for an aircraft type was predicted within a 3dB range of measurements with the aim being to minimise the difference between predictions and measurements as far as reasonably practicable. Where there was any variation in differences at validation locations, overpredictions were favoured to ensure a reasonable worst-case approach.

6.3 Validation Requirements

6.3.1 The noise model validation exercise was based on guidance set out in the CAA Policy on Minimum Standards for Noise Modelling (Ref. 15). The method categorises the level of validation required based on the population exposed to aircraft noise above daytime 51dB $L_{Aeq,16h}$ and night-time 45dB $L_{Aeq,8h}$. Based on

[3] Aircraft noise level at ground height as a function of distance and power setting.

the results of noise modelling presented in this ES, the airport falls into Category C for all assessment years.

6.3.2 Noise model validation requirements for Category C are as follows:

a. Aircraft flight profiles are adapted from the standard ICAO dataset for the main noise dominant aircraft types, which must cover more than 75 percent of the total noise energy at the airport.

c. Noise measurements are not required.

6.3.3 It should be noted that, although Category C does not require noise measurements, the use of noise data to validate predictions is seen as key part of the validation process. Consequently, the validation process undertaken is equivalent to Category B requirements, which is identical to Category C but requires at least two monitoring locations for each approach and departure route.

6.3.4 Category B requires that noise monitors "*…are sufficient in number and appropriately positioned, as for Category A*". There is no requirement for noise monitors in a Category B to be compliant with noise monitoring principles set out in ISO 20906 (Ref. 16).

6.4 Changes in the Validation Process

6.4.1 The validation process set out in this section was updated from the process undertaken for the 2022 PEIR in response to statutory consultation feedback (see **Consultation Report [TR020001/APP/6.01]** and **[TR020001/APP/6.02]**) and through engagement with the NWG and NEDG (see Table 16.8 of ES **[TR020001/APP/5.03]**). The key changes to the validation process are as follows:

a. 2019 radar track data has been used in the validation process in response to statutory consultation feedback.

b. Departure profiles for each aircraft have been adjusted using departure speed and altitude profile data from 2019 radar track data.

c. AEDT approach profiles have been tested against 2019 radar data.

d. Validation locations have been refined using coordinate location information provided by LLAOL.

e. Noise data and departure profile data are presented as percentiles in order to provide an understanding of the range of data in each dataset.

f. Corrections applied to approach and departure noise predictions have been applied in 0.5dB increments.

g. Validation has been undertaken for both the Sound Exposure Level (SEL) and L_{ASmax} noise metrics. The validation exercise has focussed on validating noise predictions for SEL as it is used to calculate the primary $L_{Aeq,T}$ noise metric; however, in order to improve the accuracy of supplementary noise metrics that use the L_{ASmax}, different corrections have been calculated for the L_{ASmax} to those applied to the SEL.

6.5 Use of Ground Speed Data

6.5.1 The updated validation process uses both aircraft altitude data and ground speed data to test the accuracy of departure profiles in AEDT. Although this provides a means of defining more accurate departure profiles, there are limitations on using ground speed data that should be noted. The ground speed data includes a combination of the aircraft speed and the wind speed so, for example, if an aircraft is flying at 160-knots into a 20-knot headwind, then the ground speed will be 140-knots.

6.5.2 Ground speed is averaged over all movements of each aircraft over the 92-day summer period. It is typical for aircraft to fly into the wind, so ground speed data may underestimate the actual aircraft speed. However, the average wind speed during the summer period in Luton is approximately 8 knots, which is not considered to be significant compared to aircraft speeds. Additionally, the statistical analysis of the ground speed data provides a means that uncertainties in ground speed due to wind will be minimised. Consequently, the use of ground speed data in the validation process is considered to be a reasonable approach.

6.6 Aircraft Tested

6.6.1 Aircraft were tested depending on the data available. A summary of how aircraft were tested against radar and noise data is presented in Table 6.1. These aircraft make up a range of 75% to 80% of aircraft movements for all scenarios modelled and, as the aircraft are among the noisiest operated at the airport, it is assumed that they contribute to at least 75% of the total noise energy at the airport. Consequently, the validation process is in line with the CAP2091 (Ref. 15) Category B requirements to validate aircraft that produce 75% of the total noise energy.

Table 6.1: Aircraft Testing Summary

Aircraft	Radar Data Profile Test	Measured Noise Data Test
A319	✓	✓
A320	✓	✓
A320Neo	✓	✓
A321	✓	✓
A321Neo	✓	✓
B737-800	✓	✓

6.6.2 There is no A321Neo aircraft data currently available within AEDT, so it was necessary to select a surrogate aircraft to base A321Neo noise predictions on. Testing of the A321Neo was undertaken using the A321 and A320Neo as surrogate aircraft to determine whether the A321Neo performance matched better with the current generation variant or an equivalent Airbus next generation aircraft. It was found the A320Neo provided better correlation with approach and departure profiles and noise data. Consequently, the A320Neo was used as a surrogate for modelling the A321Neo.

6.6.3 The performance of the A321Neo at the airport is not currently as good as the expected performance from noise certification testing. Through discussions with LLAOL and airline operators, it has become apparent that the poor performance is restricted to a particular engine variant of the A321Neo and other engine variants perform as would be expected from noise certification testing. Measured noise data was used to predict A321Neo (assessment Phase 1) noise in the 2027 scenario; however, it is assumed that, by 2039, any issues with the A321Neo performance would be resolved through fleet transition to equivalent aircraft that are no worse than the expected performance from noise certification testing. Consequently, A321Neo predictions for the 2039 and 2043 scenarios were modelled based on the modelling methodology referenced from the Air Noise and Performance (ANP) database[17] v2.3 (released 14 October 2020) aircraft substitutions[4].

6.6.4 No noise or radar data was available for the B737MAX as it was not operating at the airport in the 2019 baseline year. Consequently, the B737MAX has been modelled using default data and profiles in AEDT. Any future updates of the noise model will include validation of the B737MAX.

6.6.5 No radar or noise data was available for the A319Neo as it is not yet operating at the airport, so reference was made to ANP guidance to model. Corrections applied to A319 and A321 aircraft to model A319Neo and A321Neo are presented in Table 6.2.

Table 6.2: New Generation Aircraft Modelling with no Data

Aircraft	Surrogate Aircraft	Approach CorrectiondsB	Departure CorrectionsdB	Source
A319Neo	A319	-4.0	-1.0	ANP
A321Neo (assessment Phase 2a, assessment Phase 2b)	A321	-0.7	-3.7	ANP

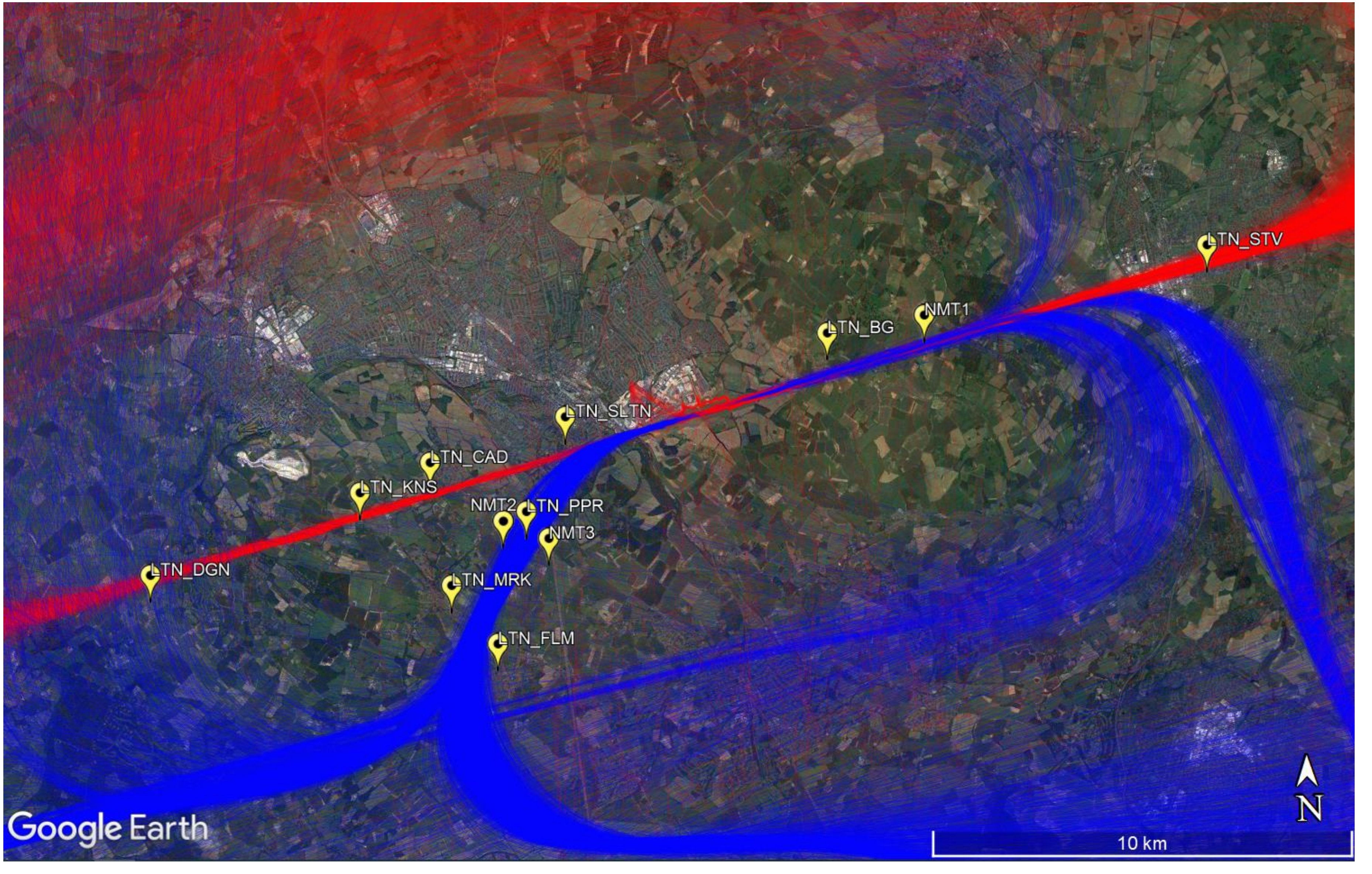
6.7 Measured Noise Data

6.7.1 Noise data was provided by LLAOL in order to validate the noise model. LLAOL noise monitoring locations used to validate modelled aircraft and radar tracks are presented in Inset 6.1. The noise data consists of SEL measurements of a variety of aircraft at a number of different locations along approach and departure routes.

6.7.2 LLAOL's noise monitors were installed in 2004, prior to the publication of ISO 20906 (Ref. 18). Guidance from the CAA (Ref. 19) notes that compliance with the ISO standard is only required for what they define as 'Category A' airports. There is no requirement for noise monitors in Category B to be compliant with noise monitoring principles set out in ISO 20906. As the validation process

[4] ANP v2.2 Aircraft substitutions - jets & heavy props (22022018)

follows Category B requirements from the CAA Policy on Minimum Standards for Noise Modelling, the noise data is considered to be appropriate for the validation exercise. However, a commitment has been made within the Noise Monitoring Plan of GCG that, as the airport expands, the airport operator will review and, if necessary, improve the noise monitoring stations in line with ISO standards (see **Appendix C** of **Green Controlled Growth Framework [TR020001/APP/7.08]**).



Inset 6.1: LLAOL Noise Monitoring Locations Used for Validation

6.7.3 A summary of how noise monitoring locations relate to approach and departure tracks is presented in Table 6.3. This demonstrates that at least two monitoring locations were used to validate aircraft noise along each route, which is in accordance with CAP2091 (Ref. 15).

Table 6.3: Noise Monitoring Locations Relating to Approach and Departure Routes

Monitoring Location	07 Approaches	25 Approaches	07 Departures	25 Departures
LTN_KNS	✓			
LTN_CAD	✓			
LTN_DGN	✓			
LTN_MRK				✓
LTN_FLM				✓
LTN_STV		✓		
LTN_BG		✓	✓	
LTN_SLTN	✓			✓
LTN_PPR				✓
NMT01		✓	✓	
NMT02				✓
NMT03				✓

6.7.4 Measured SEL noise data are summarised in Table 6.4 for departures and Table 6.5 for approaches. Noise data are presented as a 50th percentile, which is the noise level that is exceeded by 50% in each dataset. Equivalent data in terms of L_{ASmax} are provided in Table 6.6 and Table 6.7.

Table 6.4: Measured 50th Percentile SEL Departure Data

Monitoring Location	Measured SELdB					
	A20N	A21N	A319	A320	A321	B738
LTN_KNS	-	-	-	-	-	-
LTN_CAD	-	-	-	-	-	-
LTN_DGN	-	-	-	-	-	-
LTN_MRK	76.6	80.1	81.4	81.0	81.8	83.3
LTN_FLM	72.1	75.7	76.9	76.4	78.4	80.7
LTN_STV	-	-	-	-	-	-
LTN_BG	85.1	88.4	89.2	89.1	91.1	92.6
LTN_SLTN	82.7	85.2	86.1	86.2	88.0	90.2
LTN_PPR	81.9	86.3	85.5	85.4	87.2	87.7
NMT01	80.9	84.2	84.3	84.3	85.8	86.6
NMT02	81.1	83.0	83.9	83.9	85.1	86.8
NMT03	83.4	83.3	84.2	84.2	85.3	86.9

Table 6.5: Measured 50th Percentile SEL Approach Data

Monitoring Location	Measured SELdB					
	A20N	A21N	A319	A320	A321	B738
LTN_KNS	82.2	83.4	82.8	82.7	82.5	82.7
LTN_CAD	83.7	85.2	85.1	84.6	84.2	85.7
LTN_DGN	75.2	74.6	75.1	75.6	75.6	76.2
LTN_MRK	-	-	-	-	-	-
LTN_FLM	-	-	-	-	-	-
LTN_STV	76.1	77.2	76.7	77.6	76.4	77.0
LTN_BG	82.6	83.7	84.2	83.8	83.0	86.2
LTN_SLTN	80.1	81.9	81.8	80.1	80.4	84.6
LTN_PPR	-	-	-	-	-	-
NMT01	83.8	84.6	84.7	84.5	84.2	85.6
NMT02	-	-	-	-	-	-
NMT03	-	-	-	-	-	-

Table 6.6: Measured 50th Percentile L_{ASmax} Departure Data

Monitoring Location	Measured L_{ASmax}dB					
	A20N	A21N	A319	A320	A321	B738
LTN_KNS	-	-	-	-	-	-
LTN_CAD	-	-	-	-	-	-

Monitoring Location	Measured L_{ASmax}dB					
	A20N	A21N	A319	A320	A321	B738
LTN_DGN	-	-	-	-	-	-
LTN_MRK	66.6	70.3	70.7	70.9	70.9	71.5
LTN_FLM	61.2	64.5	66.8	66.1	67.1	69.4
LTN_STV	-	-	-	-	-	-
LTN_BG	74.8	79.1	80.0	79.1	80.5	83.4
LTN_SLTN	72.3	75.1	76.4	75.5	76.9	79.7
LTN_PPR	72.6	77.4	74.6	75.9	77.0	76.1
NMT01	70.0	74.2	72.9	73.9	75.0	74.6
NMT02	69.3	72.7	72.4	73.1	73.8	74.3
NMT03	70.5	71.8	72.6	72.2	73.4	75.3

Table 6.7: Measured 50th Percentile L_{ASmax} Approach Data

Monitoring Location	Measured L_{ASmax}dB					
	A20N	A21N	A319	A320	A321	B738
LTN_KNS	72.0	73.3	72.5	72.3	72.1	72.8
LTN_CAD	74.7	77.1	76.6	75.7	75.2	77.1
LTN_DGN	65.5	65.0	65.2	65.5	65.7	66.0
LTN_MRK	-	-	-	-	-	-
LTN_FLM	-	-	-	-	-	-
LTN_STV	65.5	65.8	66.7	66.4	65.6	66.5
LTN_BG	73.0	75.6	75.5	74.5	73.6	77.2
LTN_SLTN	71.9	74.0	74.3	73.5	72.7	77.0
LTN_PPR	-	-	-	-	-	-
NMT01	73.4	74.8	75.0	74.6	74.4	75.9
NMT02	-	-	-	-	-	-
NMT03	-	-	-	-	-	-

6.7.5 A limitation of automated monitoring of aircraft noise is distinguishing aircraft noise from background noise. In order to derive the SEL from an aircraft movement, the sound pressure level needs to increase by at least 10dB, which is identified as a requirement in BS ISO 20906 (Ref. 20) for monitoring aircraft noise. Where ambient sound levels are typically high, it becomes harder to obtain suitable SEL data. This has been identified as a potential issue at NMT03, which is located in an area of high ambient noise from continuous road traffic due to the close proximity to the M1.

6.8 Weather Data

6.8.1 There is inherent variability in aircraft noise measurements that may be attributed to factors such as aircraft weights, flight operating procedures and atmospheric conditions. The main influence due to weather conditions is on the propagation of noise and aircraft climb rates. To minimise variability due to weather conditions during measurement of SEL data, validation predictions were undertaken using weather data provided by LLAOL, which is summarised in Table 6.8.

Table 6.8: Validation Weather Data

Monitoring Location	Period	Temperature (° F)	Pressure (millibars)	Humidity (%)	Wind Speed (knots)
LTN_KNS	Apr-Jun 2019	53.1	1012.1	76.0	8
LTN_CAD	Apr-Jul 2019	56.1	1012.4	74.5	8
LTN_DGN	May-Jul 2019	59.0	1012.8	73.8	8
LTN_MRK	Jun-Oct 2019	59.1	1011.7	77.6	9
LTN_FLM	Jun-Oct 2019	59.1	1011.7	77.6	9
LTN_STV	Aug-Oct 2019	57.1	1011.3	79.8	6
LTN_BG	Oct-Dec 2019	45.0	998.4	91.5	8
LTN_SLTN	Oct-Dec 2019	45.0	998.4	91.5	9
LTN_PPR	Feb-Mar 2020	42.8	993.3	81.4	12
NMT01	Jun-Sep 2019	62.9	1014.2	73.9	5
MNT02	Jun-Sep 2019	63.0	1014.2	70.6	9
NMT03	Jun-Sep 2019	62.7	1014.2	71.1	9

6.9 Approach Profile Analysis

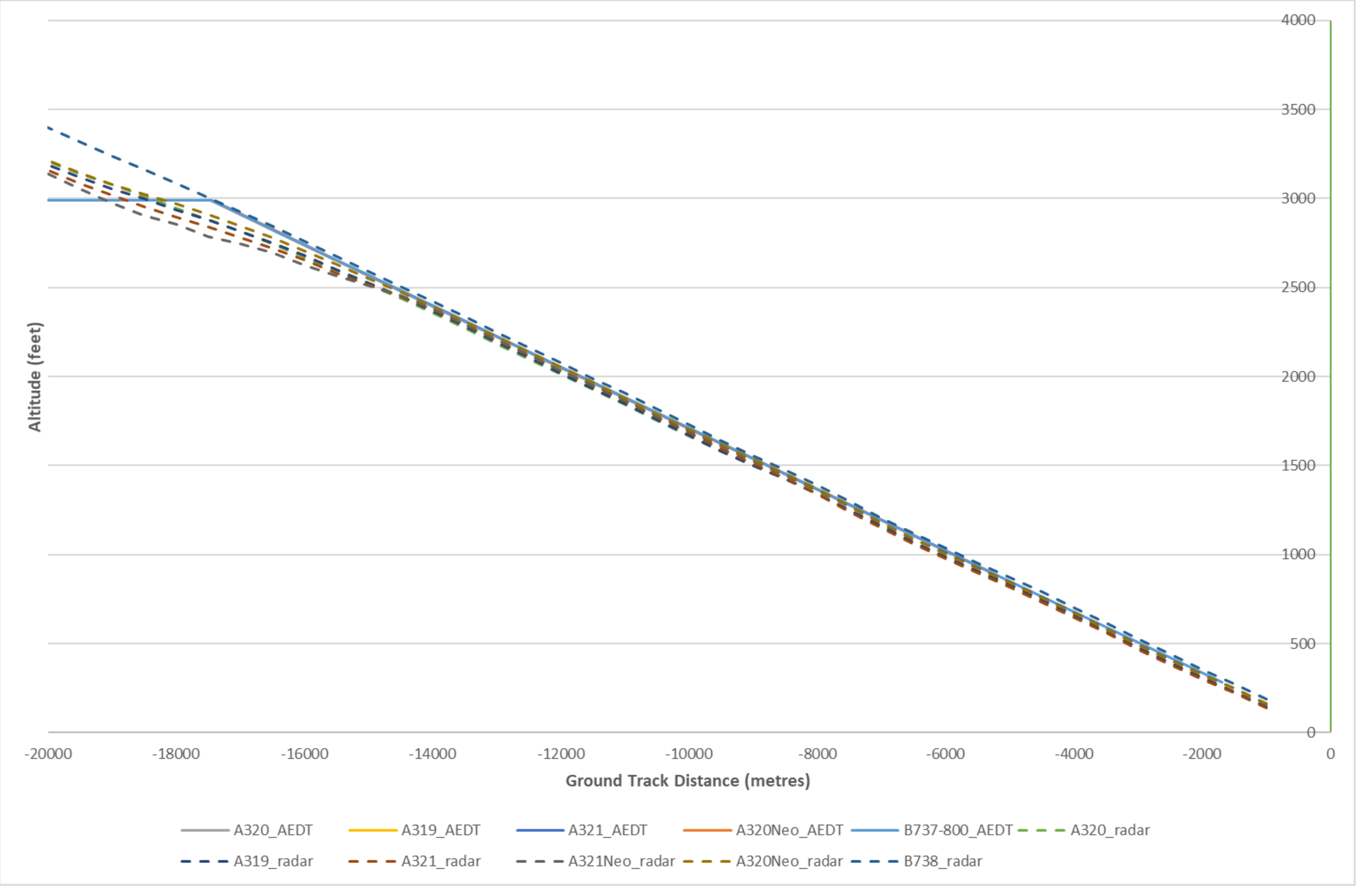
6.9.1 The number of data samples for each aircraft along each approach route are presented in Table 6.9. As aircraft approach procedures are consistent regardless of the runway direction, the total approach samples for each aircraft variant have been grouped together.

Table 6.9: 2019 Radar Data Samples per Aircraft Approach

Aircraft	Approach Data Samples
A319	2,193
A320	4,465
A320Neo	472
A321	1,884
A321Neo	170
B737-800	1,747

6.9.2 Comparison of the 50th percentile of total radar data for each aircraft against the default approach profiles is presented in Inset 6.2. The default AEDT profiles for each aircraft are identical so only the B737-800 AEDT profile is visible as it is on top of the other AEDT aircraft approach profiles.

6.9.3 The default approach profiles show a good correlation with radar data up to a distance within approximately 15km to the runway threshold. As the maximum extent of approach contours for all scenarios is equivalent to this distance from the runway threshold, the default approach profiles from AEDT are considered to be appropriate for modelling aircraft approach noise.



Inset 6.2: Approach Profile Analysis

6.10 Approach Noise Testing

6.10.1 Results comparing measured and predicted SEL noise levels for aircraft approaches are presented in Table 6.10 to Table 6.14.

Table 6.10: A319 SEL Approach Noise Prediction Testing

Runway	Location	Measured SELdB	Predicted SELdB	DifferencedB
07	LTN_DGN	75.1	74.9	-0.2
	LTN_KNS	82.8	82.3	-0.5
	LTN_CAD	85.1	84.9	-0.2
	LTN_SLTN	82.2	85.6	+3.4
25	LTN_STV	77.1	77.0	-0.1
	NMT01	84.8	85.4	+0.6
	LTN_BG	84.4	85.7	+1.3

Table 6.11: A320 SEL Approach Noise Prediction Testing

Runway	Location	Measured SELdB	Predicted SELdB	DifferencedB
07	LTN_DGN	75.6	76.8	+1.2
	LTN_KNS	82.7	83.1	+0.4
	LTN_CAD	84.6	85.5	+0.9
	LTN_SLTN	80.1	86.2	+6.1
25	LTN_STV	77.3	78.3	+1.0~~1~~
	NMT01	84.5	85.9	+1.4
	LTN_BG	83.8	86.2	+2.4

Table 6.12: A320Neo SEL Approach Noise Prediction Testing

Runway	Location	Measured SELdB	Predicted SELdB	DifferencedB
07	LTN_DGN	75.2	73.5	-1.7
	LTN_KNS	82.2	81.5	-0.7
	LTN_CAD	83.7	83.8	+0.1
	LTN_SLTN	80.1	84.4	+4.3
25	LTN_STV	76.1	75.2	-0.9
	NMT01	83.8	84.2	+0.4
	LTN_BG	82.6	84.4	+1.8

Table 6.13: A321 SEL Approach Noise Prediction Testing

Runway	Location	Measured SELdB	Predicted SELdB	DifferencedB
07	LTN_DGN	75.6	75.1	-0.5
	LTN_KNS	82.5	82.6	+0.1

Runway	Location	Measured SELdB	Predicted SELdB	DifferencedB
	LTN_CAD	84.2	85.2	+1.0
	LTN_SLTN	80.4	86.0	+5.6
25	LTN_STV	76.4	77.3	+0.9
	NMT01	84.2	85.7	+1.5
	LTN_BG	~~82.7~~83.0	86.0	+3.0

Table 6.14: A321Neo SEL Approach Noise Prediction Testing

Runway	Location	Measured SELdB	Predicted SELdB	DifferencedB
07	LTN_DGN	74.6	73.5	-1.1
	LTN_KNS	83.4	81.5	-1.9
	LTN_CAD	85.2	83.8	-1.4
	LTN_SLTN	81.8	84.4	+~~-~~2.6
25	LTN_STV	76.7	75.2	-1.5
	NMT01	84.7	84.2	-0.5
	LTN_BG	84.2	84.4	-0.2

Table 6.15: B737-800 SEL Approach Noise Prediction Testing

Runway	Location	Measured SELdB	Predicted SELdB	DifferencedB
07	LTN_DGN	76.2	78.5	+2.3
	LTN_KNS	82.7	83.3	+0.6
	LTN_CAD	85.7	85.7	0.0
	LTN_SLTN	84.6	86.3	+1.7
25	LTN_STV	77.0	79.6	+2.6
	NMT01	85.6	86.1	+0.5
	LTN_BG	86.2	86.3	+0.1

6.10.2 There is some uncertainty over the results at LTN_SLTN. Whereas all other locations are reasonably consistent, a trend of overpredictions are noted at LTN_SLTN. It is expected that there would be some correlation in noise measurements at LTN_BG and LTN_SLTN as both locations are at a similar to their respective runway thresholds and located laterally (to the north) of approach tracks. However, this correlation is observed in noise predictions but not in the noise measurements. This leaves some uncertainty over the measured noise data at LTN_SLTN.

6.10.3 To try and understand why there may be discrepancies between measured and predicted levels at LTN_SLTN, consultation on the monitoring location was undertaken with LLAOL, who undertook the monitoring. A review of the monitoring data and the location did not reveal why there may be a discrepancy between measured and predicted levels. As such, LTN_SLTN has been omitted from the validation exercise. This is considered justifiable as it would result in a smaller correction applied to approaches, which would result in smaller noise contours (i.e. lower noise levels). This approach is considered to be conservative; however, the results of noise predictions at LTN_SLTN have been included for information.

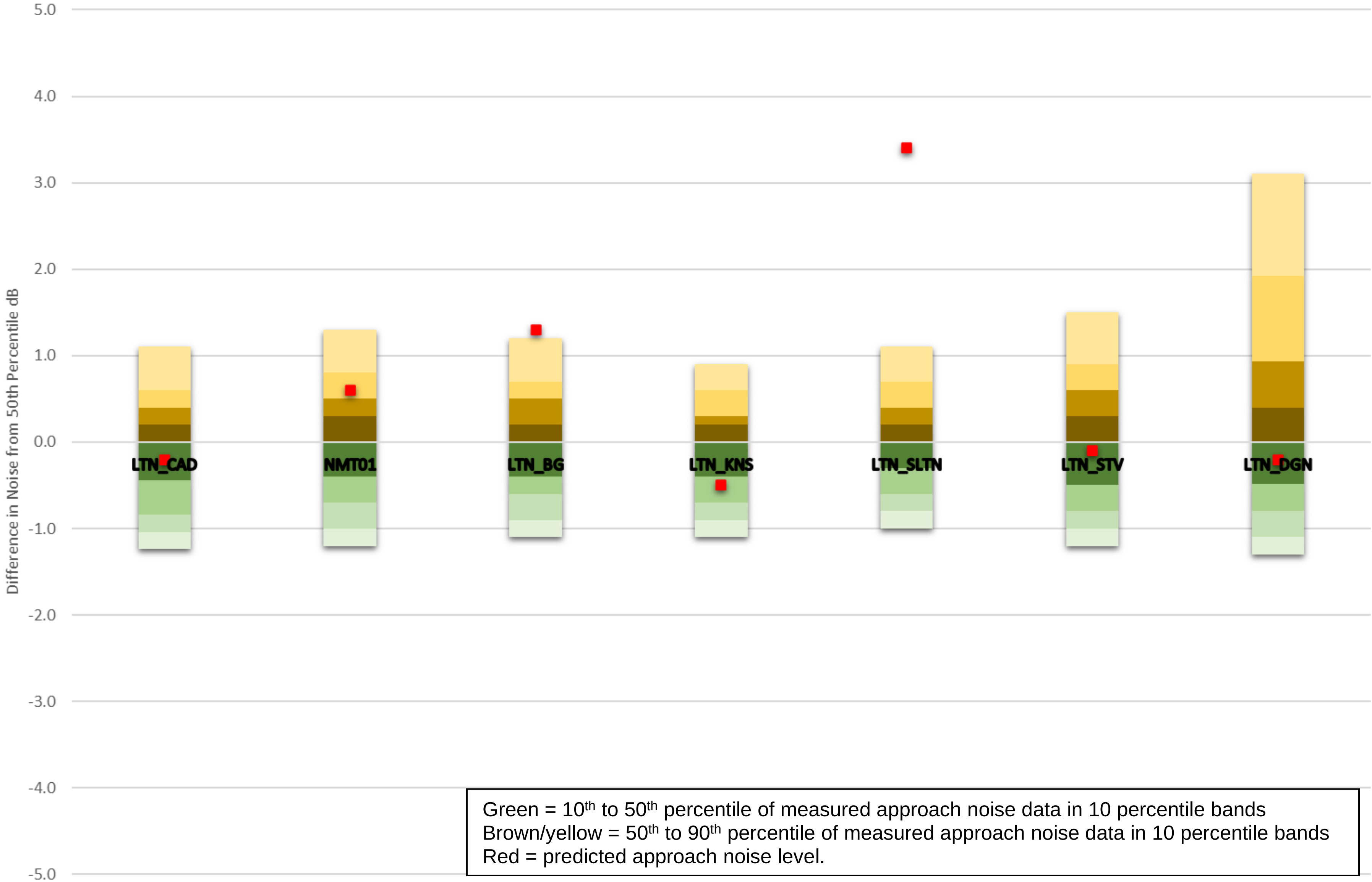
6.10.4 As 07 and 25 runway approaches will use the same procedures when flying over monitoring locations, the average of the difference between measured and predicted levels has been used to determine an approach noise correction for each aircraft. Corrections have been applied to individual aircraft types, so SEL approach noise predictions are more representative of measured data are presented in **Table 6.16.**

Table 6.16: SEL Approach Noise Corrections

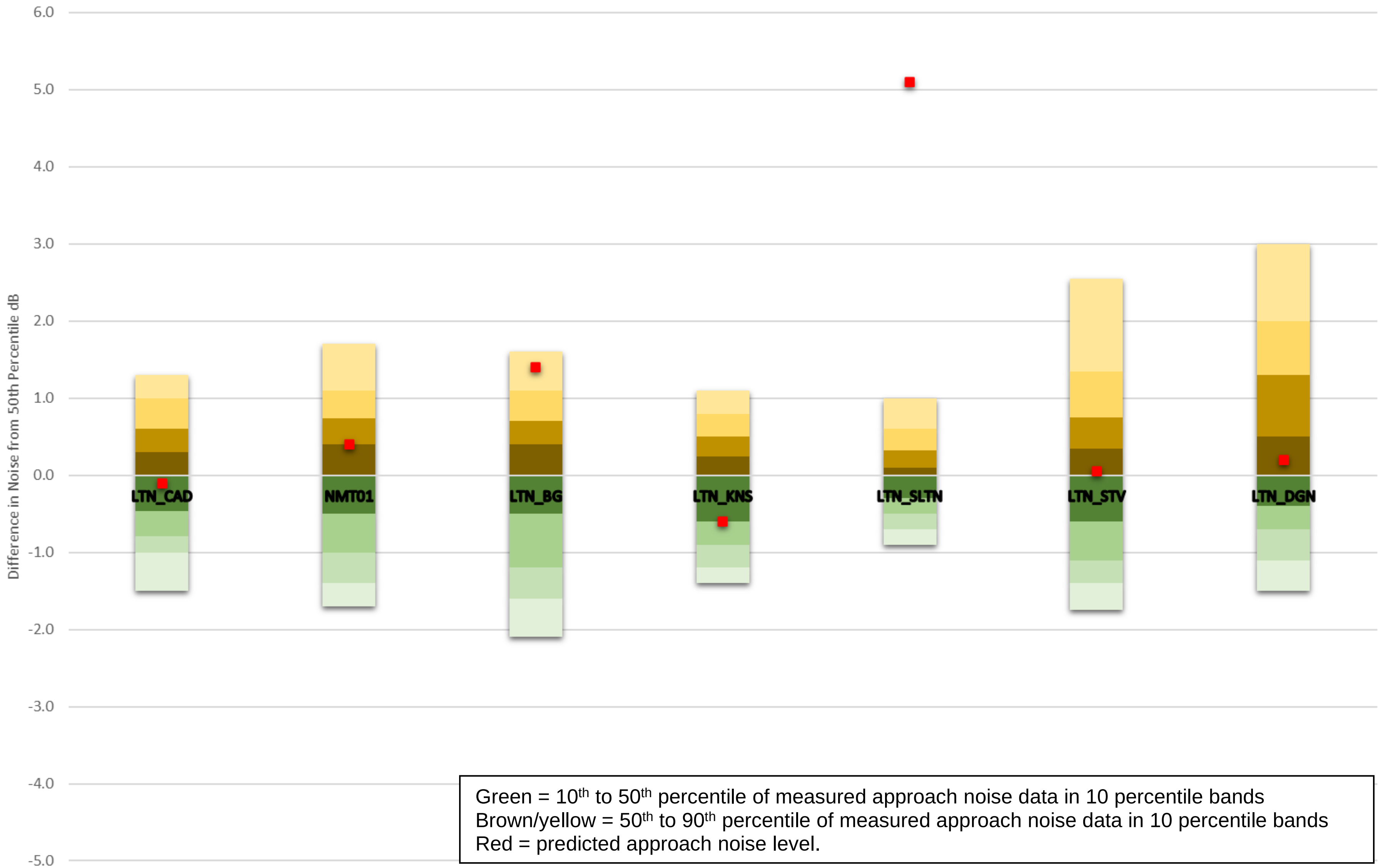
Aircraft	Approach Correction SELdB
A319	0.0
A320	-1.0
A320Neo	0.0
A321	-1.0
A321Neo	+1.0
B737-800	-1.0

6.10.5 A comparison of corrected SEL approach noise level predictions against the spread of measured noise data are presented in **Inset 6.3** to **Inset 6.7**. Each inset shows the difference in predicted noise (with correction applied) compared to the measured noise data for each aircraft. The measured noise data is set to zero for the 50^{th} percentile with the 10^{th} to 50^{th} percentile illustrated in green 10 percentile bands and the 50^{th} to 90^{th} percentiles illustrated in brown/yellow in 10 percentile bands.

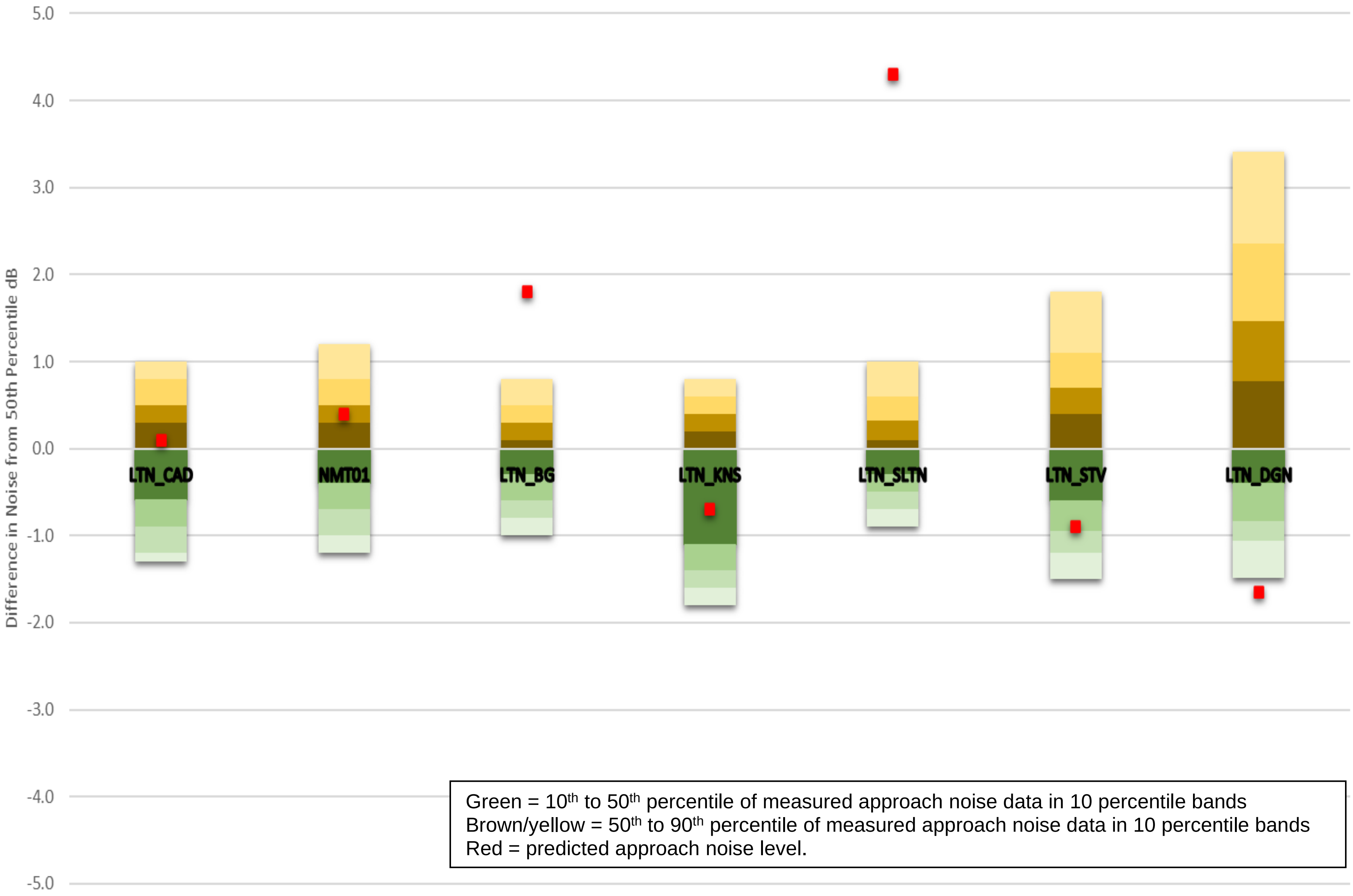
6.10.6 The majority of noise predictions are located within the range of measured noise data; however, there are some outliers that are still within a ±2dB range of the 50^{th} percentile. The exception to this is at LTN_SLTN at which there is consistent overpredictions of between 3 and 5dB for all aircraft except for the B737-800.



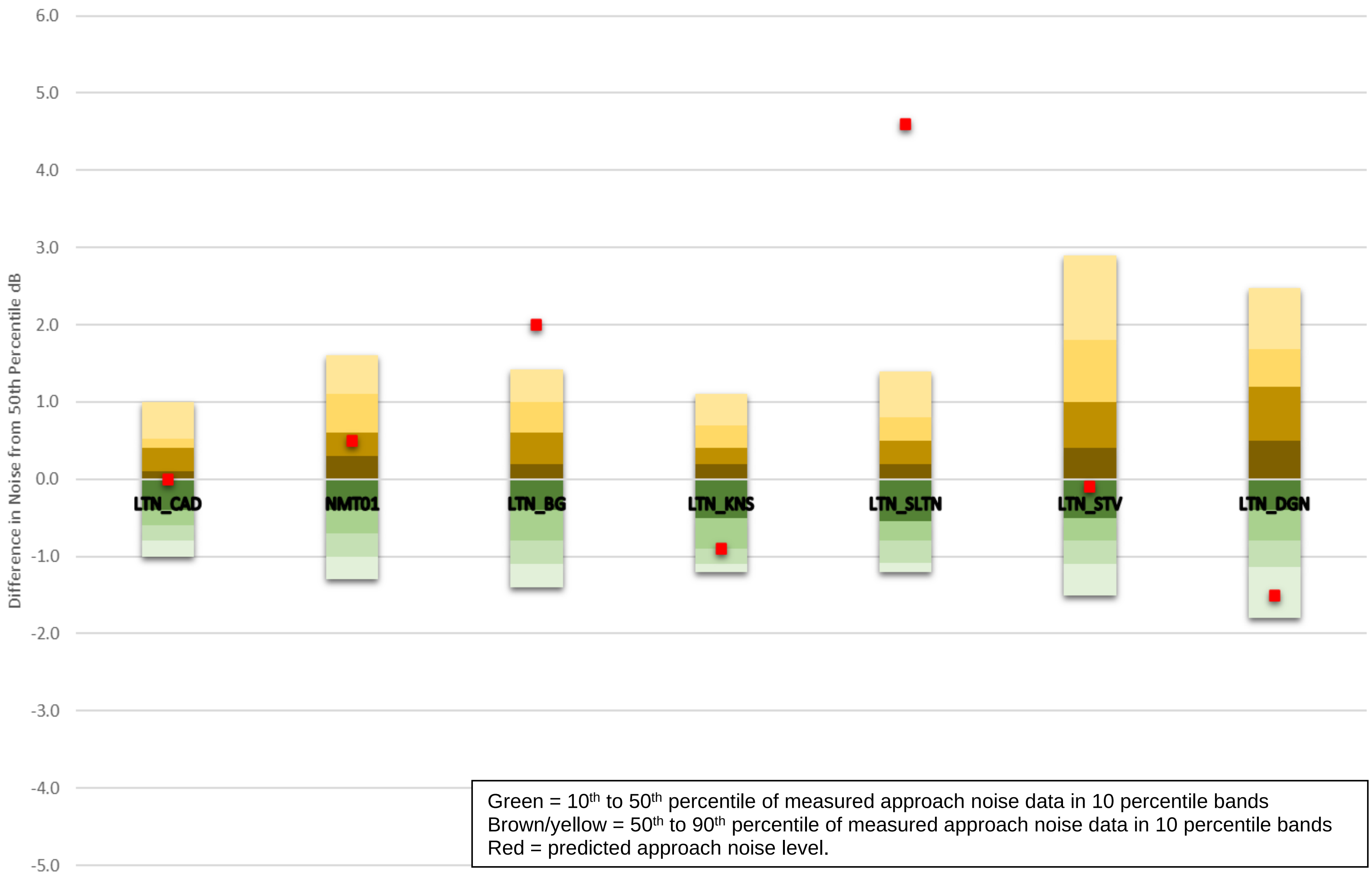
Inset 6.3: A319 SEL Approach Noise Testing



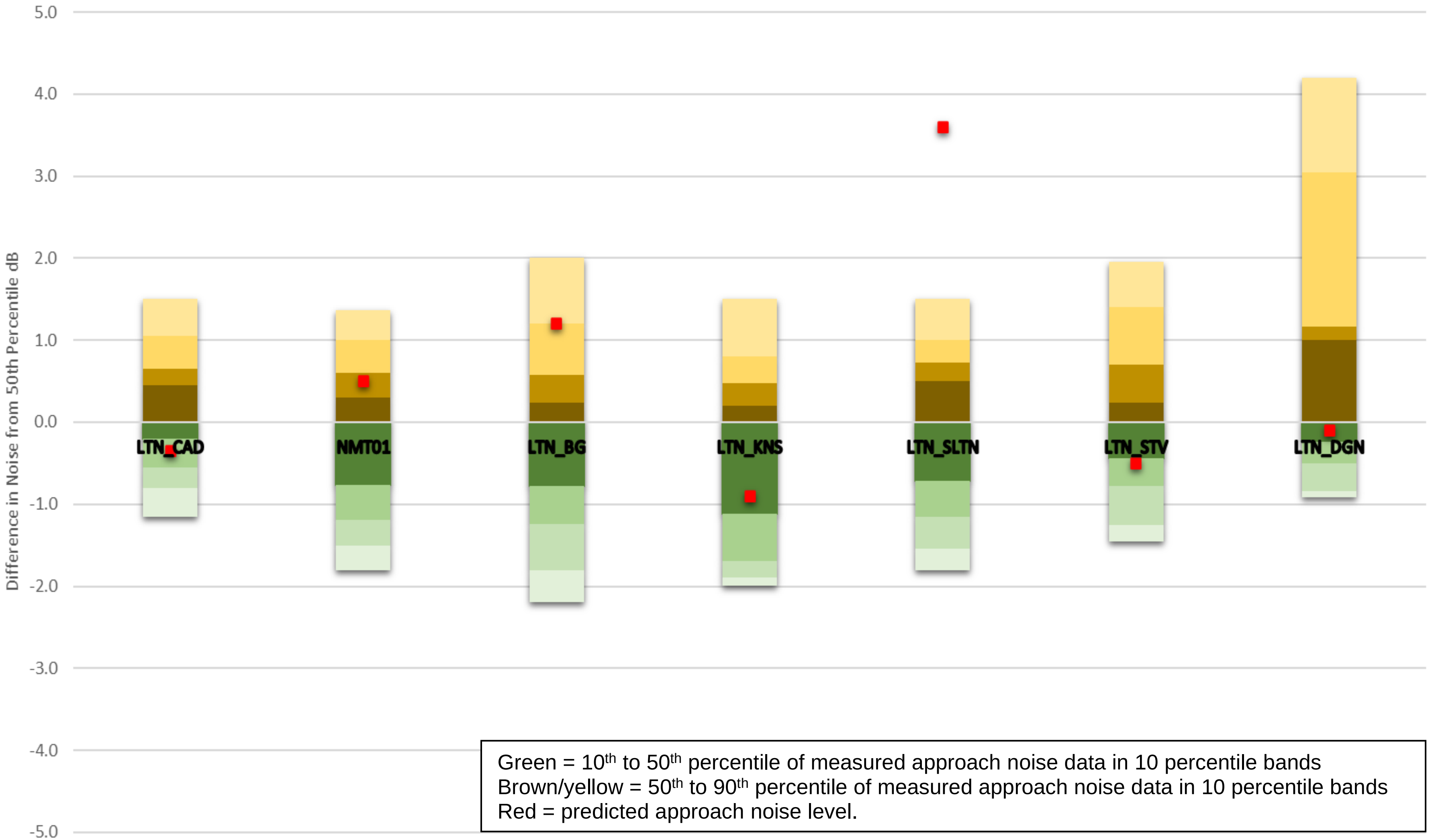
Inset 6.4: A320 SEL Approach Noise Testing



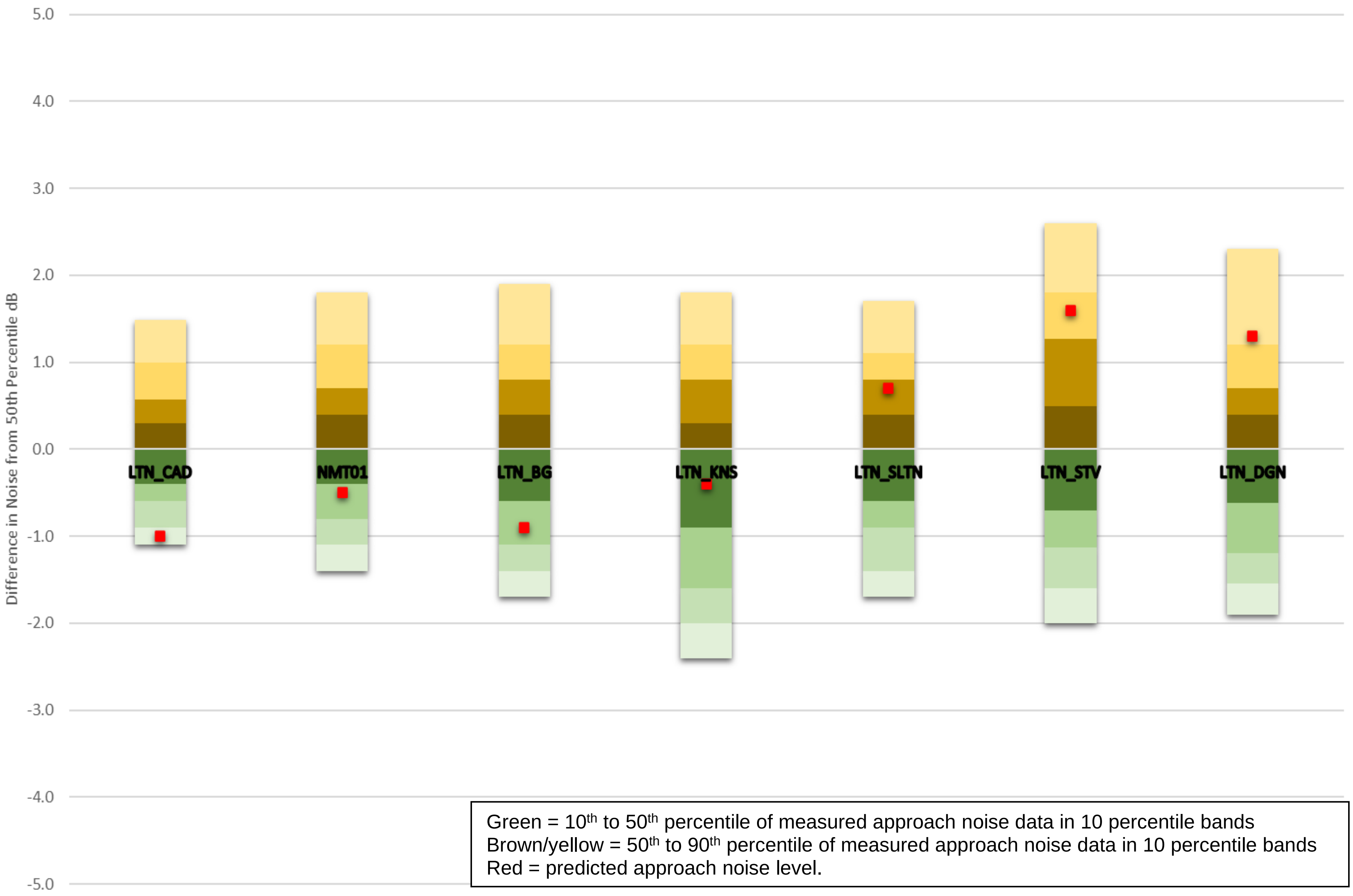
Inset 6.5: A320Neo SEL Approach Noise Testing



Inset 6.6: A321 SEL Approach Noise Testing



Inset 6.7: A321Neo SEL Approach Noise Testing



Inset 6.8: B737-800 SEL Approach Noise Testing

6.10.7 Results comparing measured and predicted L_{ASmax} noise levels for aircraft approaches are presented in Table 6.17 to Table 6.22.

Table 6.17: A319 L_{ASmax} Approach Noise Prediction Testing

Runway	Location	Measured L_{ASmax}dB	Predicted L_{ASmax}dB	DifferencedB
07	LTN_DGN	65.2	62.4	-2.8
	LTN_KNS	72.5	70.7	-1.8
	LTN_CAD	76.6	74.4	-2.2
	LTN_SLTN	74.3	75.6	+1.3
25	LTN_STV	66.7	64.6	-2.1
	NMT01	75.0	74.9	-0.1
	LTN_BG	75.5	75.6	+0.1

Table 6.18: A320 L_{ASmax} Approach Noise Prediction Testing

Runway	Location	Measured L_{ASmax}dB	Predicted L_{ASmax}dB	DifferencedB
07	LTN_DGN	65.5	64.5	-1.0
	LTN_KNS	72.3	71.6	-0.7
	LTN_CAD	75.7	75.3	-0.4
	LTN_SLTN	73.5	76.4	+2.9
25	LTN_STV	66.4	66.4	0.0
	NMT01	74.6	75.7	+1.1
	LTN_BG	74.5	76.4	+1.9

Table 6.19: A320Neo L_{ASmax} Approach Noise Prediction Testing

Runway	Location	Measured L_{ASmax}dB	Predicted L_{ASmax}dB	DifferencedB
07	LTN_DGN	65.5	62.4	-3.1
	LTN_KNS	7~~2.0~~1.6	71.0	-0.~~5~~64
	LTN_CAD	74.7	74.5	-0.2
	LTN_SLTN	71.9	75.6	+3.7
25	LTN_STV	65.5	64.5	-1.0
	NMT01	73.4	75.0	+1.6
	LTN_BG	73.0	75.5	+2.5

Table 6.20: A321 L_{ASmax} Approach Noise Prediction Testing

Runway	Location	Measured L_{ASmax}dB	Predicted L_{ASmax}dB	DifferencedB
07	LTN_DGN	65.7	63.3	-2.4
	LTN_KNS	72.1	72.0	-0.1
	LTN_CAD	75.2	75.8	+0.6

Runway	Location	Measured L_{ASmax} dB	Predicted L_{ASmax} dB	Difference dB
	LTN_SLTN	72.7	77.0	+4.3
25	LTN_STV	65.6	65.4	-0.2
	NMT01	74.4	76.2	+1.8
	LTN_BG	73.6	77.0	+3.4

Table 6.21: A321Neo L_{ASmax} Approach Noise Prediction Testing

Runway	Location	Measured L_{ASmax} dB	Predicted L_{ASmax} dB	Difference dB
07	LTN_DGN	65.0	62.4	-2.6
	LTN_KNS	73.3	71.0	-2.3
	LTN_CAD	77.1	74.5	-2.6
	LTN_SLTN	74.0	75.6	+1.6
25	LTN_STV	65.8	64.5	-1.3
	NMT01	74.8	75.0	+0.2
	LTN_BG	75.6	75.5	-0.1

Table 6.22: B737-800 L_{ASmax} Approach Noise Prediction Testing

Runway	Location	Measured L_{ASmax} dB	Predicted L_{ASmax} dB	Difference dB
07	LTN_DGN	66.0	65.7	-0.3
	LTN_KNS	72.8	72.3	-0.5
	LTN_CAD	77.1	75.9	-1.2
	LTN_SLTN	77.0	77.0	0.0
25	LTN_STV	66.5	67.7	+1.2
	NMT01	75.9	76.4	+0.5
	LTN_BG	77.2	77.0	-0.2

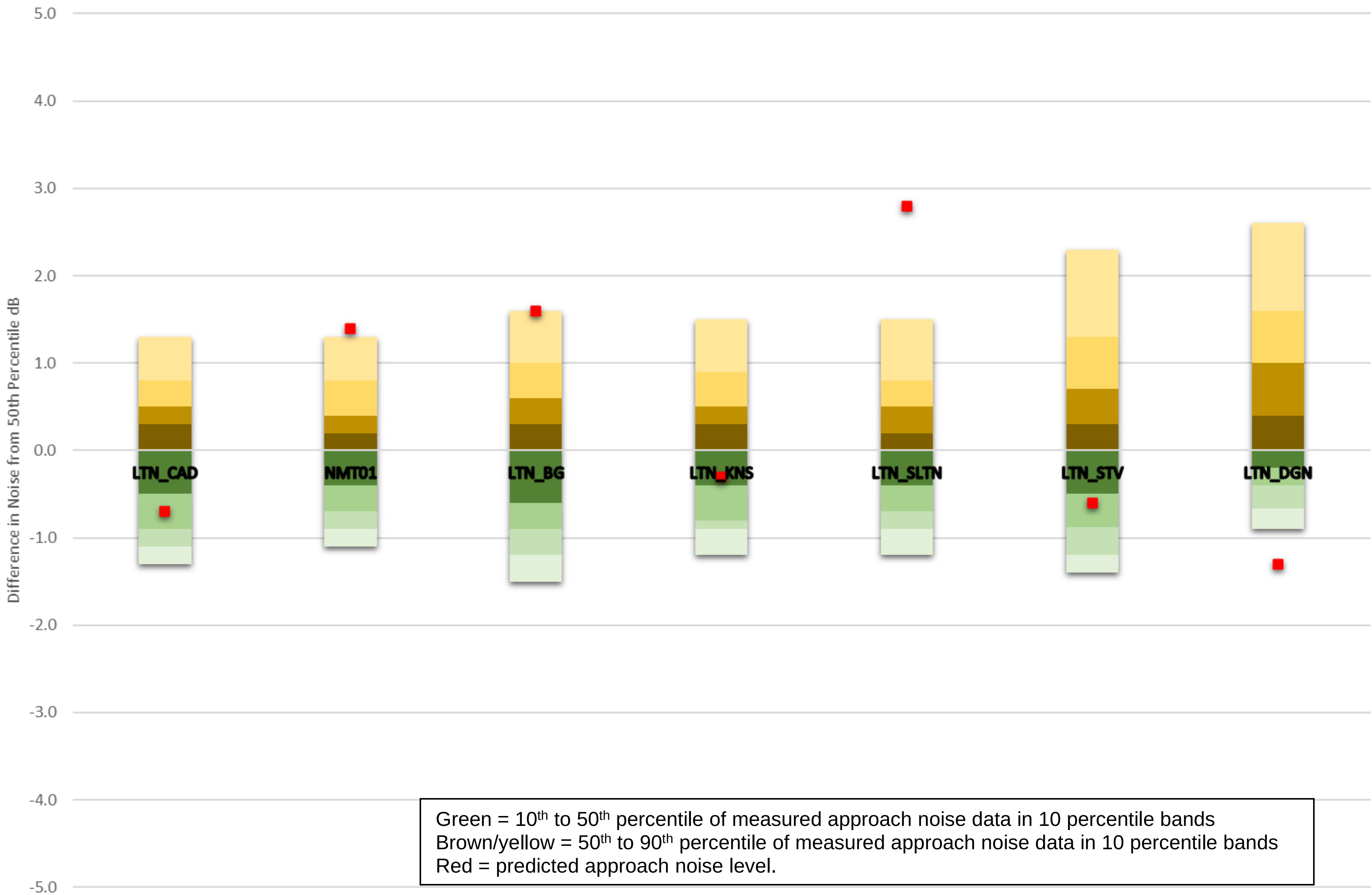
6.10.8 Corrections have been applied to individual aircraft types, so L_{ASmax} approach noise predictions are more representative of measured data are presented in Table 6.23.

Table 6.23: L_{ASmax} Approach Noise Corrections

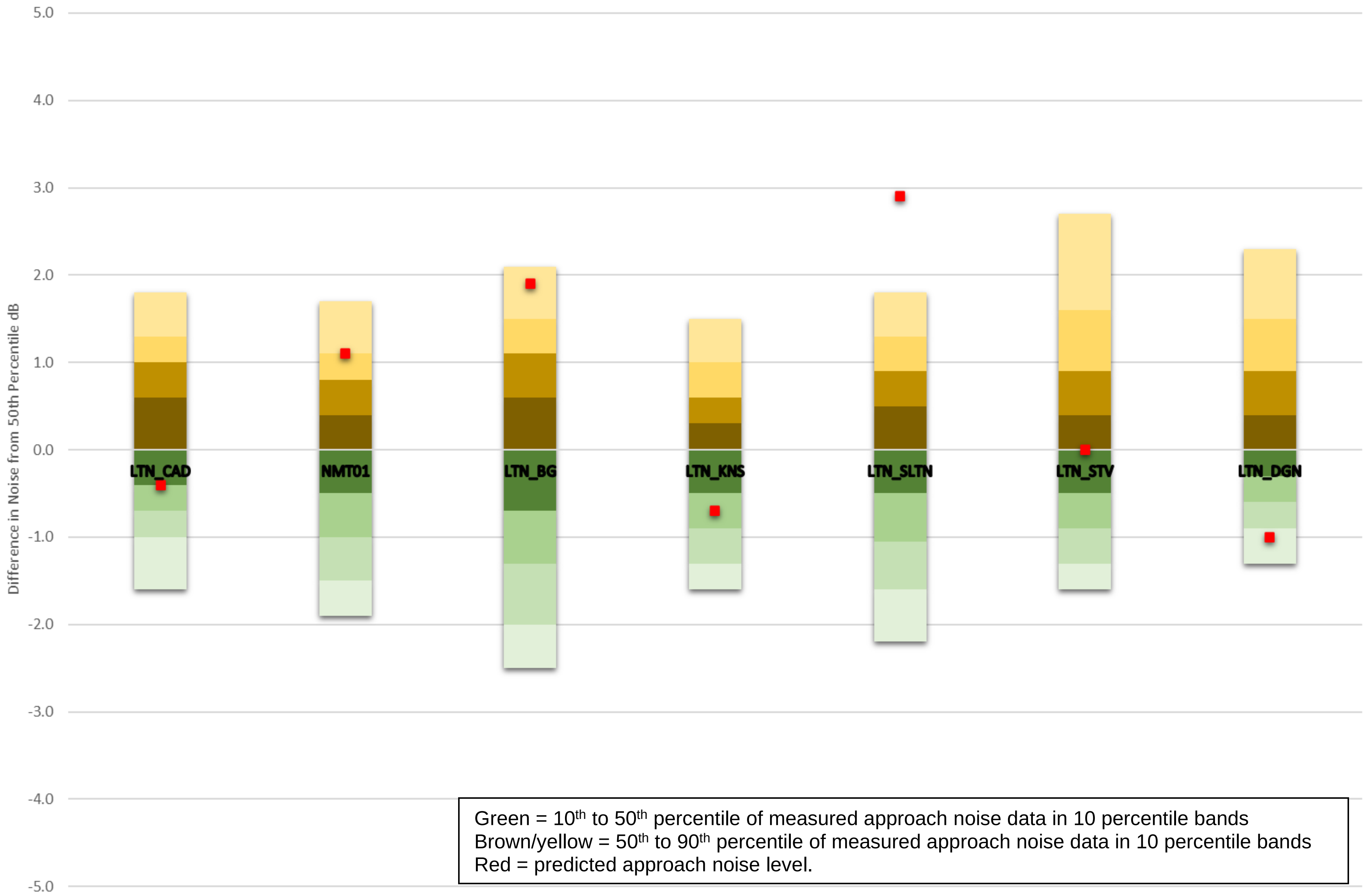
Aircraft	L_{ASmax} Approach Correction dB
A319	-1.5
A320	0.0
A320Neo	0.0
A321	-0.5
A321Neo	+1.5
B737-800	0.0

6.10.9 A comparison of corrected approach noise level predictions against the spread of measured noise data are presented in Inset 6.9 to Inset 6.7. Each inset shows the difference in predicted noise (with correction applied) compared to the measured noise data for each aircraft. The measured noise data is set to zero for the 50th percentile with the 10th to 50th percentile illustrated in green 10 percentile bands and the 50th to 90th percentiles illustrated in brown/yellow in 10 percentile bands.

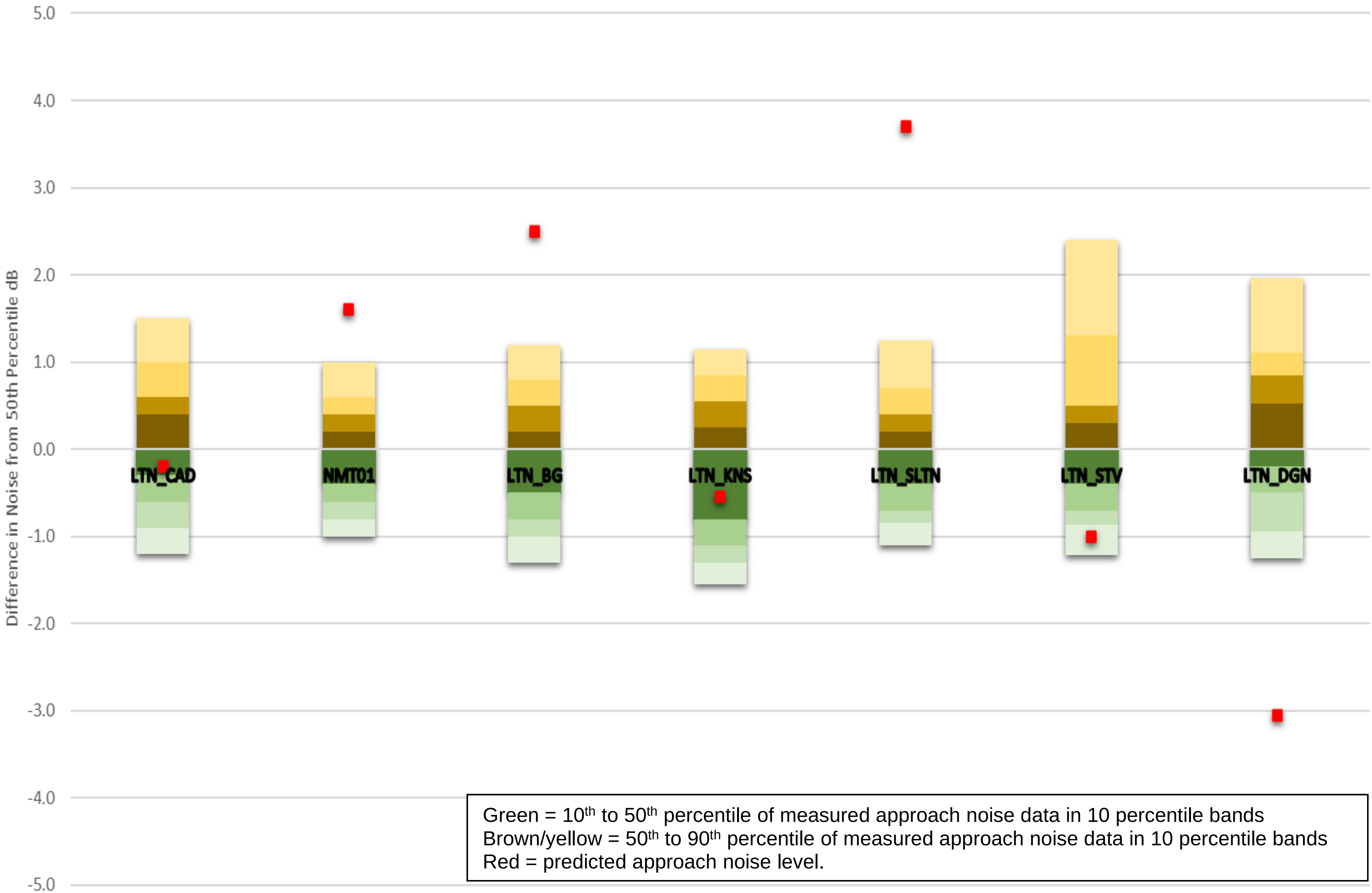
6.10.10 The majority of noise predictions are located within the range of measured noise data; however, there are some outliers that are still within a ±3dB range of the 50th percentile. The exception to this is at LTN_SLTN at which there is consistent overpredictions of between 3 and 5dB for all aircraft except for the B737-800.



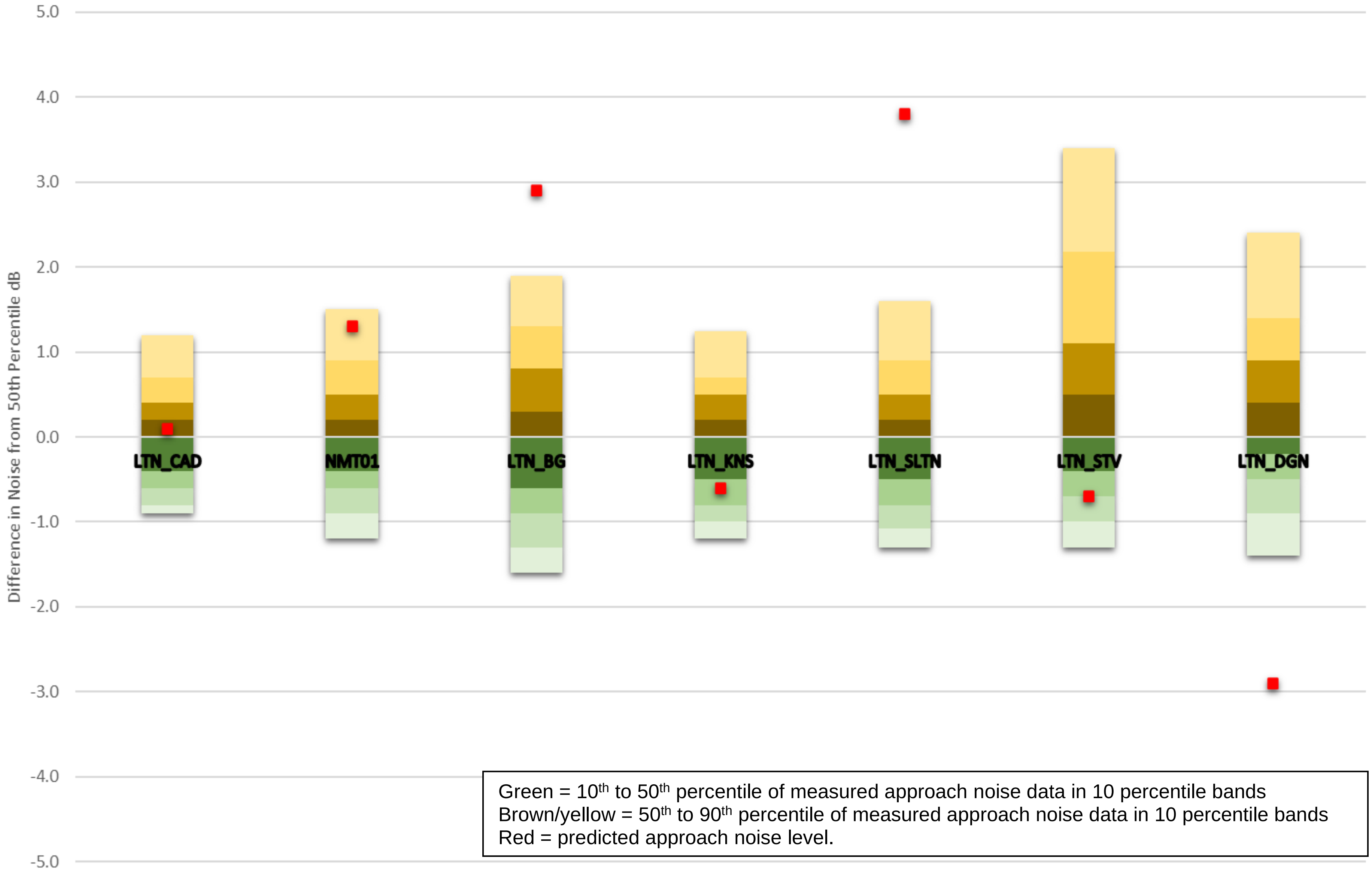
Inset 6.9: A319 L_{ASmax} Approach Noise Testing



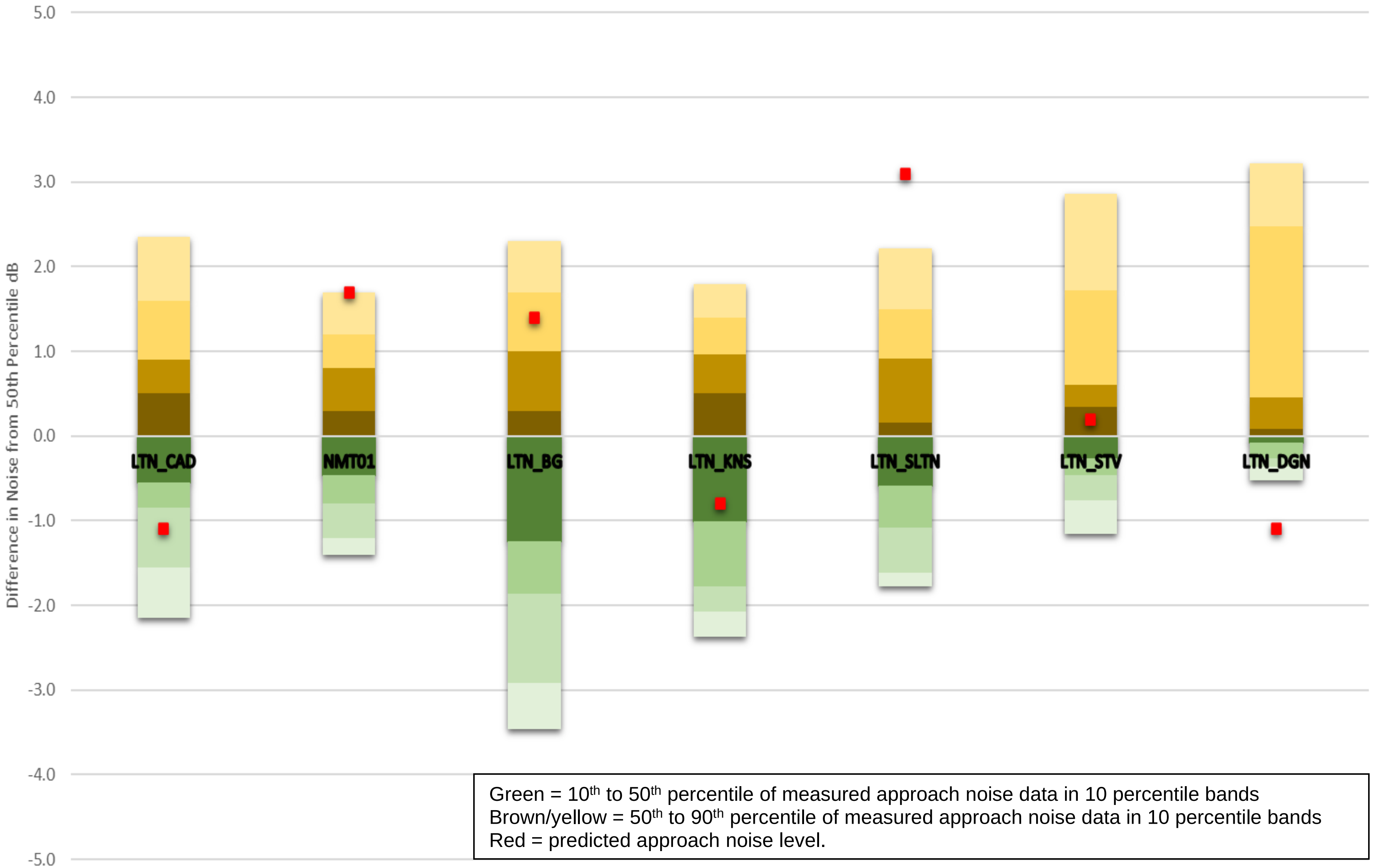
Inset 6.10: A320 L_{ASmax} Approach Noise Testing



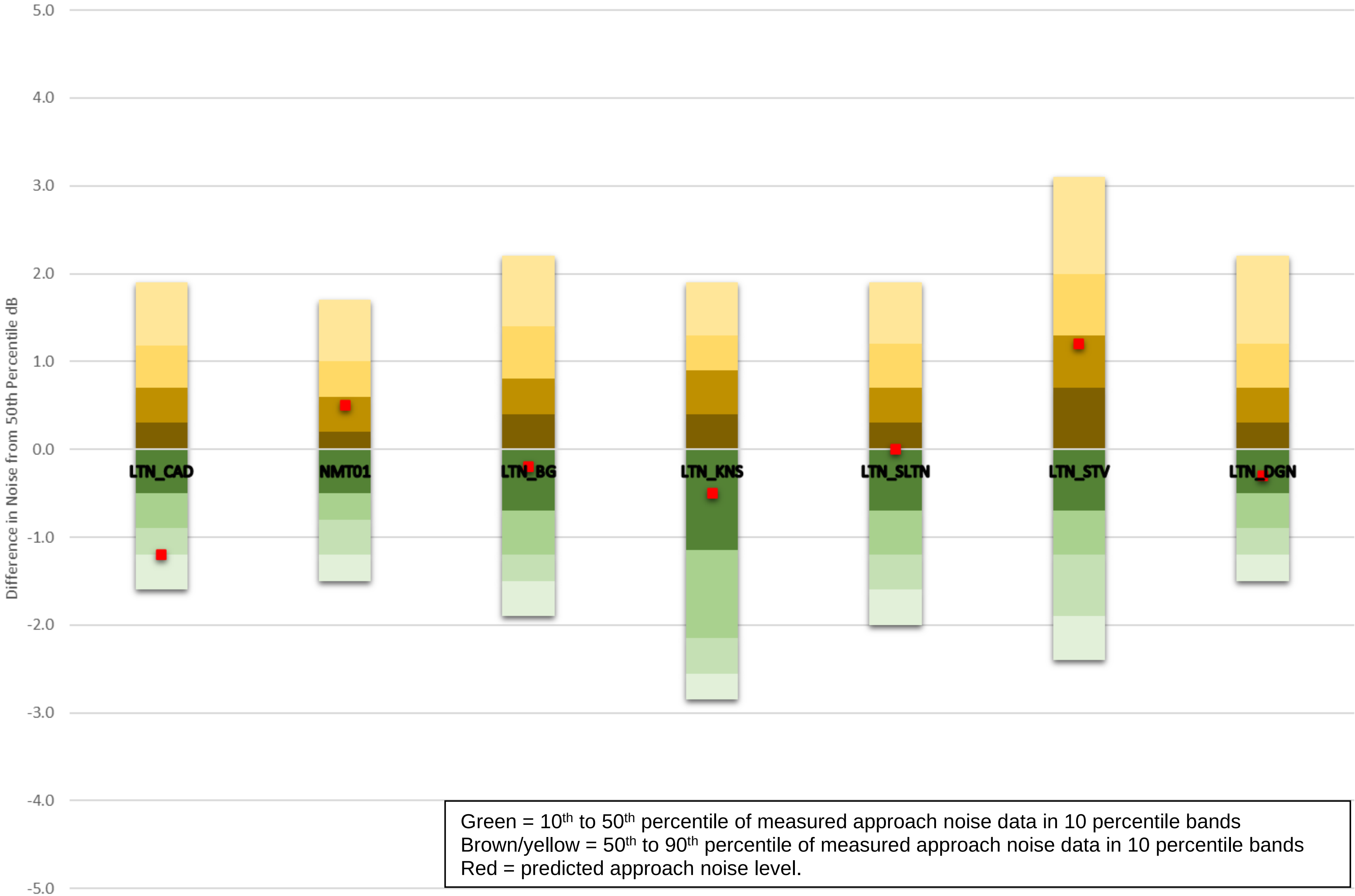
Inset 6.11: A320Neo L_{ASmax} Approach Noise Testing



Inset 6.12: A321 L_{ASmax} Approach Noise Testing



Inset 6.13: A321Neo L_{ASmax} Approach Noise Testing



Inset 6.14: B737-800 L_{ASmax} Approach Noise Testing

6.11 Departure Profile Analysis

6.11.1 Speed and altitude departure profiles were analysed for each aircraft from 2019 radar data for the 92-day summer period. Aircraft profiles were analysed along the following routes:

a. 07 Compton (CPT);
b. 07 Detling (DET);
c. 07 Olney (OLN);
d. 25 Compton;
e. 25 Detling; and
f. 25 Olney.

6.11.2 Each route is named after a navigation beacon that direct aircraft. The CPT route directs aircraft west, the DET route directs aircraft east and the OLN route directs aircraft north.

6.11.3 Aircraft were analysed per carrier to see if there were any trends amongst different carriers that should be accounted for in noise modelling. The main carriers that operate at the airport in 2019 are:

a. easyJet (EZY);
b. Ryan~~ A~~air (RYA); and
c. Wizz Air (WZZ).

6.11.4 The number of data samples for each aircraft along each departure route are presented in Table 6.24. These are not total number of movements and relate only to the most prominent aircraft operating at the airport. Wizz Air only fly the DET route as all their aircraft fly routes to eastern Europe.

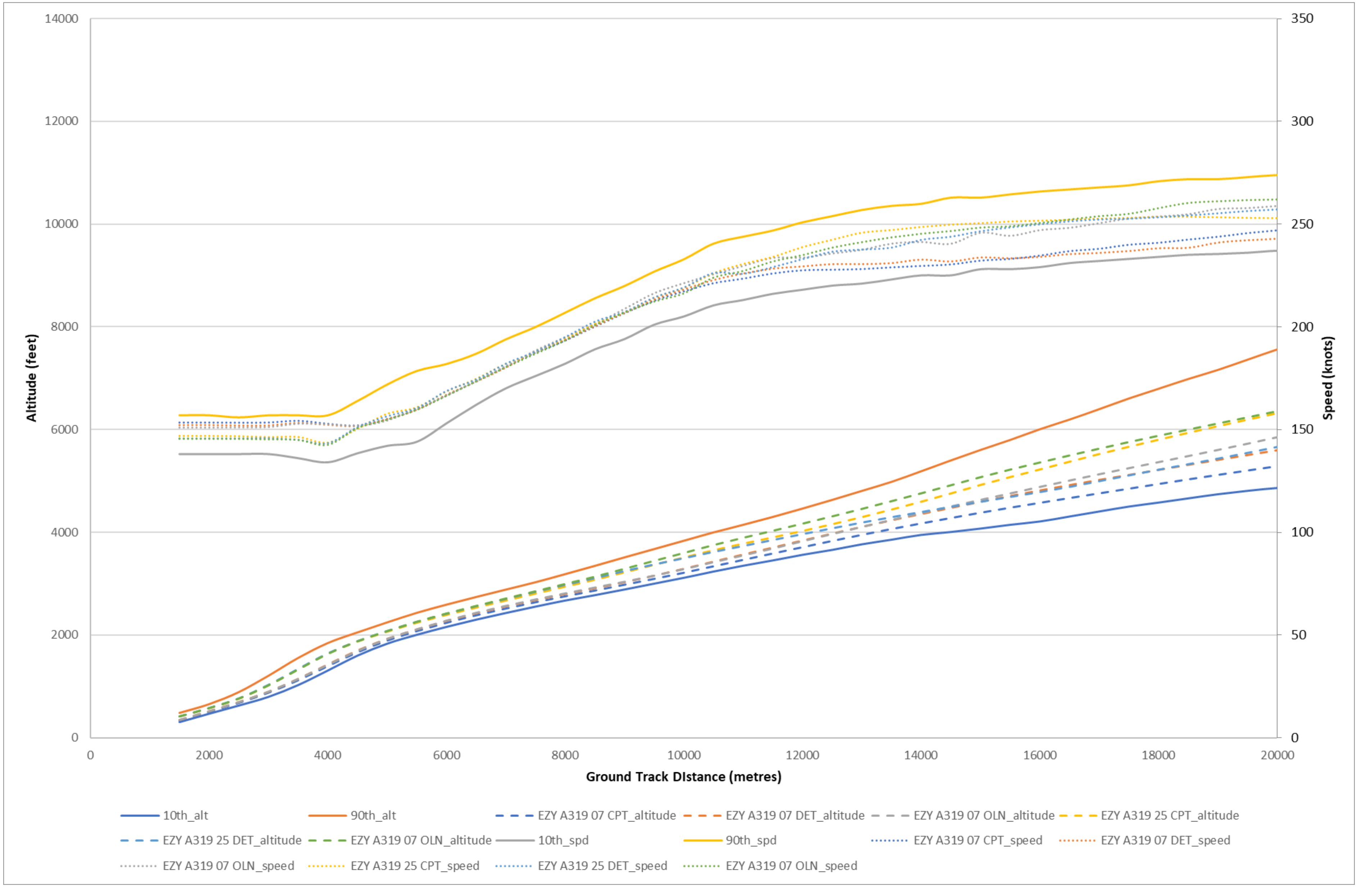
Table 6.24: 2019 Radar Data Samples per Aircraft Departure

Aircraft	07-runway			25-runway		
	CPT	DET	OLN	CPT	DET	OLN
A319_EZY	181	144	97	903	416	380
A320_EZY	208	186	48	948	509	204
A320_WZZ	-	394	-	-	1749	-
A320Neo_EZY	34	33	10	211	122	61
A321_WZZ	-	337	-	-	1399	-
A321Neo_WZZ	-	34	-	-	138	-
B737-800_RYA	149	89	31	651	241	185

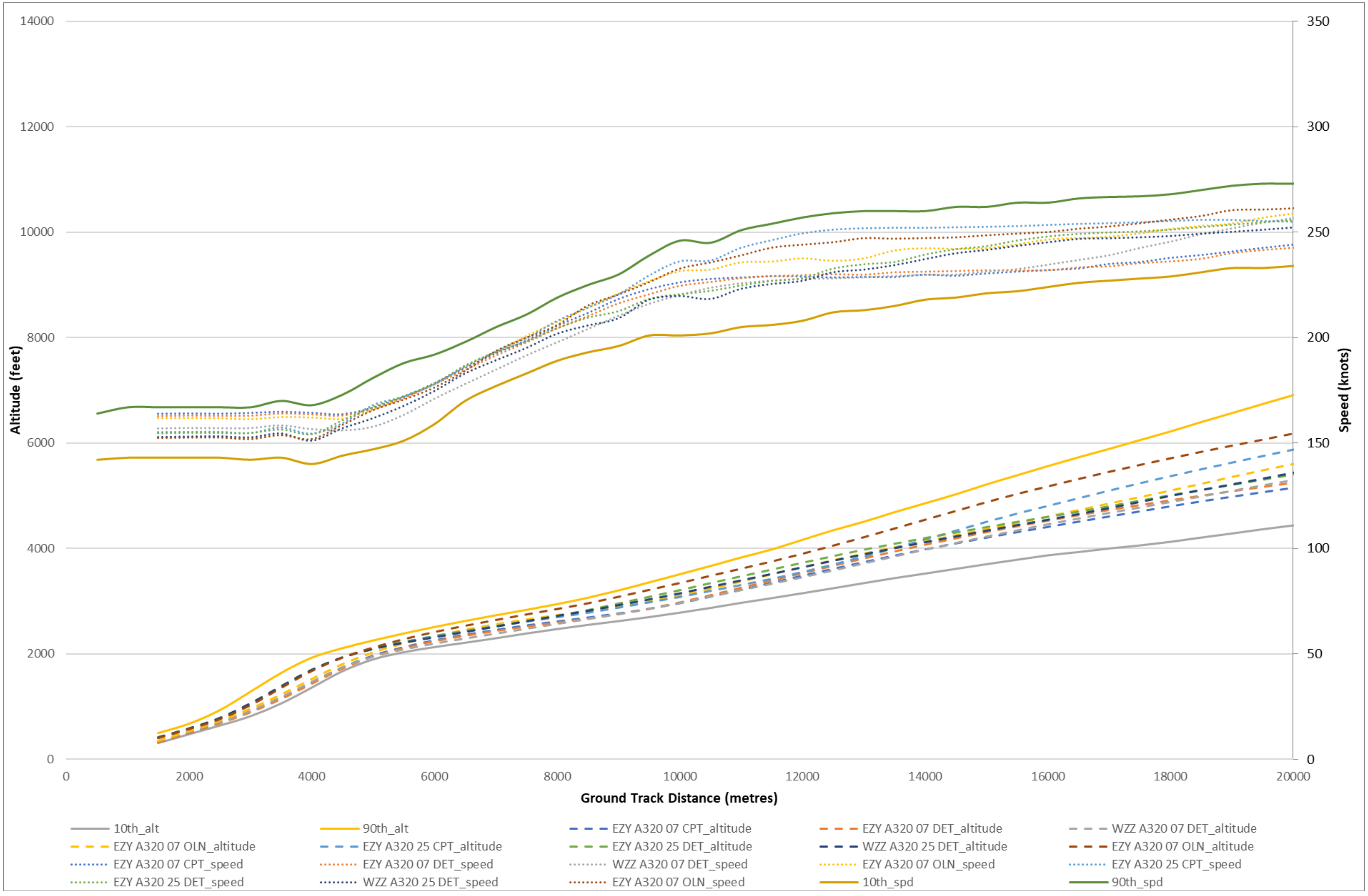
6.11.5 Inset 6.15 to Inset 6.20 show the results of analysis of departure radar data for each aircraft type. The analysis shows the average profile data for each aircraft type along each route with the 10th and 90th percentile of each total dataset.

6.11.6 The analysis demonstrates that each aircraft type flies similar profiles regardless of the route and data falls between the 10th and 90th percentiles of the respective total dataset. Consequently, the 10th and 90th percentiles for departure profiles has been used as an upper and lower boundary for validation.

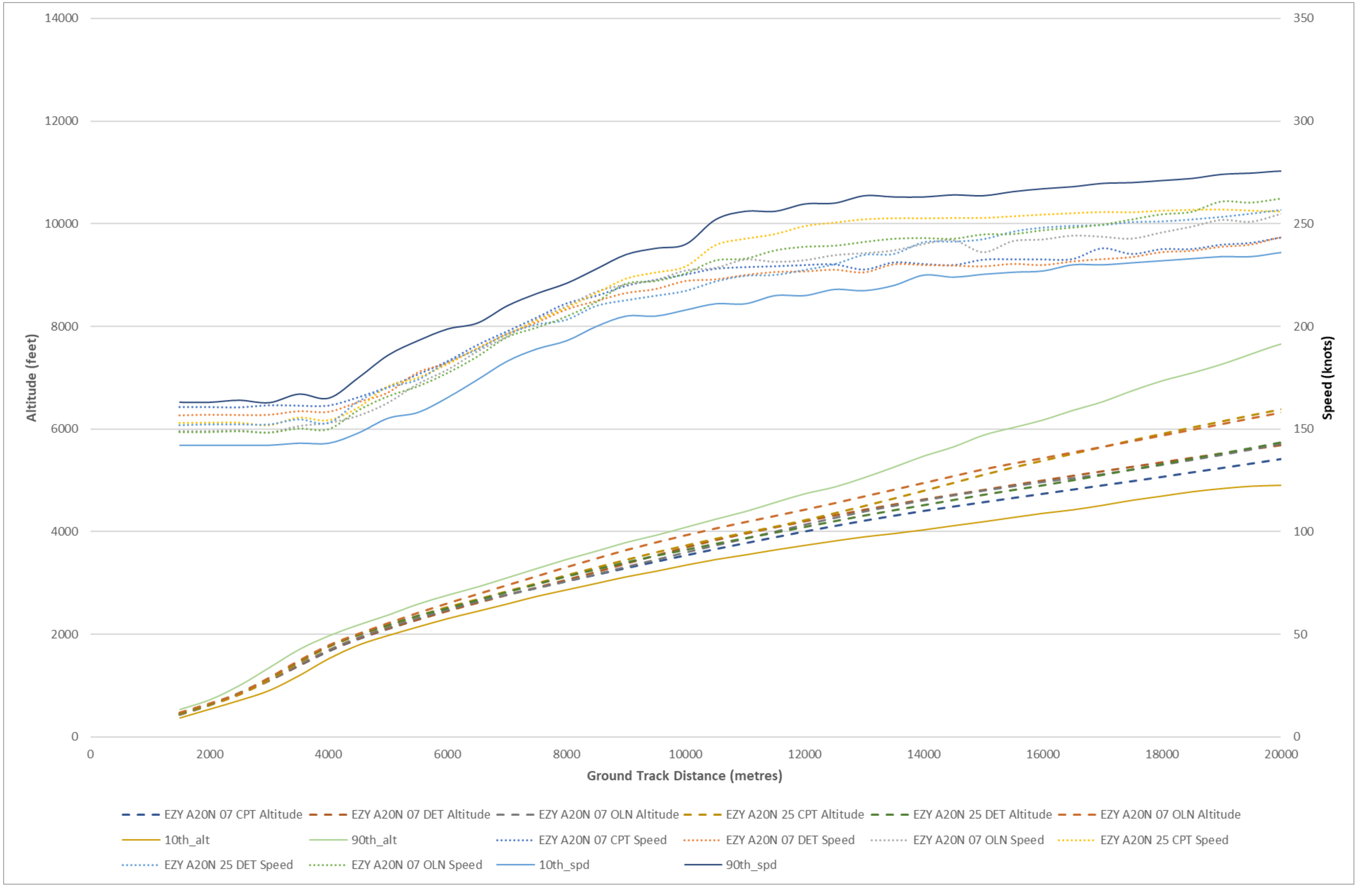
6.11.7 The analysis of departure profiles identifies a change in operating procedures for RYA B737-800 aircraft from the 25 runway. In the 2022 PEIR, it was identified from 2017 radar data that RYA would fly a different departure profile if they were departing from the 07 or 25 runway. However, 2019 radar data identifies that this trend no longer occurs and departures from the 25 runway use a similar profile to that flown from the 07 runway.



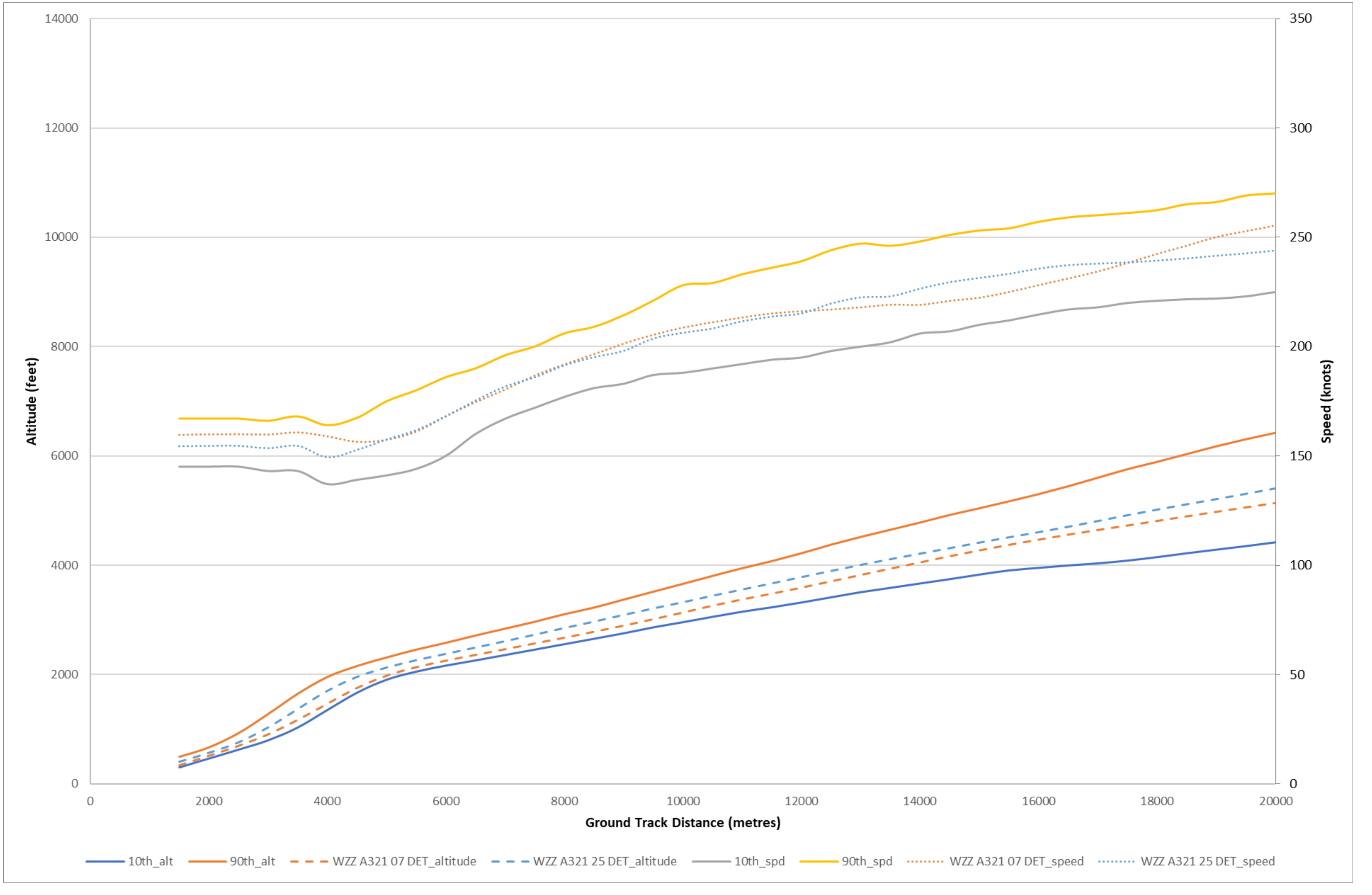
Inset 6.15: A319 Departure Profiles



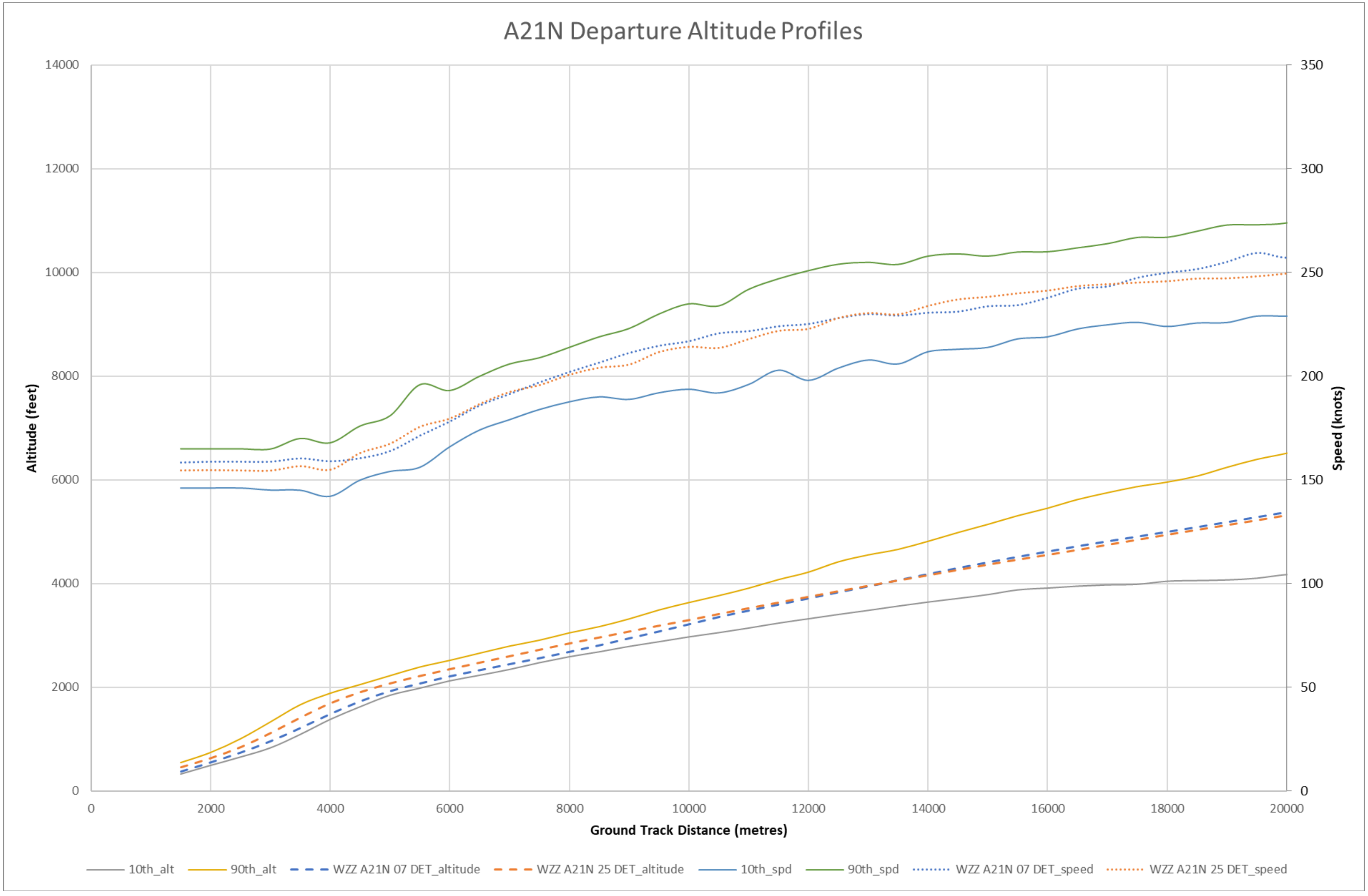
Inset 6.16: A320 Departure Profiles



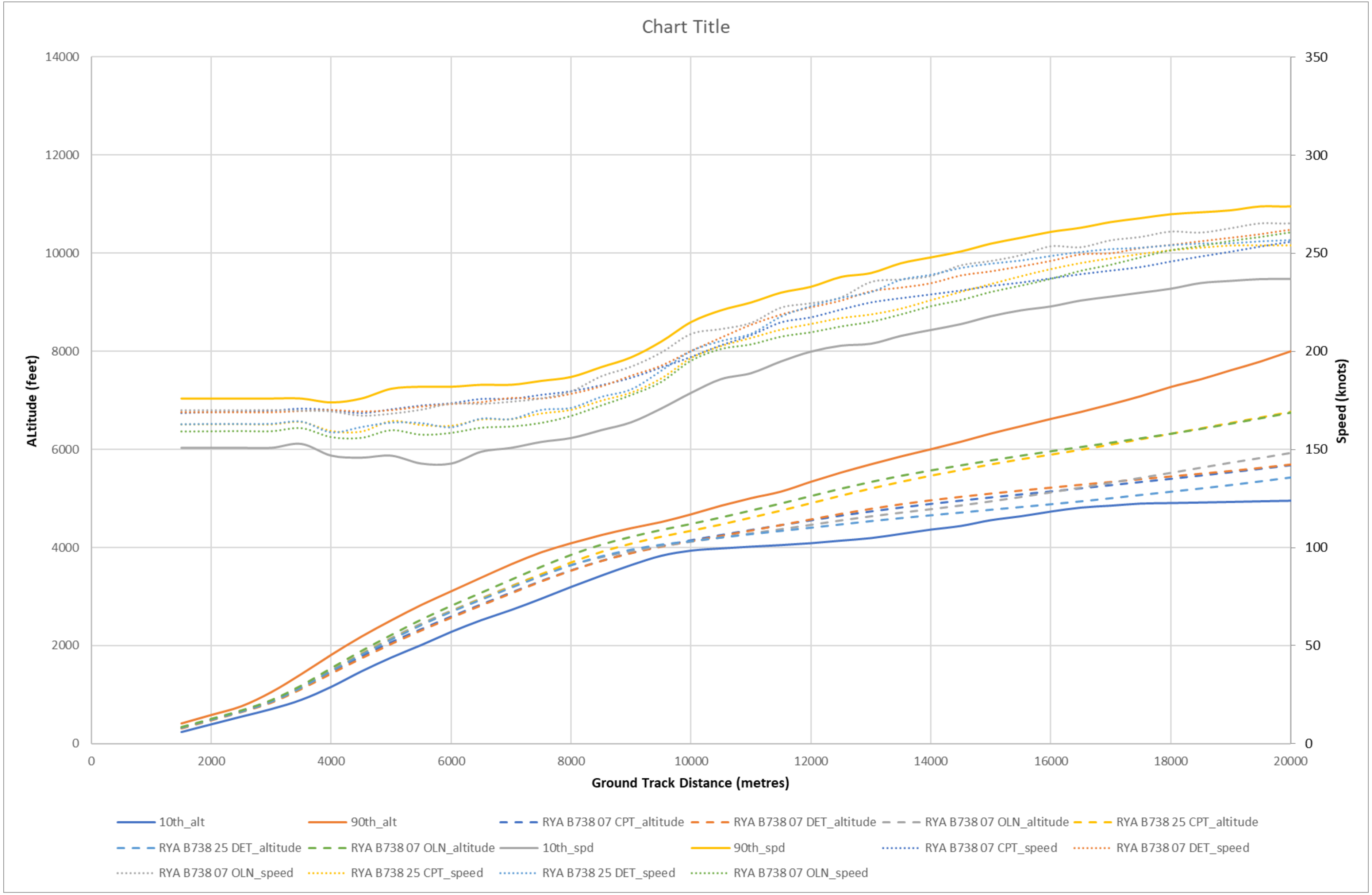
Inset 6.17: A320Neo Departure Profiles



Inset 6.18: A321 Departure Profiles



Inset 6.19: A321Neo Departure Profiles



Inset 6.20: B737-800 Departure Profiles

6.12 Departure Profile Testing

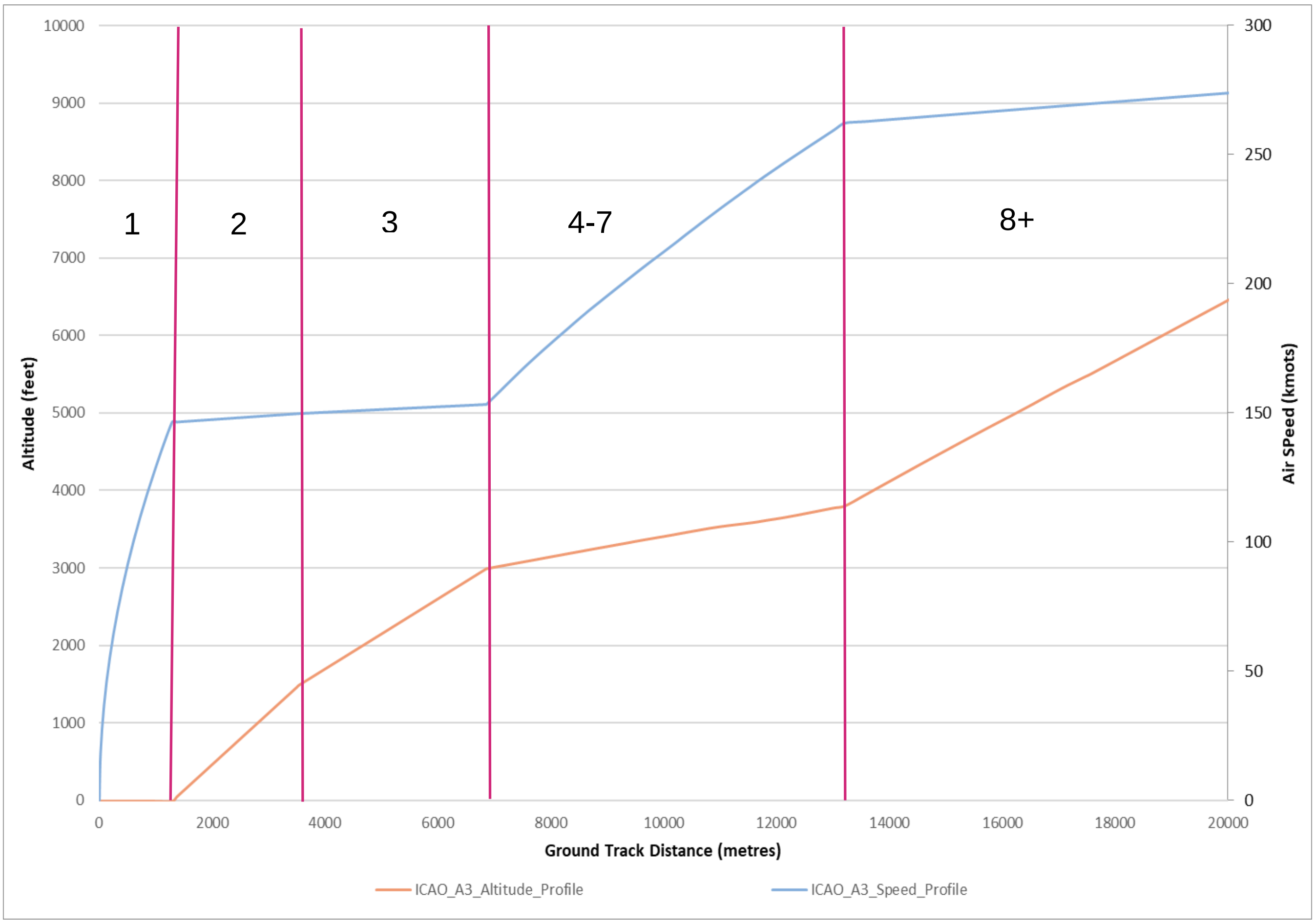
6.12.1 Default departure profiles are defined in AEDT as a series of ascents and accelerations. An example of a default departure profile for an A320 aircraft is presented in Inset 6.21. The departure profile is split into steps, which are described as follows:

a. Take--off – the aircraft increase in speed prior to take-off.
b. Climb – the aircraft speed remains reasonably constant whilst the aircraft increases altitude.
c. Accelerate – the aircraft altitude remains reasonably constant whilst the aircraft speed increases.

6.12.2 The altitude and speed profiles for the default departure are illustrated in Inset 6.22, which has been split into steps described in Inset 6.21. In the validation process, these steps are altered to match altitude and speed profiles from 2019 radar data as closely as possible.

Step Number	Step Type	Flap ID	Thrust Level	Altitude AFE (ft)	Calibrated Airspeed (kt)	Climb Rate (ft/min)
1	Takeoff	1+F	Max Takeoff			
2	Climb	1+F	Max Takeoff	1500		
3	Climb	1+F	Max Climb	3000		
4	Accelerate	1+F	Max Climb		194.1	730.3
5	Accelerate	1	Max Climb		207.6	868
6	Accelerate	ZERO	Max Climb		231.7	1021.8
7	Accelerate	ZERO	Max Climb		250	1115.4
8	Climb	ZERO	Max Climb	5500		
9	Climb	ZERO	Max Climb	7500		
10	Climb	ZERO	Max Climb	10000		

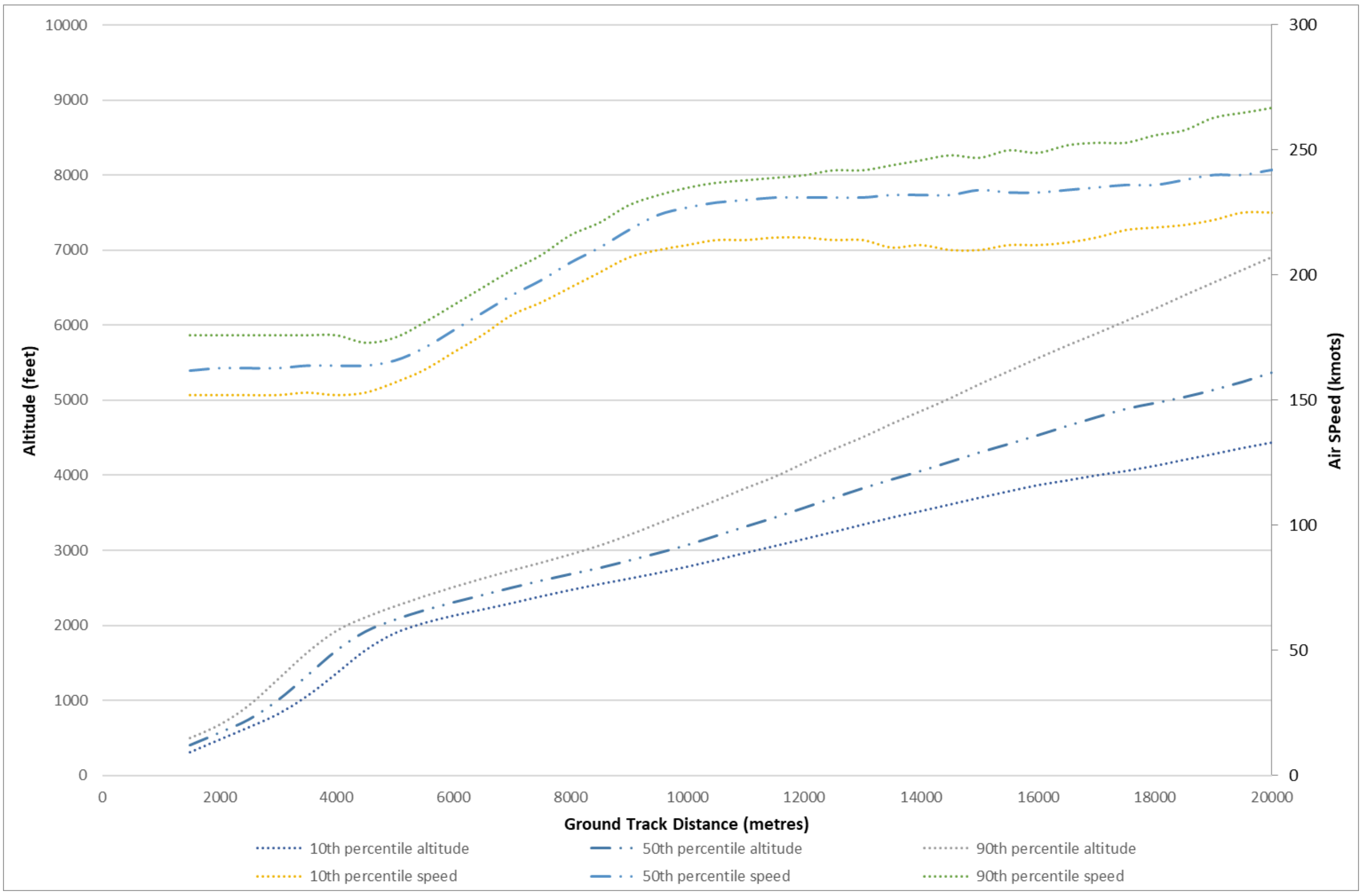
Inset 6.21: Example Default A320 Departure Profile Steps



Inset 6.22: Default A320 ICAO_A3 Departure Altitude and Speed Profile

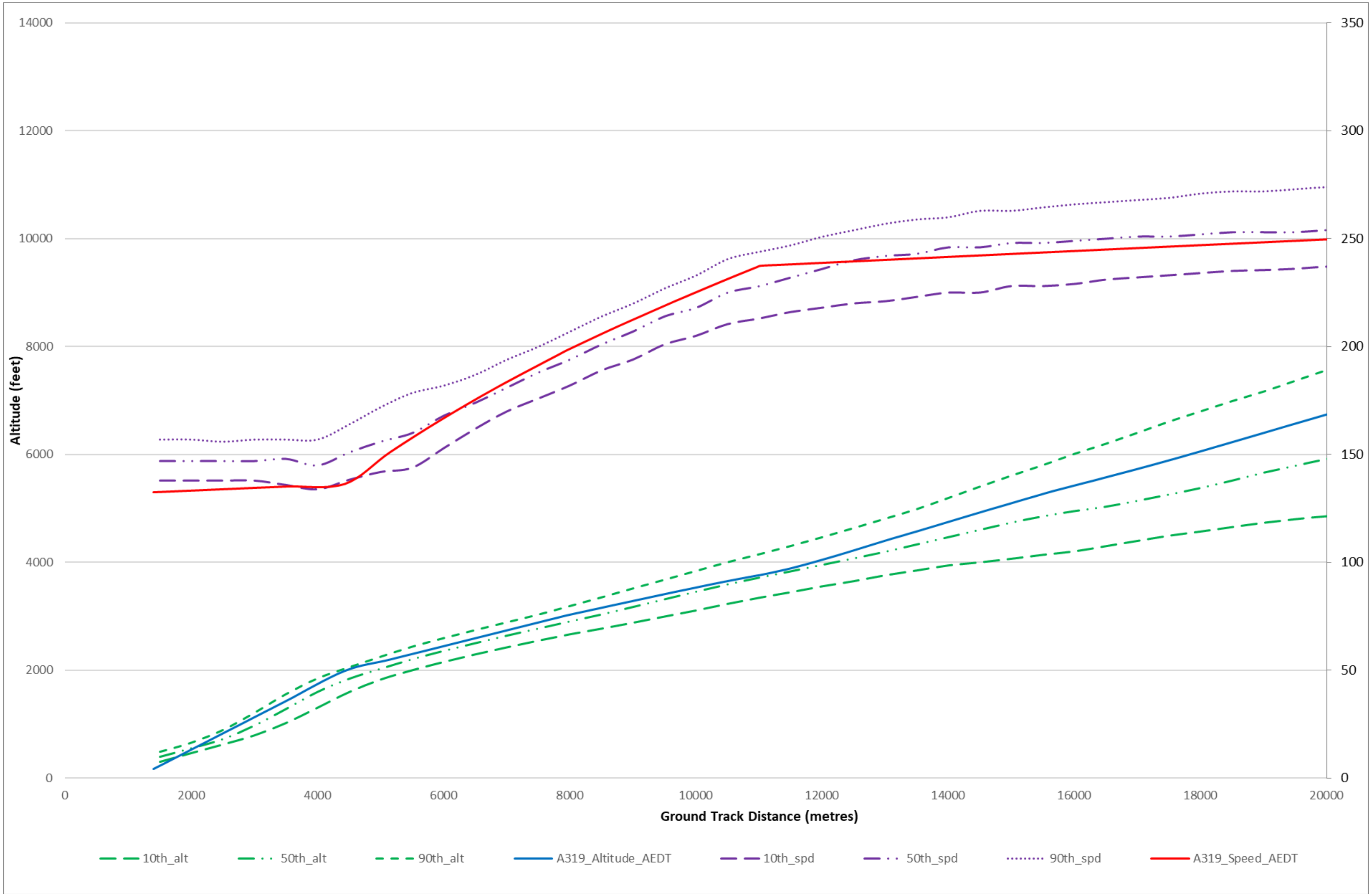
6.12.3 Alterations of AEDT departure profiles was undertaken to determine the best fit with departure profiles from radar data for each aircraft. The average departure profile for each aircraft was reasonably similar; as an example, the A320 departure profile data is presented in Inset 6.23. The 50th percentile data shows the A320 aircraft climbing to approximately 2,000 feet and continuing on a constant, reduced ascent during the acceleration stage. Once the aircraft reaches a speed of approximately 230 knots, the acceleration reduces; however, the rate of ascent continues at a similar rate to the acceleration stage.

6.12.4 The greatest difficulty in matching AEDT departure profiles with 2019 radar data departure profiles comes after the acceleration phase, which ends at a speed of approximately 230 knots. The rate of ascent to the 50th percentile altitude data is best matched with the aircraft set at "minimum thrust". This approach is not considered appropriate as aircraft noise levels decrease noticeably at the point where an aircraft switches to "minimum thrust". Consequently, departure profiles were adjusted to maintain aircraft thrust settings throughout the departure whilst retaining the speed and altitude within the 10th and 90th percentile values. Although this, at times results in aircraft being at an altitude between the 50th and 90th percentile, the thrust setting has a greater influence on noise contours than the altitude so maintaining a higher thrust setting is considered to represent a reasonable worst-case.

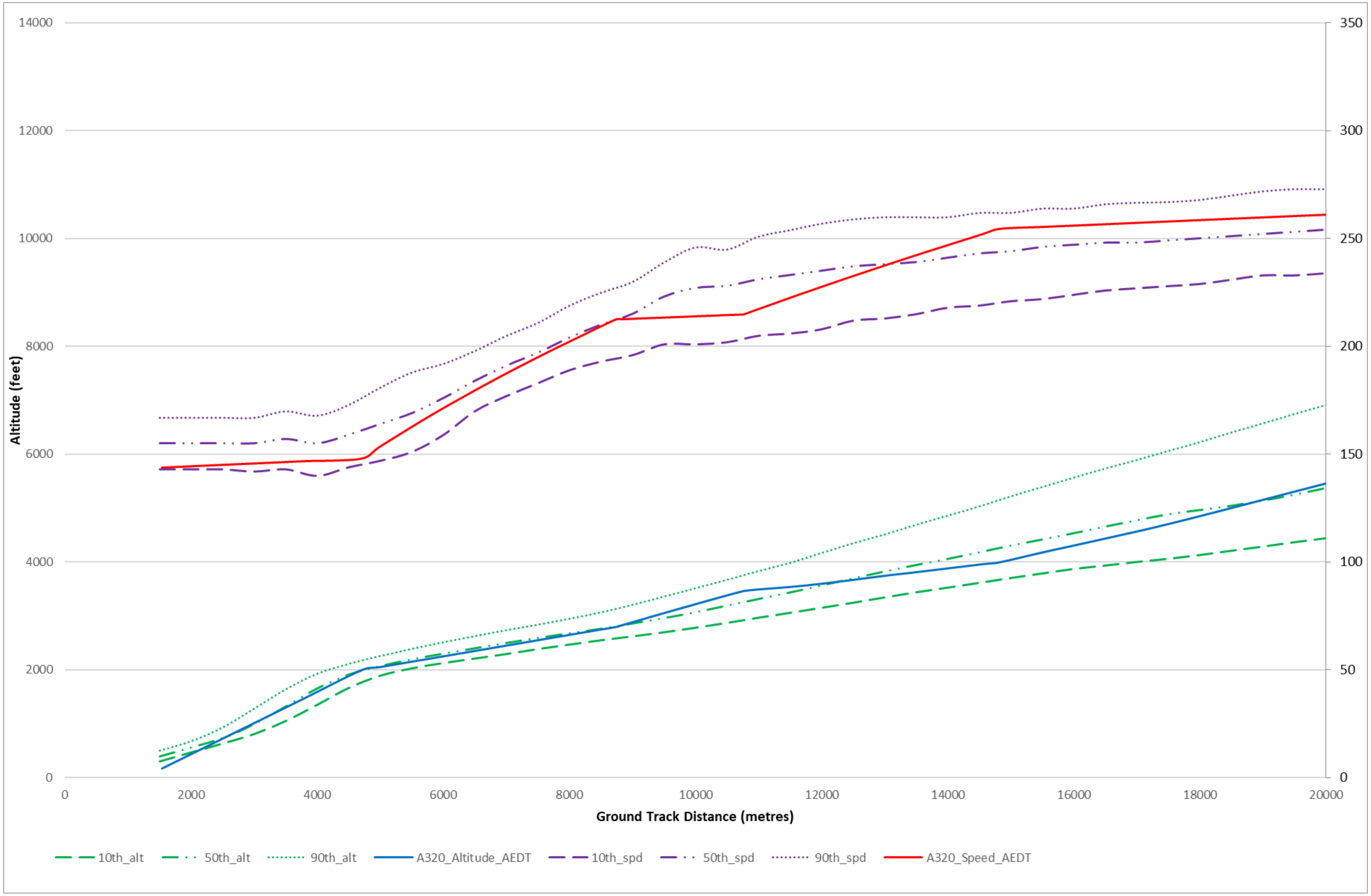


Inset 6.23: A320 Departure Altitude and Speed Profile from Radar Data

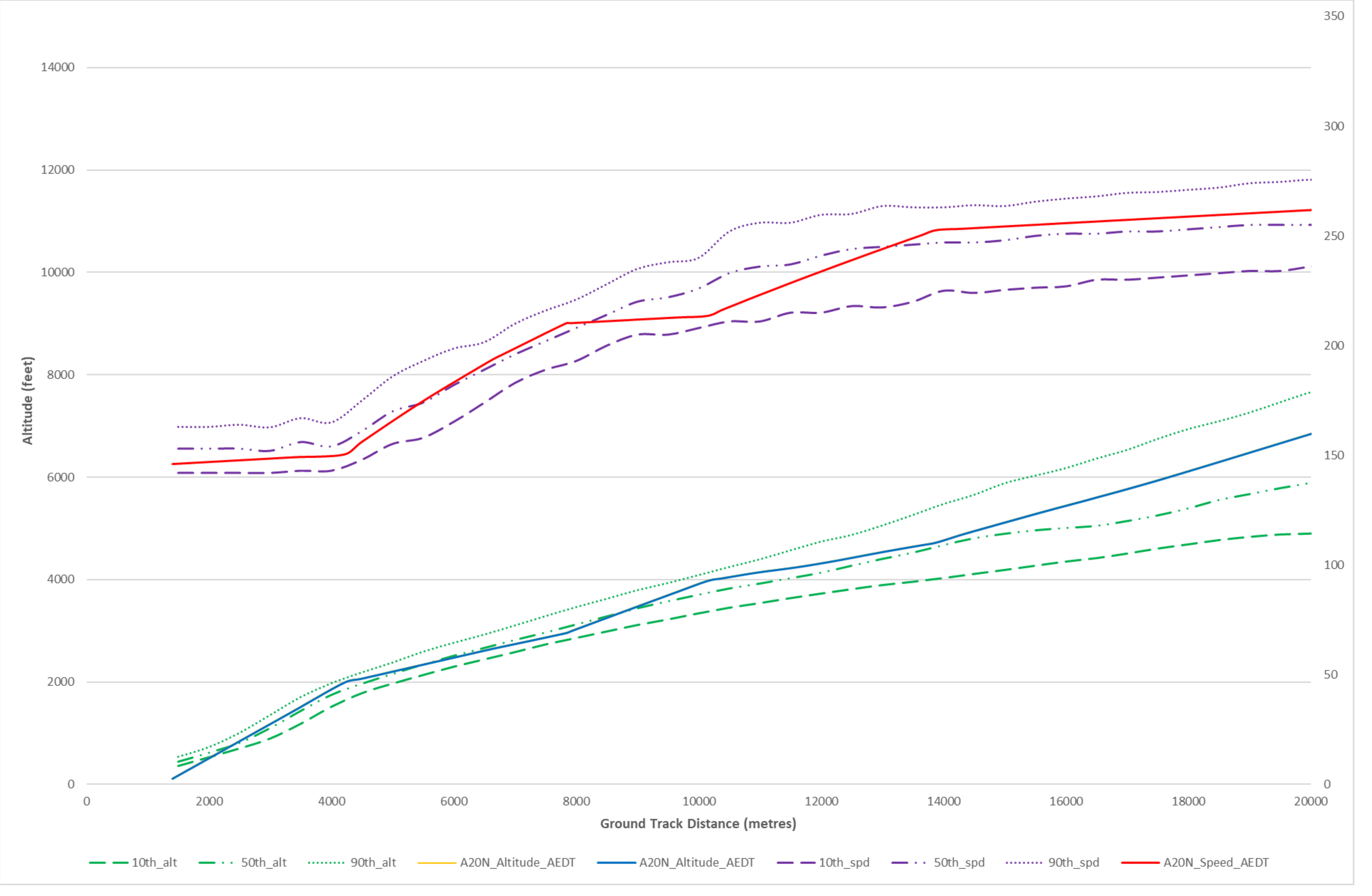
6.12.5 The results of speed and altitude departure analysis of 2019 radar data for each aircraft along with adjusted AEDT departure profiles are presented in Inset 6.24 to Inset 6.29.



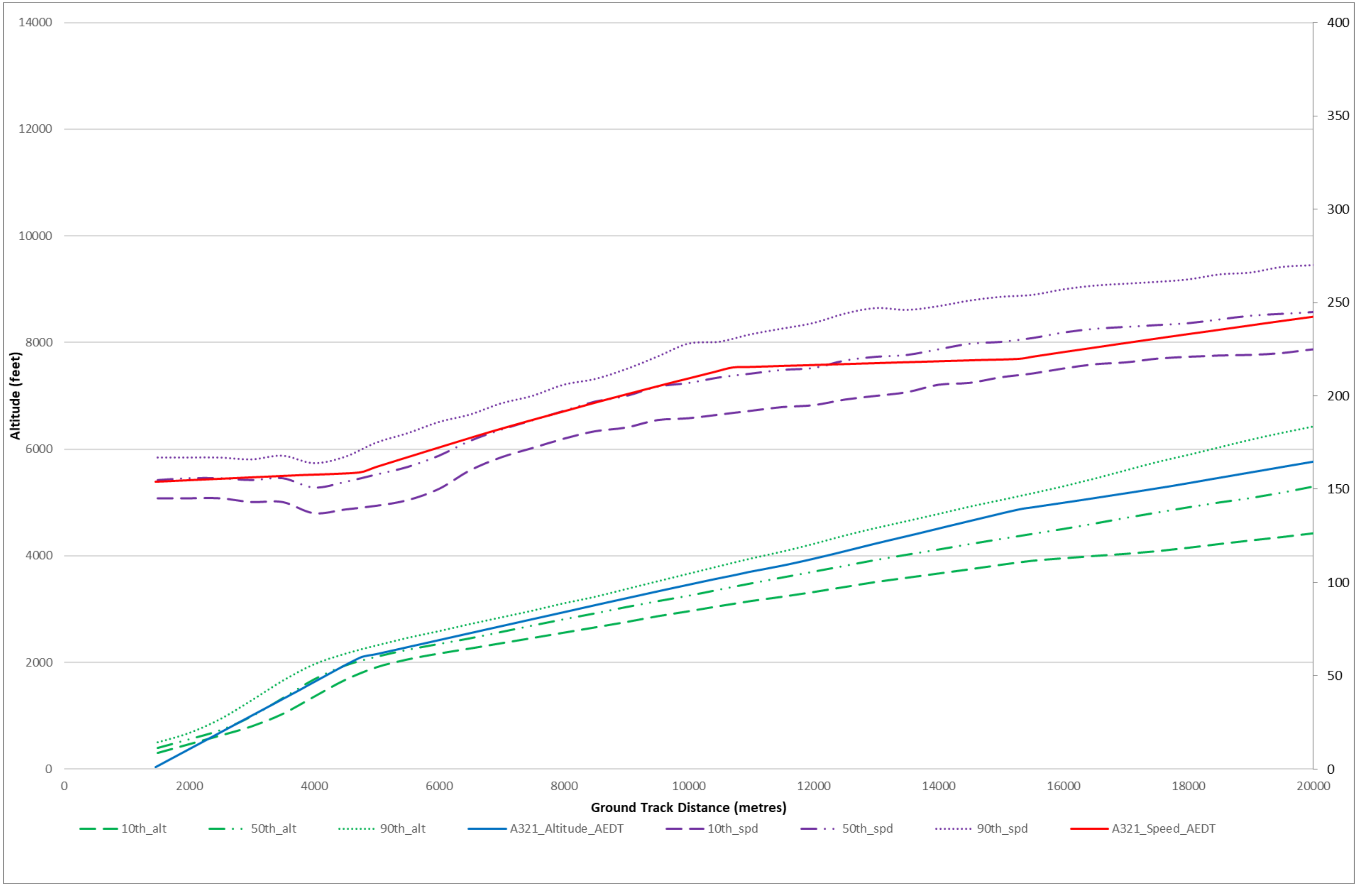
Inset 6.24: A319 Departure Profile Analysis



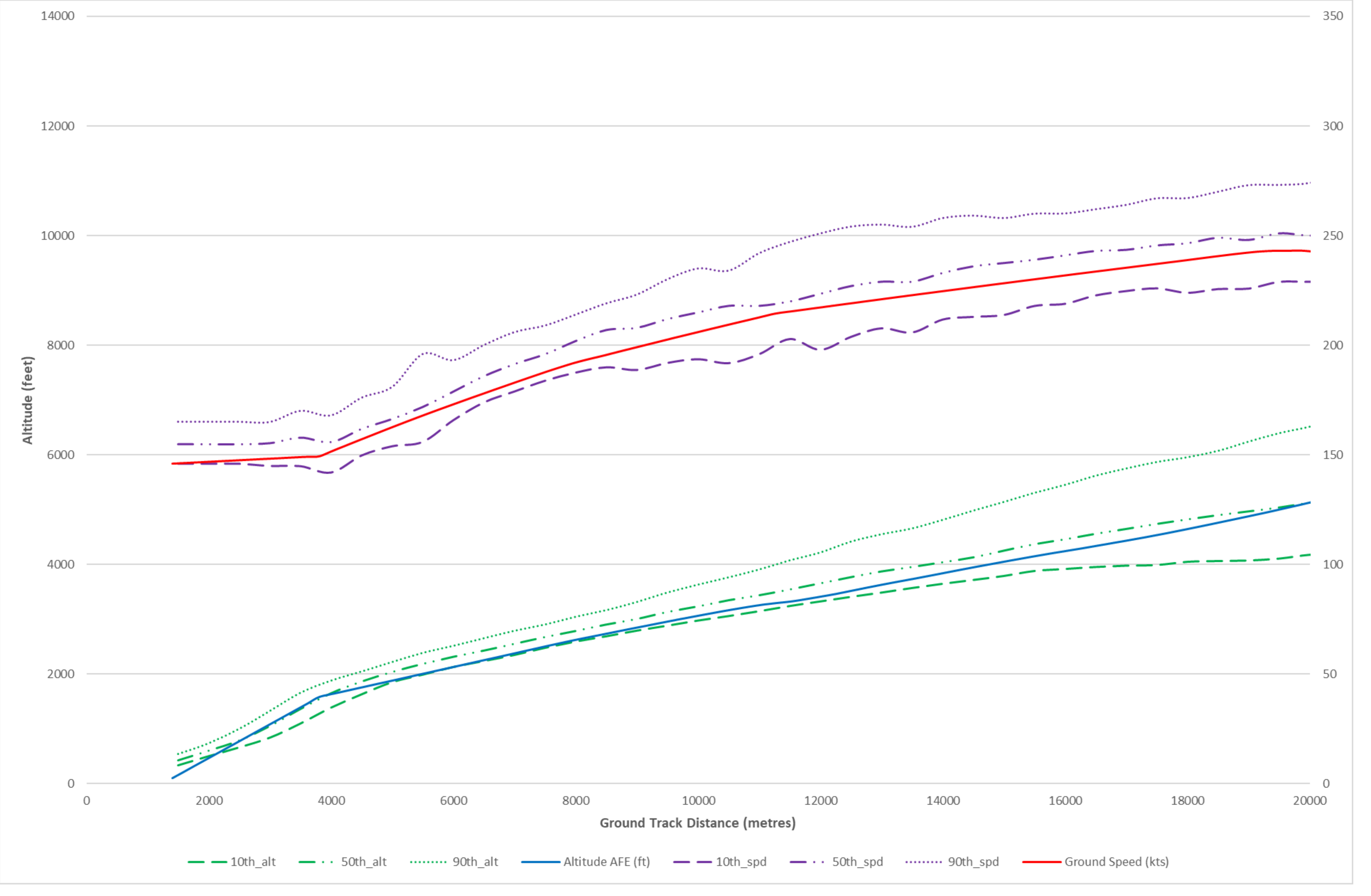
Inset 6.25: A320 Departure Profile Analysis



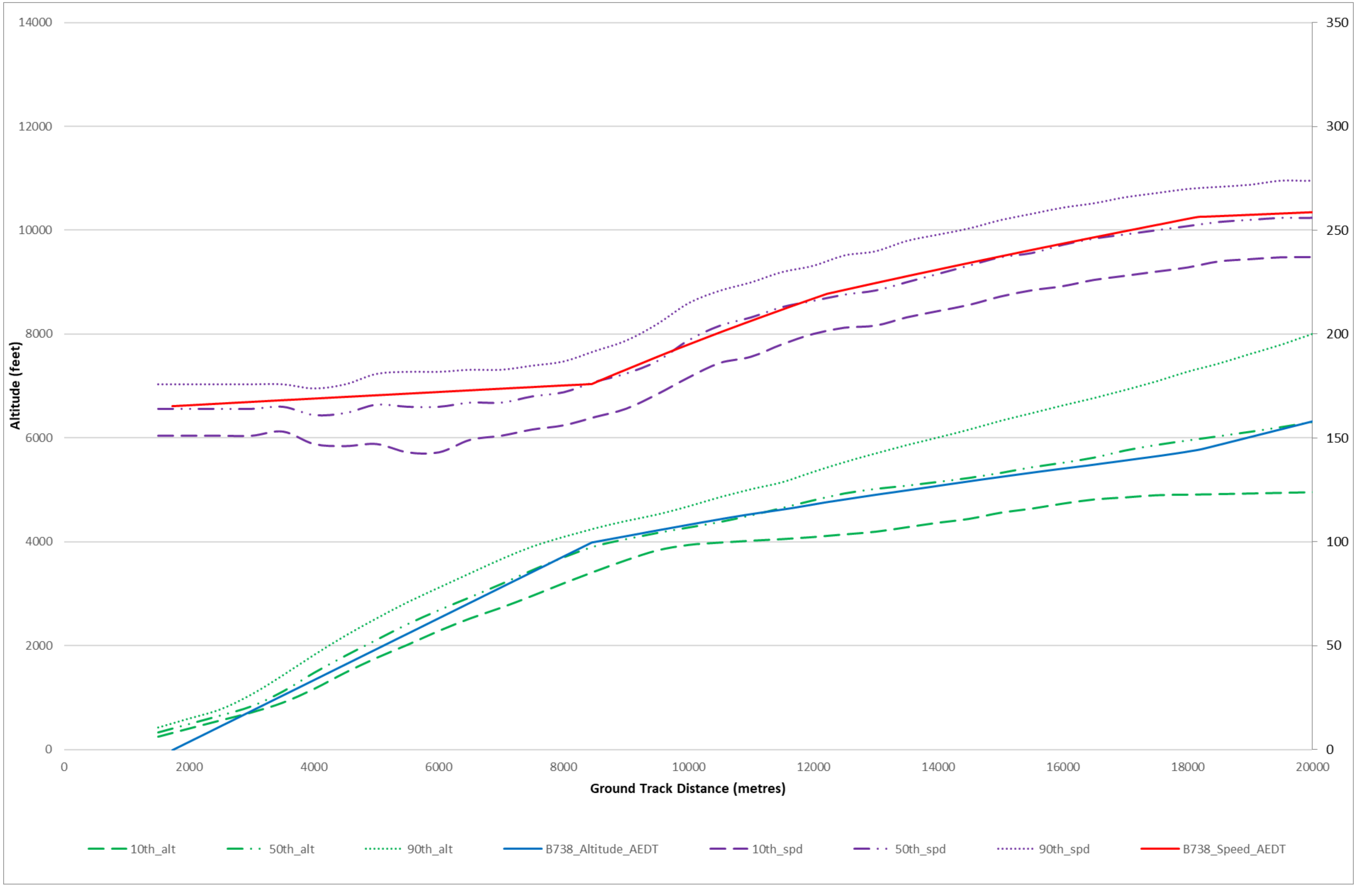
Inset 6.26: A320Neo Departure Profile Analysis



Inset 6.27: A321 Departure Profile Analysis



Inset 6.28: A321Neo Departure Profile Analysis



Inset 6.29: B737-800 Departure Profile Analysis

6.13 Departure Noise Testing

6.13.1 Results comparing measured and predicted SEL noise levels for aircraft departures are presented in Table 6.25 to Table 6.29.

Table 6.25: A319 SEL Departure Noise Prediction Testing

Runway	Location	Measured SELdB	Predicted SELdB	DifferencedB
7	LTN_BG	89.6	89.4	-0.2
	NMT01	83.8	84.9	+1.1
25	LTN_SLTN	86.7	86.9	+0.2
	LTN_PPR	84.8	86.3	+1.5
	NMT02	83.7	84.4	+0.7
	NMT03	84.3	82.1	-2.2
	LTN_MRK	81.1	81.3	+0.2
	LTN_FLM	77.4	77.8	+0.4

Table 6.26: A320 SEL Departure Noise Prediction Testing

Runway	Location	Measured SELdB	Predicted SELdB	DifferencedB
7	LTN_BG	89.2	90.3	+1.1
	NMT01	84.3	84.9	+0.6
25	LTN_SLTN	86.1	87.3	+1.2
	LTN_PPR	85.5	86.2	+0.7
	NMT02	83.9	83.8	-0.1
	NMT03	84.3	82.8	-1.5~~4~~
	LTN_MRK	81.4	80.7	-0.7
	LTN_FLM	76.9	77.9	+1.0

Table 6.27: A320Neo SEL Departure Noise Prediction Testing

Runway	Location	Measured SELdB	Predicted SELdB	DifferencedB
7	LTN_BG	85.1	86.2	+1.1
	NMT01	80.9	80.1	-0.8
25	LTN_SLTN	82.7	83.5	+0.8
	LTN_PPR	81.9	81.7	-0.2
	NMT02	81.1	79.7	-1.4
	NMT03	83.4	79.0	-4.4
	LTN_MRK	76.6	76.9	+0.3
	LTN_FLM	72.1	74.8	+2.7

Table 6.28: A321 SEL Departure Noise Prediction Testing

Runway	Location	Measured SELdB	Predicted SELdB	DifferencedB
7	LTN_BG	91.1	92.2	+1.1
	NMT01	85.8	84.6	-1.2
25	LTN_SLTN	88.0	89.4	+1.4
	LTN_PPR	87.2	85.8	-1.4
	NMT02	85.1	83.7	-1.4
	NMT03	85.8	82.9	-2.4
	LTN_MRK	81.8	81.1	-0.7
	LTN_FLM	78.4	78.8	+0.4

Table 6.29: A321Neo SEL Departure Noise Prediction Testing

Runway	Location	Measured SELdB	Predicted SELdB	DifferencedB
7	LTN_BG	88.4	85.6	-2.8
	NMT01	84.2	82.1	-2.1
25	LTN_SLTN	85.2	82.6	-2.6
	LTN_PPR	86.3	83.2	-3.1
	NMT02	83.0	81.1	-1.9
	NMT03	83.3	80.1	-3.2
	LTN_MRK	80.1	78.4	-1.7
	LTN_FLM	75.7	76.0	+0.3

Table 6.30: B737-800 SEL Departure Noise Prediction Testing

Runway	Location	Measured SELdB	Predicted SELdB	DifferencedB
7	LTN_BG	92.6	94.7	+2.1
	NMT01	86.6	90.3	+3.7
25	LTN_SLTN	89.8	91.7	+1.9
	LTN_PPR	87.4	91.8	+4.4
	NMT02	86.7	89.6	+2.9
	NMT03	8~~6.6~~7.0	89.2	+2.2
	LTN_MRK	83.3	85.9	+2.6
	LTN_FLM	80.7	83.5	+2.8

6.13.2 There is a trend for underpredicting at NMT03. This may be due to the fact that the noise monitor is located in close proximity to the M1 and, therefore, the SEL of aircraft may not be detected that are either quiet or fly along the 25-departure route swathe at a significant distance from NMT03. Consequently, NMT03 is not considered to be a key location for validating departure noise.

6.13.3 Corrections applied to aircraft departure noise data are presented in Table 6.31.

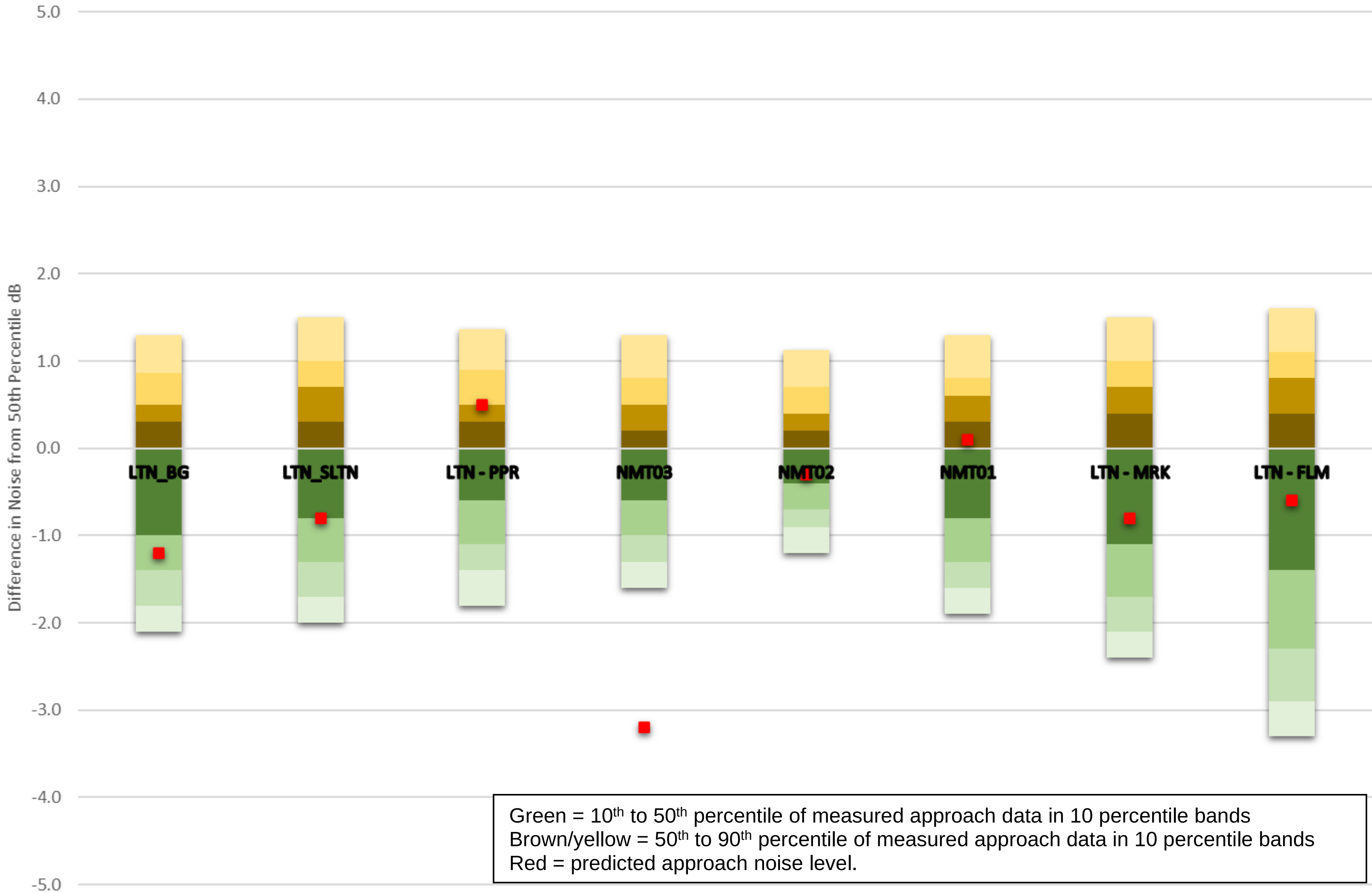
Table 6.31: SEL Departure Noise Corrections

Aircraft	SEL Departure CorrectiondB
A319	-1.0
A320	-0.5
A320Neo	0.0
A321	+0.5
A321Neo	+2.0
B737-800	-3.0

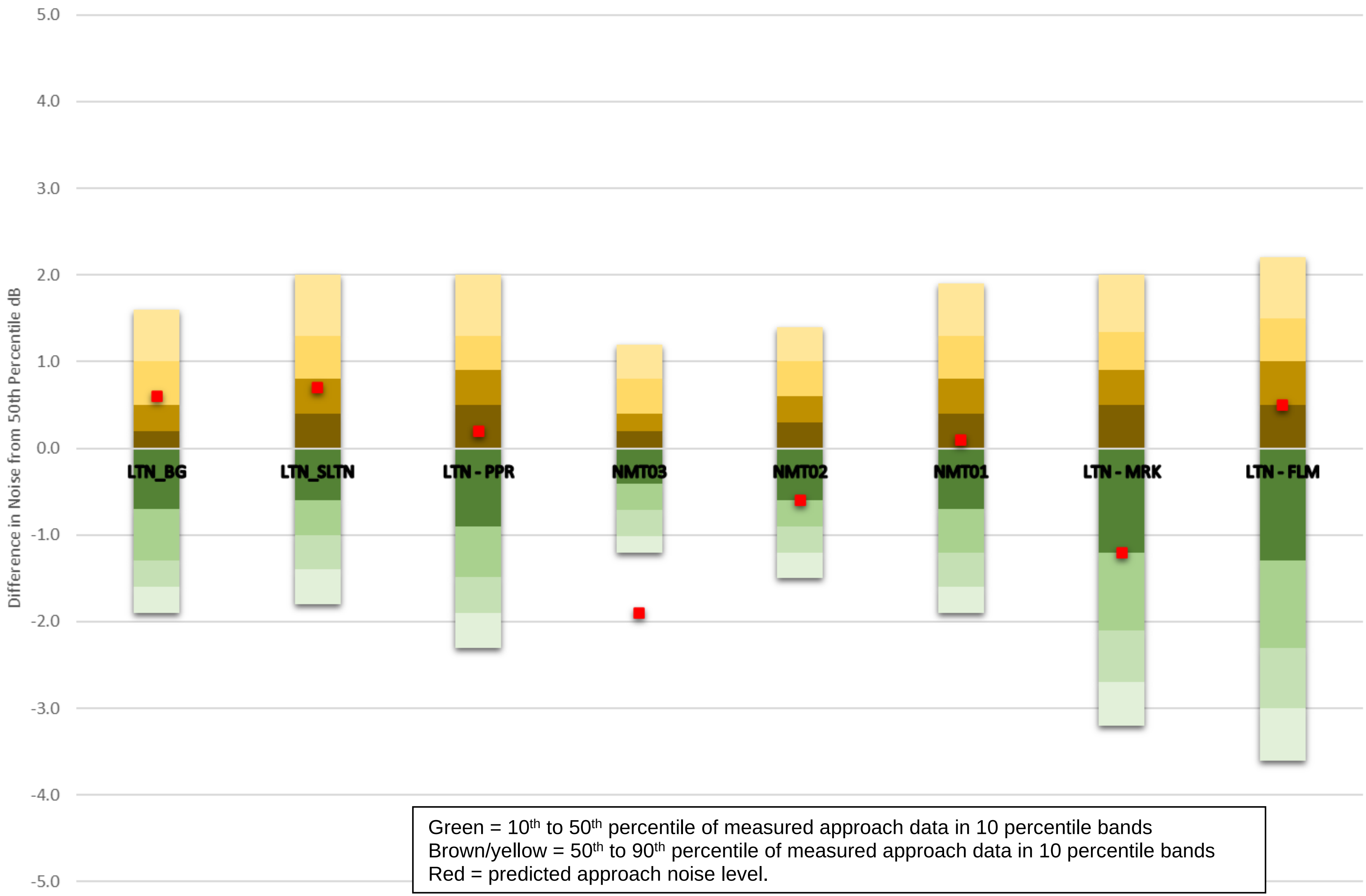
6.13.4 A comparison of the corrected departure noise level predictions against the spread of measured noise data are presented in Inset 6.30 to Inset 6.35. Each inset shows the difference in predicted noise (with correction applied) compared to the measured noise data for each aircraft. The measured noise data is set to zero for the 50th percentile with the 10th to 50th percentile illustrated in green 10 percentile bands and the 50th to 90th percentiles illustrated in brown/yellow in 10 percentile bands.

6.13.5 As identified in ~~p~~Paragraph 6.7.5, there is uncertainty regarding noise monitoring data at NMT03 due to its location near the M1 meaning quieter aircraft may be omitted from measurements due to the high levels of road traffic noise. Consequently, NMT03 has been omitted the validation process; however, results are included for information.

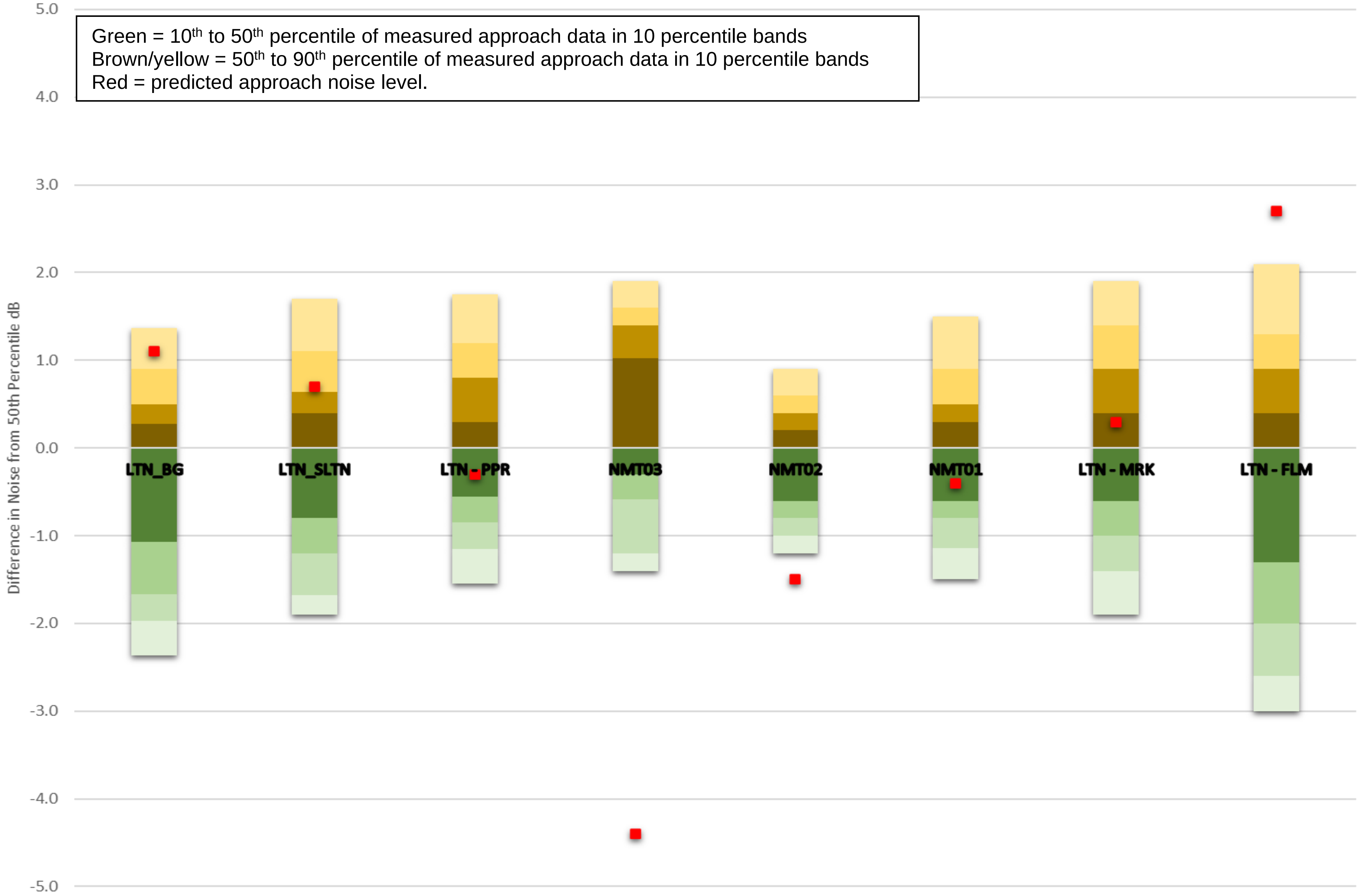
6.13.6 The majority of noise predictions are located within the range of measured noise data; however, there are some outliers that are still within a ±2dB range of the 50th percentile. The exception to this is at LTN_SLTN at which there is consistent overpredictions of between 3 and 5dB for all aircraft except for the B737-800.



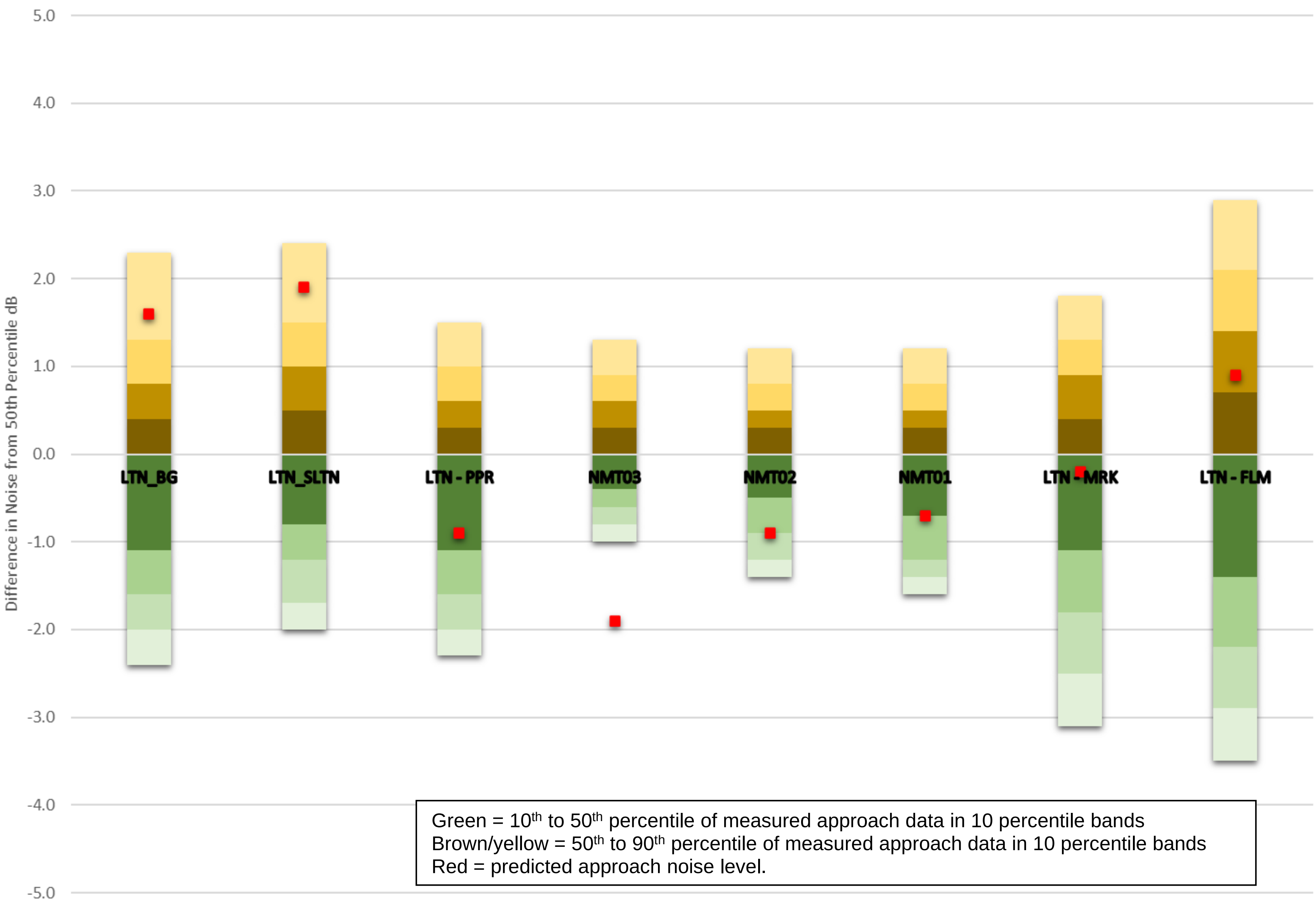
Inset 6.30: A319 SEL Departure Noise Testing



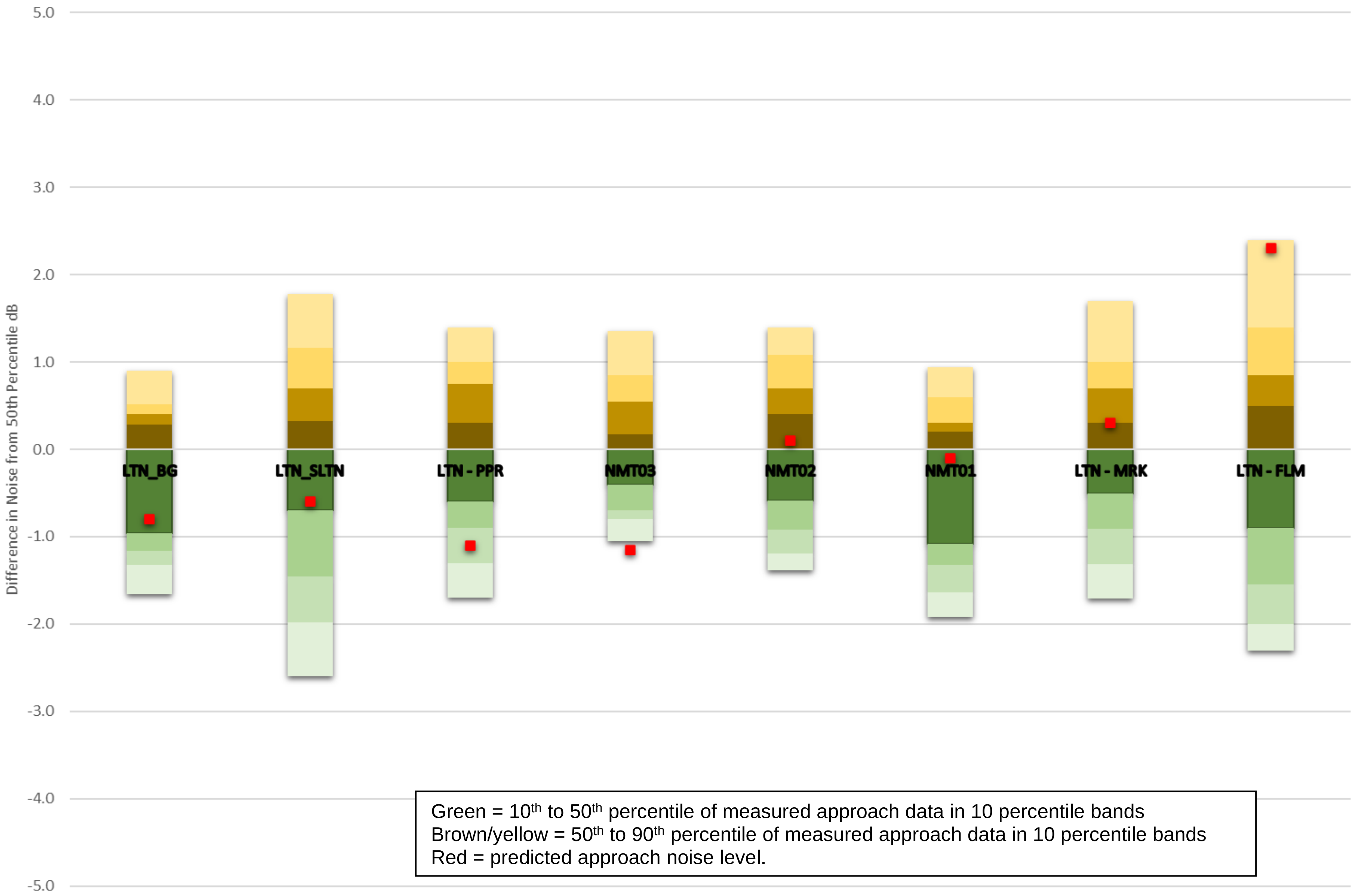
Inset 6.31: A320 SEL Departure Noise Testing



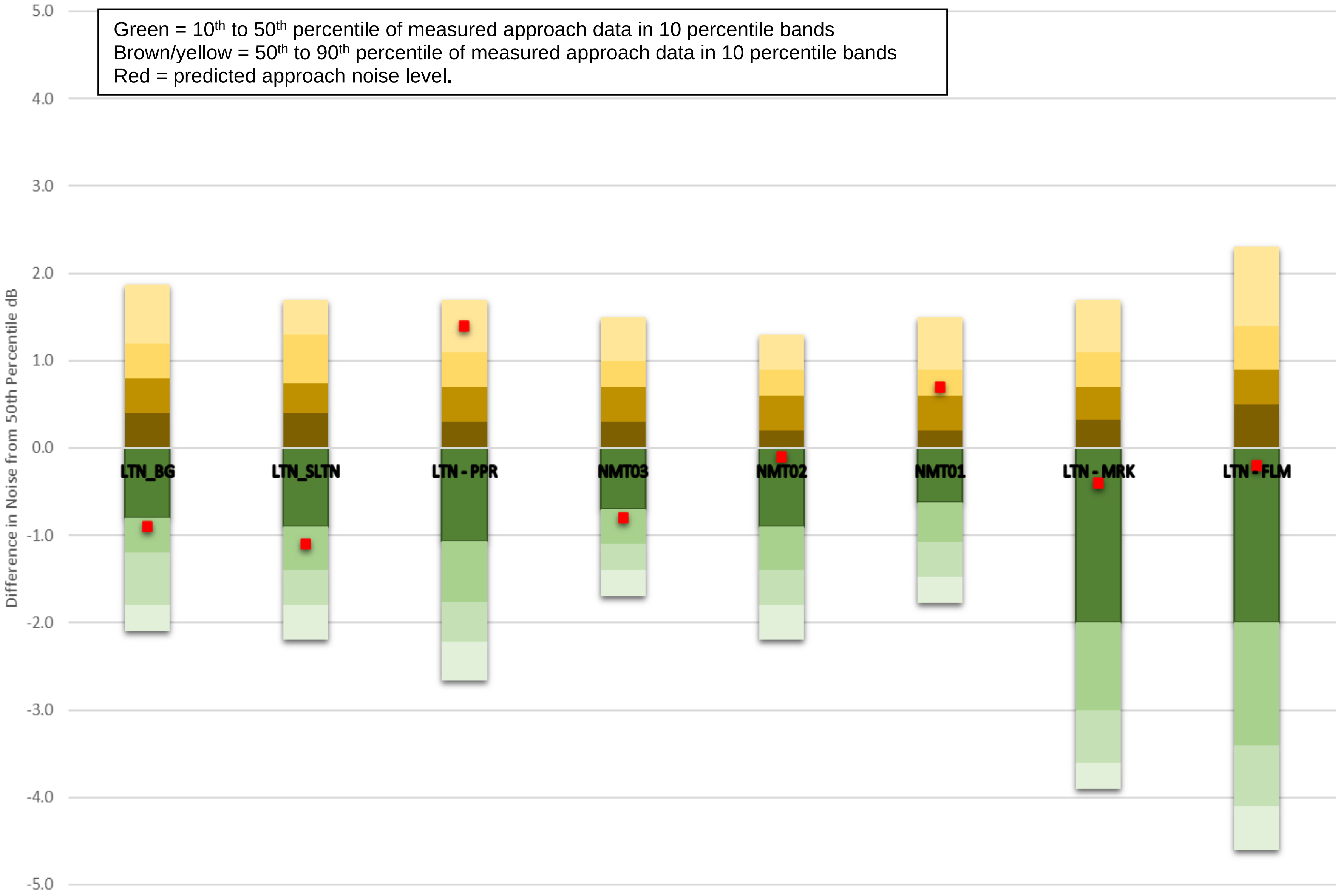
Inset 6.32: A320Neo SEL Departure Noise Testing



Inset 6.33: A321 SEL Departure Noise Testing



Inset 6.34: A321Neo SEL Departure Noise Testing



Inset 6.35: B737-800 SEL Departure Noise Testing

6.13.7 Results comparing measured and predicted L_{ASmax} noise levels for aircraft departures are presented in Table 6.32 to Table 6.37.

Table 6.32: A319 L_{ASmax} Departure Noise Prediction Testing

Runway	Location	Measured L_{ASmax}dB	Predicted L_{ASmax}dB	DifferencedB
7	LTN_BG	80.0	77.8	-2.2
	NMT01	72.9	72.7	-0.2
25	LTN_SLTN	76.4	75.6	-0.8
	LTN_PPR	74.6	74.3	-0.3
	NMT02	72.4	72.4	0.0
	NMT03	72.6	69.7	-2.9
	LTN_MRK	70.7	69.1	-1.6
	LTN_FLM	66.8	65.2	-1.6

Table 6.33: A320 L_{ASmax} Departure Noise Prediction Testing

Runway	Location	Measured L_{ASmax}dB	Predicted L_{ASmax}dB	DifferencedB
7	LTN_BG	79.1	79.3	+0.2
	NMT01	73.9	73.0	-0.9
25	LTN_SLTN	75.5	76.7	+1.2
	LTN_PPR	75.9	74.6	-1.3
	NMT02	73.1	72.1	-1.0
	NMT03	72.2	71.0	-1.2
	LTN_MRK	70.9	69.3	-1.6
	LTN_FLM	66.1	65.2	-0.9

Table 6.34: A320Neo L_{ASmax} Departure Noise Prediction Testing

Runway	Location	Measured L_{ASmax}dB	Predicted L_{ASmax}dB	DifferencedB
7	LTN_BG	74.8	77.2	+2.4
	NMT01	70.0	71.6	+1.6
25	LTN_SLTN	72.3	75.2	+2.9
	LTN_PPR	72.6	73.1	+0.5
	NMT02	69.3	70.8	+1.5
	NMT03	70.5	70.1	-0.4
	LTN_MRK	66.6	67.3	+0.7
	LTN_FLM	61.2	64.9	+3.7

Table 6.35: A321 L_{ASmax} Departure Noise Prediction Testing

Runway	Location	Measured L_{ASmax}dB	Predicted L_{ASmax}dB	DifferencedB
7	LTN_BG	80.5	81.8	+1.3
	NMT01	75.0	72.6	-2.4
25	LTN_SLTN	76.9	79.5	+2.6
	LTN_PPR	77.0	74.2	-2.8
	NMT02	73.8	71.8	-2.0
	NMT03	73.4	71.0	-2.4
	LTN_MRK	70.9	68.8	-2.1
	LTN_FLM	67.1	66.6	-0.5

Table 6.36: A321Neo L_{ASmax} Departure Noise Prediction Testing

Runway	Location	Measured L_{ASmax}dB	Predicted L_{ASmax}dB	DifferencedB
7	LTN_BG	79.1	77.8	-1.3
	NMT01	74.2	73.6	-0.6
25	LTN_SLTN	75.1	75.4	+0.3
	LTN_PPR	77.4	75.1	-2.3
	NMT02	72.7	72.5	-0.2
	NMT03	71.8	71.4	-0.4
	LTN_MRK	70.3	69.2	-1.1
	LTN_FLM	64.5	66.7	+2.2~~3~~

Table 6.37: B737-800 L_{ASmax} Departure Noise Prediction Testing

Runway	Location	Measured L_{ASmax}dB	Predicted L_{ASmax}dB	DifferencedB
7	LTN_BG	83.4	85.7	+2.3
	NMT01	74.6	78.9	+4.3
25	LTN_SLTN	79.7	82.9	+3.2
	LTN_PPR	76.1	80.4	+4.3
	NMT02	74.3	77.9	+3.6
	NMT03	75.3	77.6	+2.3
	LTN_MRK	71.5	74.2	+2.7
	LTN_FLM	69.4	71.1	+1.7

6.13.8 Corrections applied to aircraft L_{ASmax} departure noise data are presented in Table 6.38.

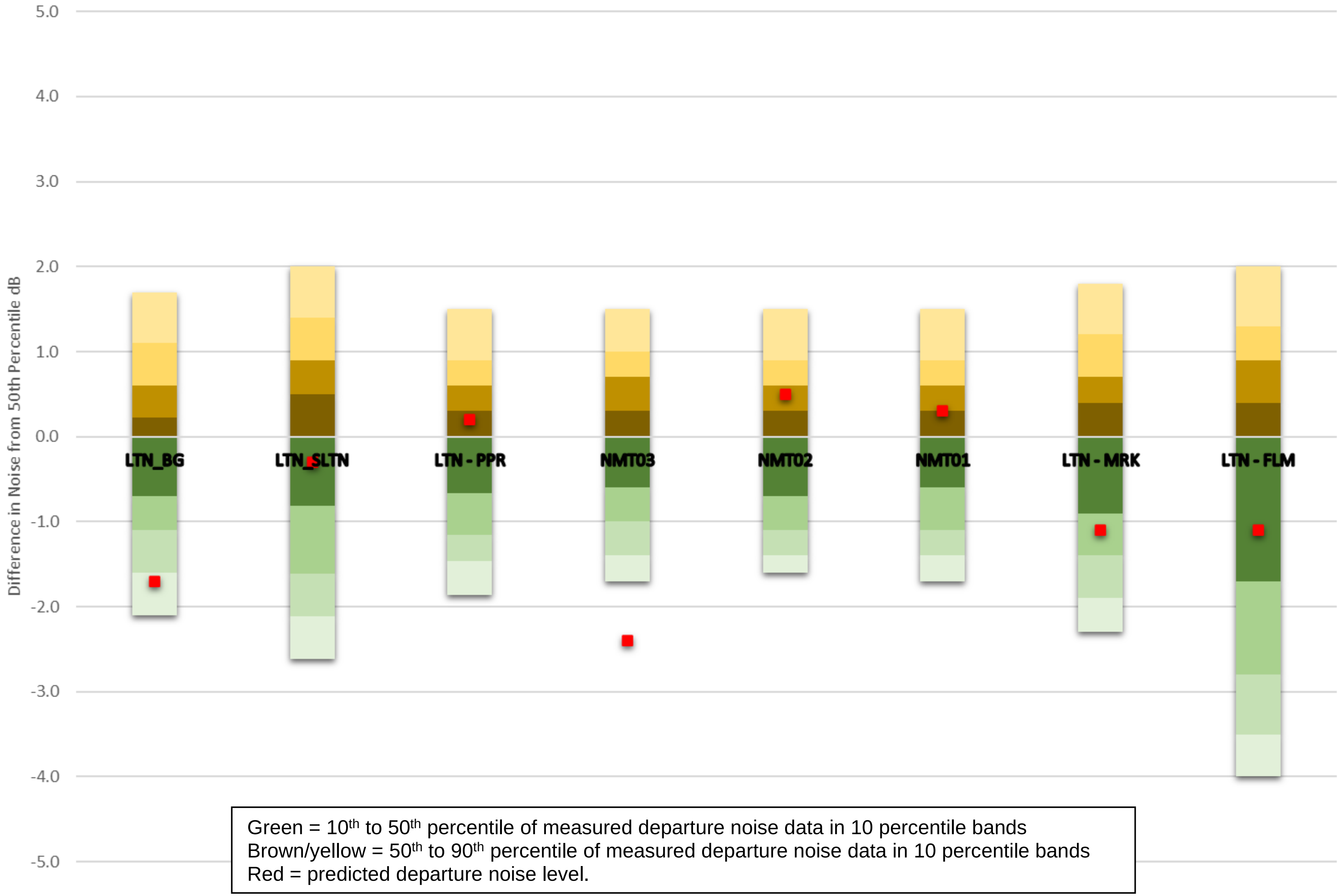
Table 6.38: L_{ASmax} Departure Noise Corrections

Aircraft	L_{ASmax} Departure CorrectiondB
A319	+0.5
A320	+0.5
A320Neo	-2.0
A321	+0.5
A321Neo	+0.5
B737-800	-3.5

6.13.9 A comparison of the corrected departure noise level predictions against the spread of measured noise data are presented in Inset 6.36 to Inset 6.41. Each inset shows the difference in predicted noise (with correction applied) compared to the measured noise data for each aircraft. The measured noise data is set to zero for the 50th percentile with the 10th to 50th percentile illustrated in green 10 percentile bands and the 50th to 90th percentiles illustrated in brown/yellow in 10 percentile bands.

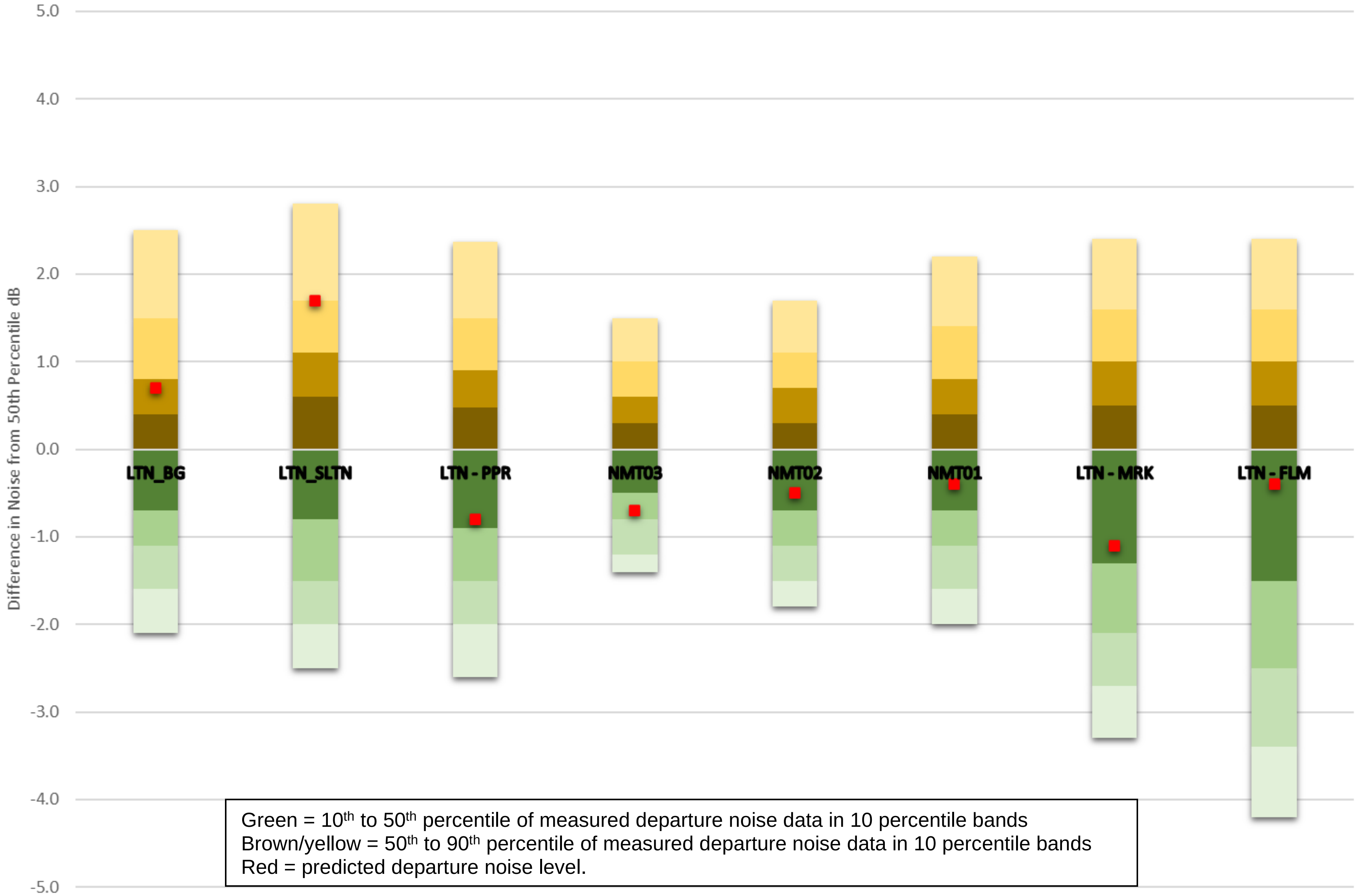
6.13.10 As identified in pParagraph 6.7.5, there is uncertainty regarding noise monitoring data at NMT03 due to its location near the M1 meaning quieter aircraft may be omitted from measurements due to the high levels of road traffic noise. Consequently, NMT03 has been omitted the validation process; however, results are included for information.

6.13.11 The majority of noise predictions are located within the range of measured noise data; however, there are some outliers that are still within a ±3dB range of the 50th percentile.

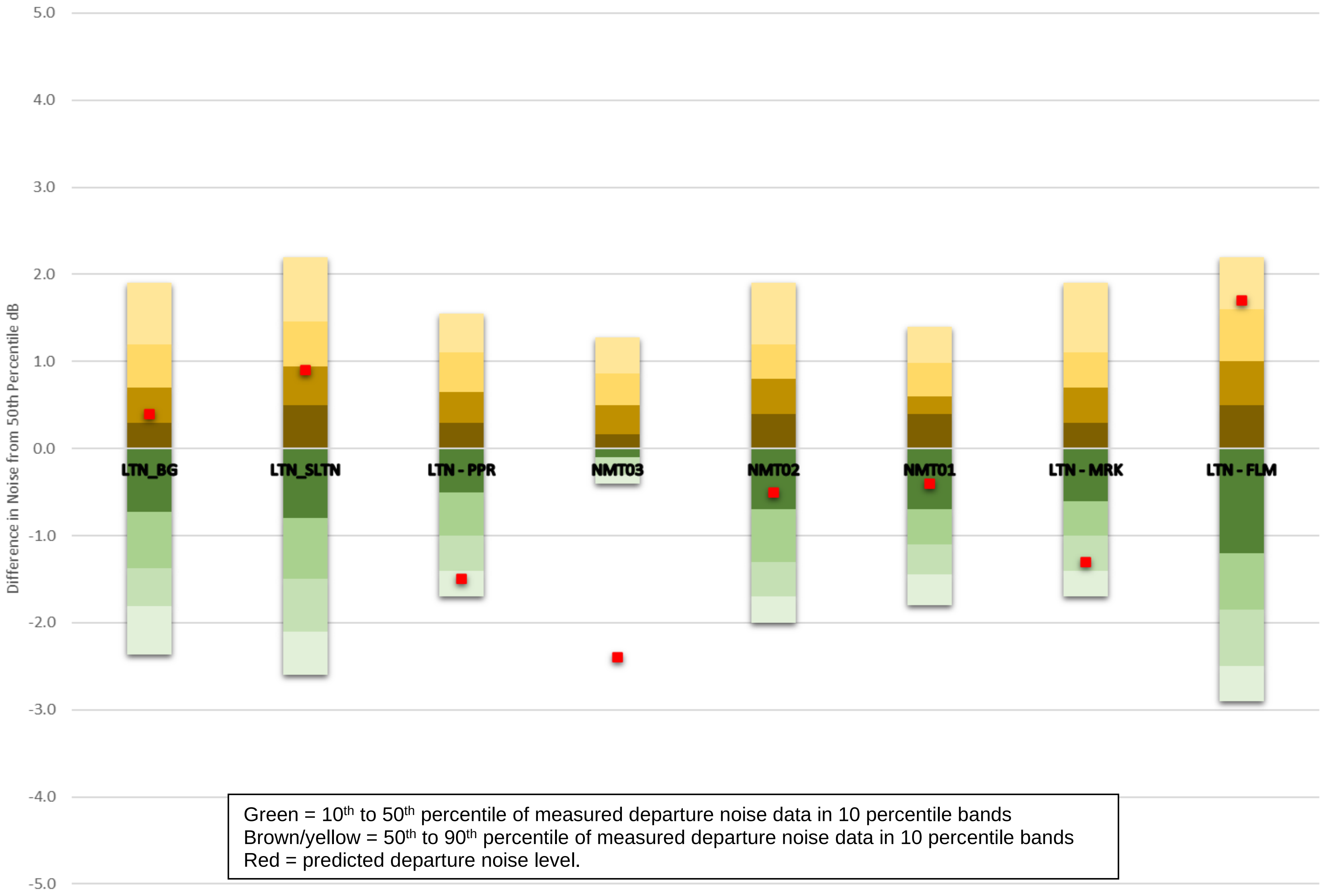


Green = 10th to 50th percentile of measured departure noise data in 10 percentile bands
Brown/yellow = 50th to 90th percentile of measured departure noise data in 10 percentile bands
Red = predicted departure noise level.

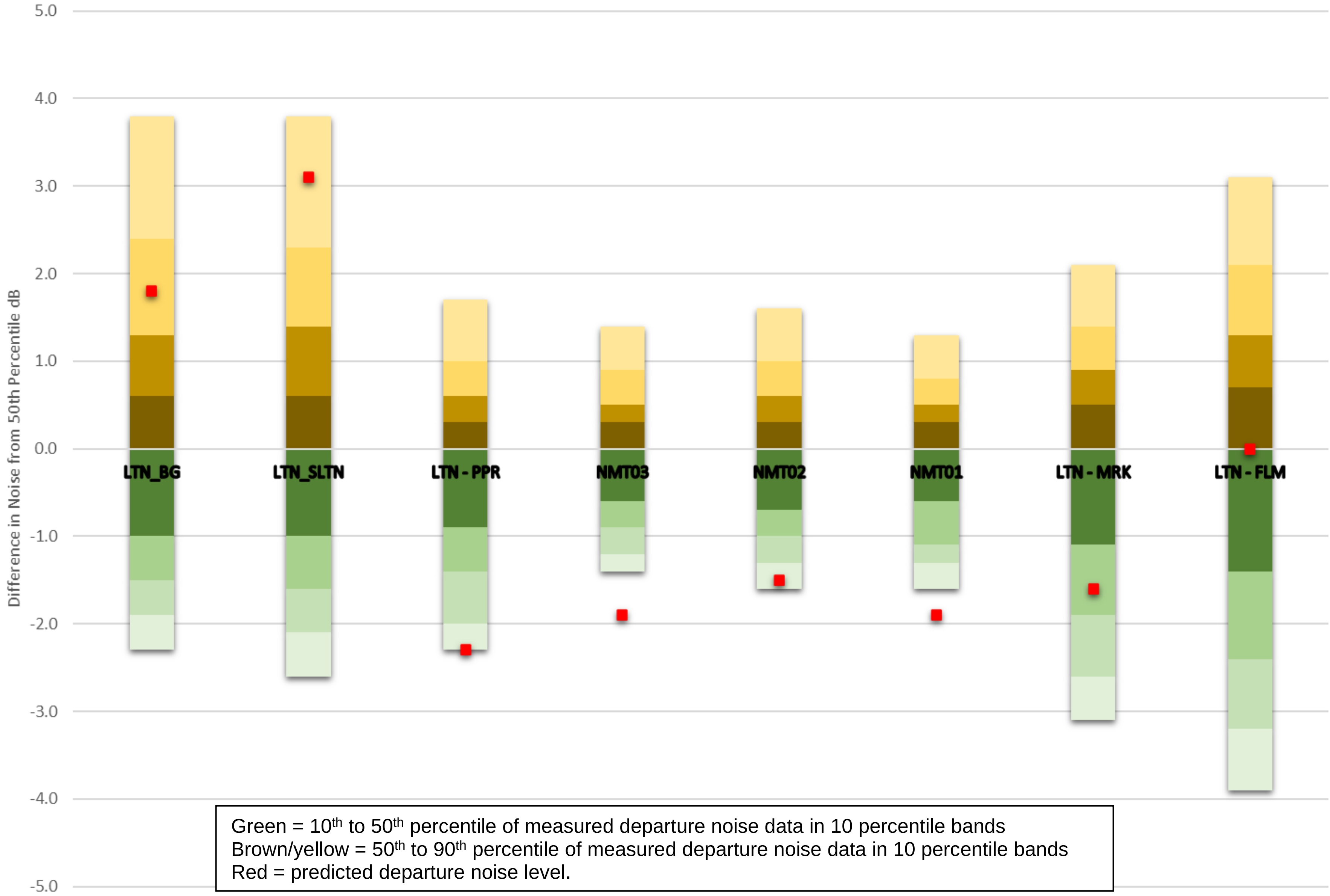
Inset 6.36: A319 L_{ASmax} Departure Noise Testing



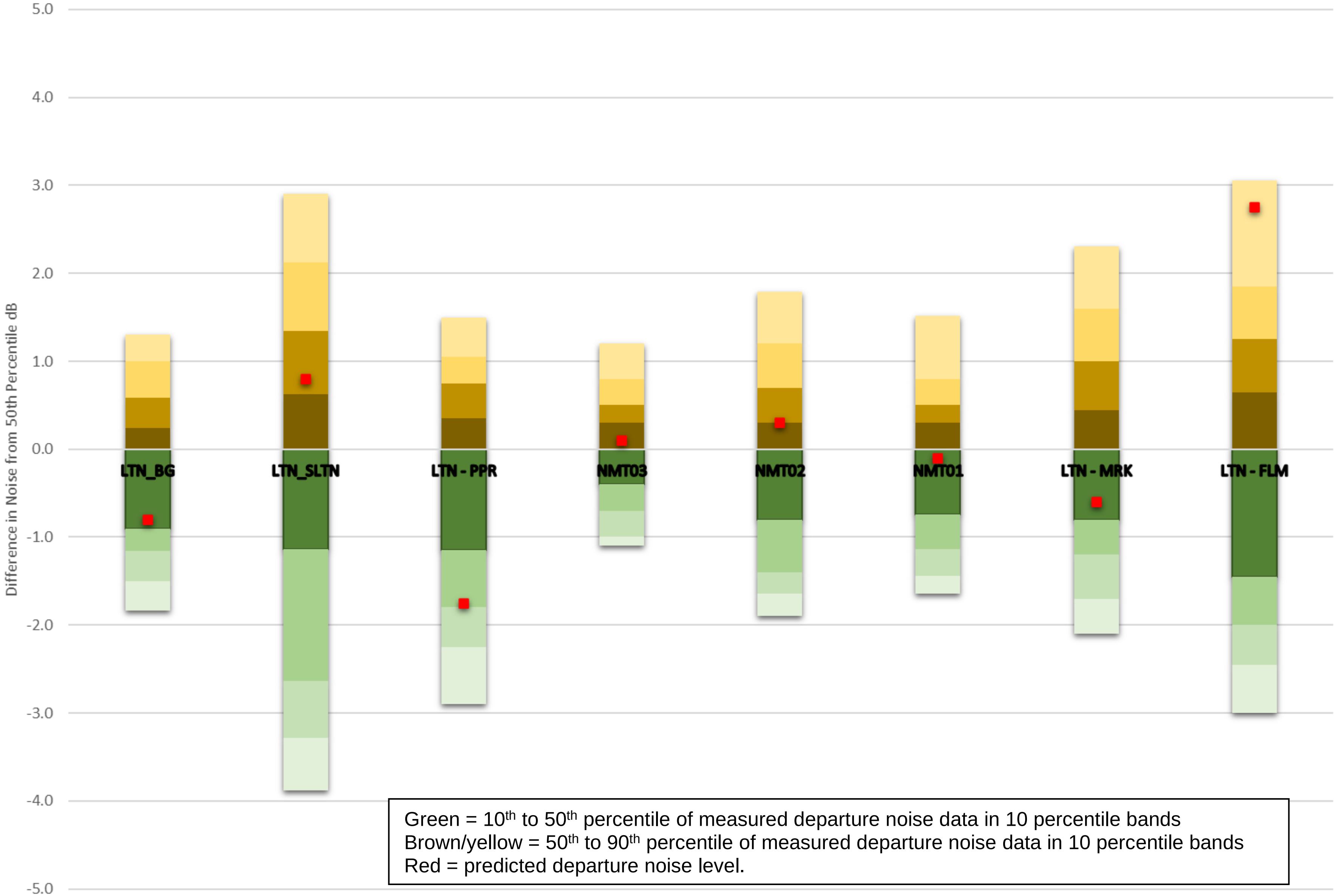
Inset 6.37: A320 L_{ASmax} Departure Noise Testing



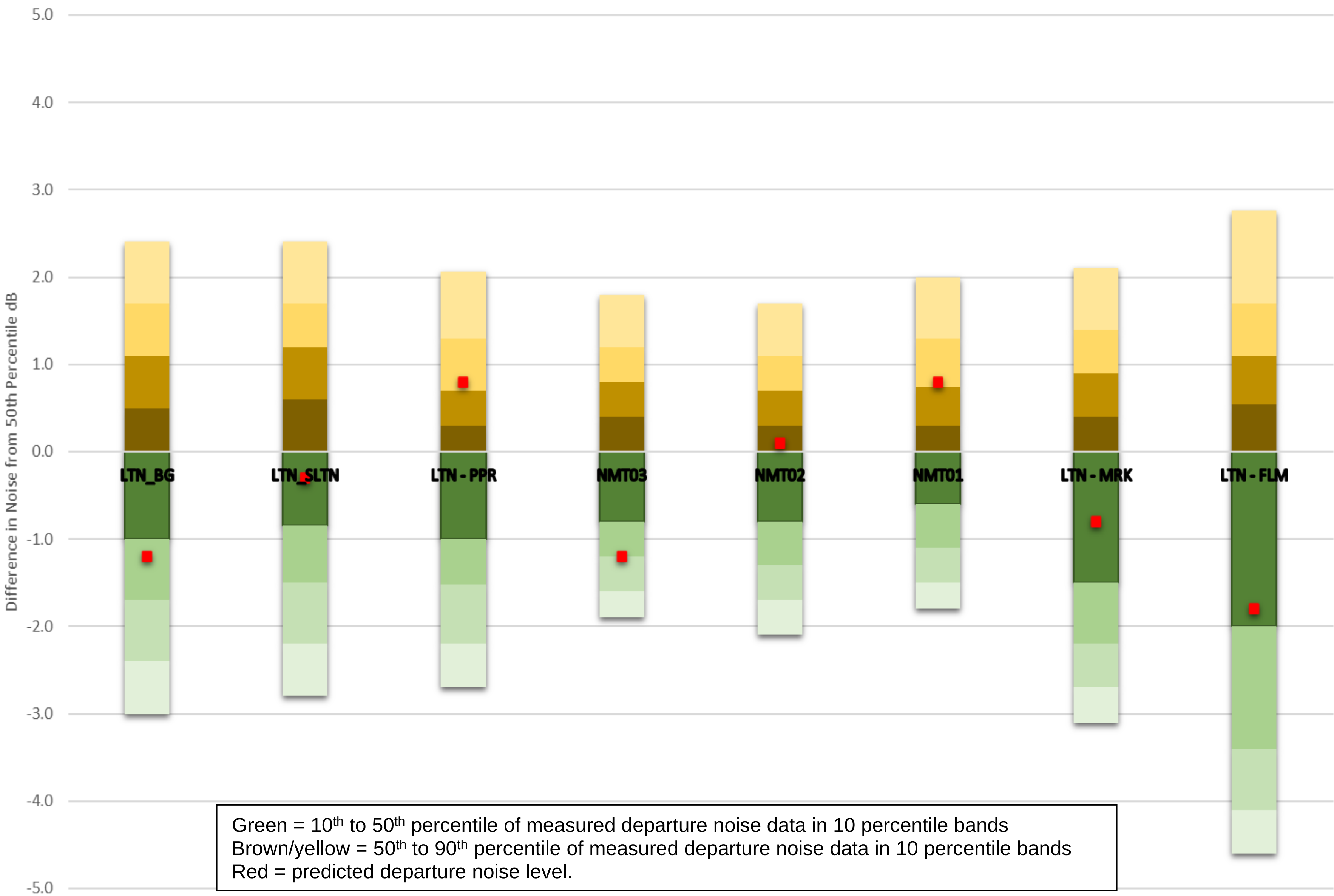
Inset 6.38: A320Neo L_{ASmax} Departure Noise Testing



Inset 6.39: A321 L_{ASmax} Departure Noise Testing



Inset 6.40: A321Neo L_{ASmax} Departure Noise Testing



Inset 6.41: B737-800 L_{ASmax} Departure Noise Testing

6.14 Aircraft Fleet Information

6.14.1 Aircraft movement forecasts used in air noise predictions are presented in Table 6.39 for 2019 ~~a~~Actuals ~~b~~Baseline, Table 6.40 for DM scenarios and Table 6.41 for DS scenarios. A 2019 baseline fleet that is compliant with 2019 noise contour limits is covered in Section 6.17.

Table 6.39: 2019 Actuals Average Summer Day Aircraft Movement Data

Aircraft	Day	Night
AIRBUS A300-600	2.4	1.7
AIRBUS A319	57.8	9.5
AIRBUS A320	114.1	23.9
AIRBUS A320Neo	11.6	3.4
AIRBUS A321	48.8	7.6
AIRBUS A321Neo	5.1	0.1
AIRBUS A330-200	0.1	0.0
BOEING 737-300	0.3	0.0
BOEING 737-400	1.2	1.2
BOEING 737-500	0.7	0.0
BOEING 737-800	44.7	7.6
BOEING 737-900	2.0	0.6
BOEING 737-MAX8	0.0	0.0
BOEING 757-200	2.9	2.5
BOEING 767-300	0.1	0.0
BOEING 777-200	0.5	0.0
BOEING 787-8	0.0	0.0

Table 6.40: Do-Minimum Average Summer Day Aircraft Movement Data

Aircraft	2027		2039		2043	
	Day	Night	Day	Night	Day	Night
Airbus A319	0.0	0.0	0.0	0.0	0.0	0.0
Airbus A320	59.0	9.6	0.0	0.0	0.0	0.0
Airbus A320Neo	105.5	17.1	162.7	26.3	162.7	26.3
Airbus A321	1.5	0.2	0.0	0.0	0.0	0.0
Airbus A321LR	0.0	0.0	0.0	0.0	0.0	0.0
Airbus A321Neo	66.2	10.8	71.3	11.5	71.3	11.5
Airbus A350-900	0.0	0.0	0.0	0.0	0.0	0.0
Boeing 737-400	0.0	0.0	0.0	0.0	0.0	0.0
Boeing 737-800W	26.8	4.3	8.4	1.4	5.0	0.9

Aircraft	2027		2039		2043	
	Day	Night	Day	Night	Day	Night
Boeing 737-900W	2.0	0.0	0.0	0.0	0.0	0.0
Boeing 737-Max10	0.0	0.0	0.0	0.0	0.0	0.0
Boeing 737-Max8	22.4	3.6	39.1	6.3	42.5	6.8
Boeing 737-Max9	0.0	0.0	2.0	0.0	2.0	0.0
Boeing-787-10	0.0	0.0	0.0	0.0	0.0	0.0
Boeing-787-8	0.0	0.0	0.0	0.0	0.0	0.0
Boeing-787-9	0.0	0.0	0.0	0.0	0.0	0.0
Dash-8-Q400	0.0	0.0	0.0	0.0	0.0	0.0
Embraer E190-E2	0.0	0.0	0.0	0.0	0.0	0.0
Airbus A300-600F	1.4	1.4	0.0	0.0	0.0	0.0
Airbus A330-200F	0.1	0.3	1.5	1.6	1.5	1.6
Boeing-737-800F	0.0	0.0	0.5	2.6	0.5	2.6
Boeing-737-400F	0.0	0.5	0.0	0.0	0.0	0.0
Boeing-757-200F	0.5	2.1	0.0	0.0	0.0	0.0
Airbus A319CJ	0.4	0.0	0.0	0.0	0.0	0.0
Airbus A319Neo CJ	0.6	0.0	1.0	0.0	1.0	0.0
Agusta 109 Helicopter	1.7	0.0	1.7	0.0	1.7	0.0
Beechcraft King Air 350	1.6	0.0	1.6	0.0	1.6	0.0
Boeing-737-BBJ7	0.4	0.0	0.0	0.0	0.0	0.0
Boeing-737-BBJ Max7	0.6	0.0	1.0	0.0	1.0	0.0
Bombardier Global Express 6000	12.3	0.1	12.3	0.1	12.3	0.1
Canadair Challenger 605	11.6	0.1	11.6	0.1	11.6	0.1
Cessna 680 Sovereign	21.3	0.2	21.3	0.2	21.3	0.2
Dassault Falcon FA8X	8.9	0.1	8.9	0.1	8.9	0.1
Embraer Legacy 650E	5.7	0.0	5.7	0.0	5.7	0.0
Embraer Phenom 300E	2.7	0.0	2.7	0.0	2.7	0.0
Gulfstream 400	7.3	0.1	7.3	0.1	7.3	0.1
Gulfstream 650	10.7	0.1	10.7	0.1	10.7	0.1

Table 6.41: Do-Something Average Summer Day Aircraft Movement Data

Aircraft	2027		2039		2043	
	Day	Night	Day	Night	Day	Night
Airbus A319	0.0	0.0	0.0	0.0	0.0	0.0
Airbus A320	65.2	15.2	0.0	0.0	0.0	0.0

Aircraft	2027		2039		2043	
	Day	Night	Day	Night	Day	Night
Airbus A320Neo	121.7	21.8	184.0	37.8	192.9	42.2
Airbus A321	2.0	0.0	0.0	0.0	0.0	0.0
Airbus A321LR	0.0	0.0	1.0	1.0	1.0	1.0
Airbus A321Neo	79.9	10.0	118.0	18.3	147.1	21.5
Airbus A350-900	0.0	0.0	2.0	0.0	2.0	0.0
Boeing 737-400	0.0	0.0	0.0	0.0	0.0	0.0
Boeing 737-800W	30.4	6.0	9.8	0.0	5.9	0.0
Boeing 737-900W	2.0	0.0	0.0	0.0	0.0	0.0
Boeing 737-Max10	0.0	0.0	4.0	3.6	9.5	6.2
Boeing 737-Max8	24.8	5.9	52.1	8.2	65.1	9.2
Boeing 737-Max9	0.0	0.0	2.0	0.0	2.0	0.0
Boeing-787-10	0.0	0.0	3.9	0.0	5.9	0.0
Boeing-787-8	0.0	0.0	4.9	1.0	9.7	4.0
Boeing-787-9	0.0	0.0	1.0	1.0	2.9	1.0
Dash-8-Q400	0.0	0.0	15.7	0.0	13.7	0.0
Embraer E190-E2	0.0	0.0	0.0	0.0	7.8	0.0
Airbus A300-600F	1.4	1.4	0.0	0.0	0.0	0.0
Airbus A330-200F	0.1	0.3	1.5	1.6	1.5	1.6
Boeing-737-800F	0.0	0.0	0.5	2.6	0.5	2.6
Boeing-737-400F	0.0	0.5	0.0	0.0	0.0	0.0
Boeing-757-200F	0.5	2.1	0.0	0.0	0.0	0.0
Airbus A319CJ	0.4	0.0	0.0	0.0	0.0	0.0
Airbus A319Neo CJ	0.6	0.0	1.0	0.0	1.0	0.0
Agusta 109 Helicopter	1.7	0.0	1.7	0.0	1.7	0.0
Beechcraft King Air 350	1.6	0.0	1.6	0.0	1.6	0.0
Boeing-737-BBJ7	0.4	0.0	0.0	0.0	0.0	0.0
Boeing-737-BBJ Max7	0.6	0.0	1.0	0.0	1.0	0.0
Bombardier Global Express 6000	12.3	0.1	12.3	0.1	12.4	0.0
Canadair Challenger 605	11.6	0.1	11.6	0.1	11.7	0.0
Cessna 680 Sovereign	21.3	0.2	21.3	0.2	21.5	0.0
Dassault Falcon FA8X	8.9	0.1	8.9	0.1	8.9	0.0
Embraer Legacy 650E	5.7	0.0	5.7	0.0	5.8	0.0
Embraer Phenom 300E	2.7	0.0	2.7	0.0	2.7	0.0
Gulfstream 400	7.3	0.1	7.3	0.1	7.3	0.0
Gulfstream 650	10.7	0.1	10.7	0.1	10.8	0.0

6.15 Route Usage

6.15.1 Noise contours were produced using the average modal split of runway usage for the 92-day summer period from 2010 to 2019, as presented in Table 6.42.

Table 6.42: 92-day Summer Period Average Modal Splits

Year	07-runway Percentage Usage	25-runway Percentage Usage
2010	22%	78%
2011	19%	81%
2012	14%	86%
2013	29%	71%
2014	37%	63%
2015	23%	77%
2016	16%	84%
2017	17%	83%
2018	27%	73%
2019	26%	74%
10-year average (2010 – 2019)	23%	77%

6.15.2 The splits of movements across departure routes that was applied in noise modelling are presented in Table 6.43.

Table 6.43: Departure Route Splits

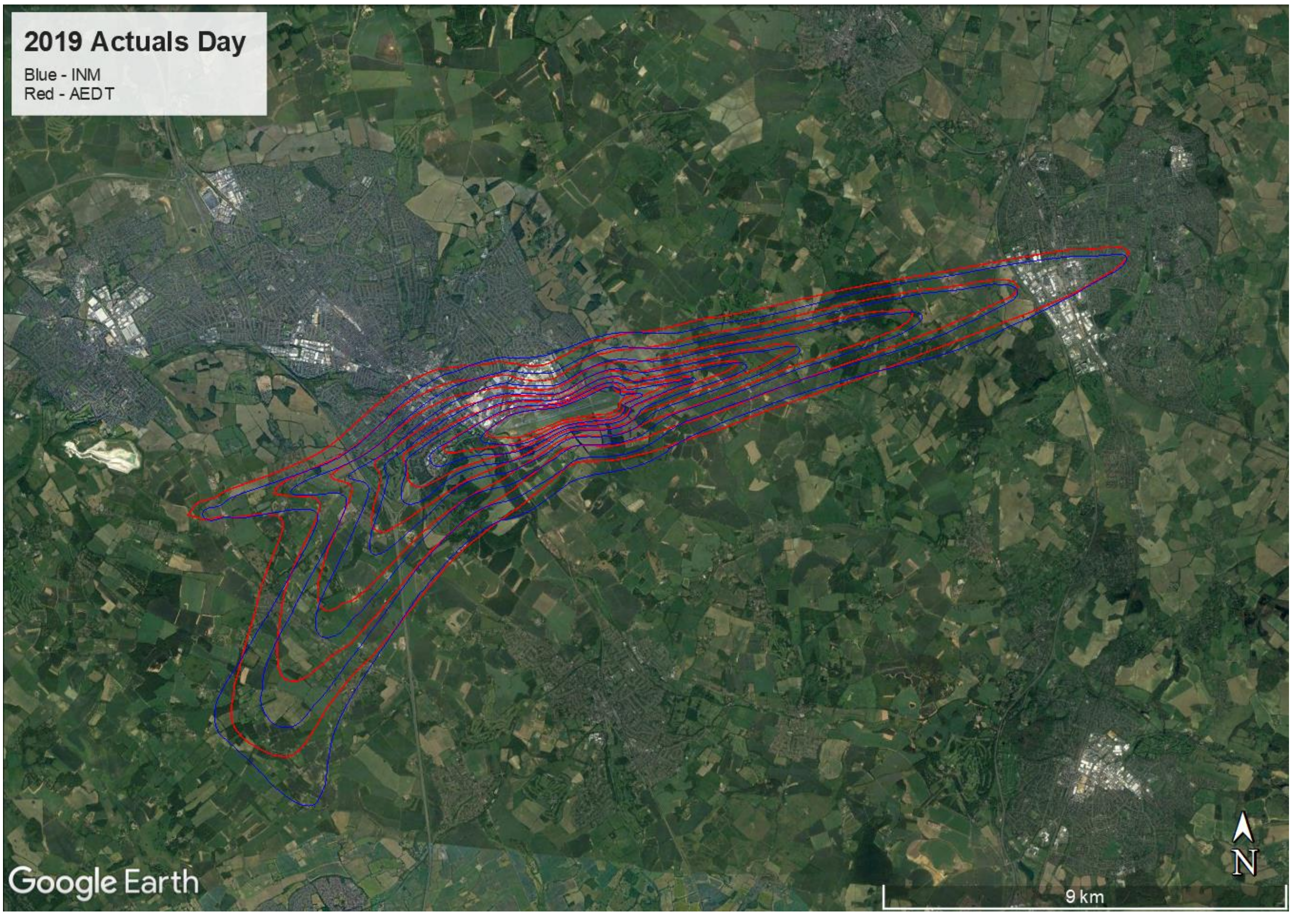
Year	Runway	Olney	Compton	Detling
2019/ 2027	07	3%	6%	13%
	25	11%	22%	45%
2039/ 2043	07	5%	7%	12%
	25	15%	23%	39%

6.16 Comparison of 2019 Actuals Modelled in INM and AEDT

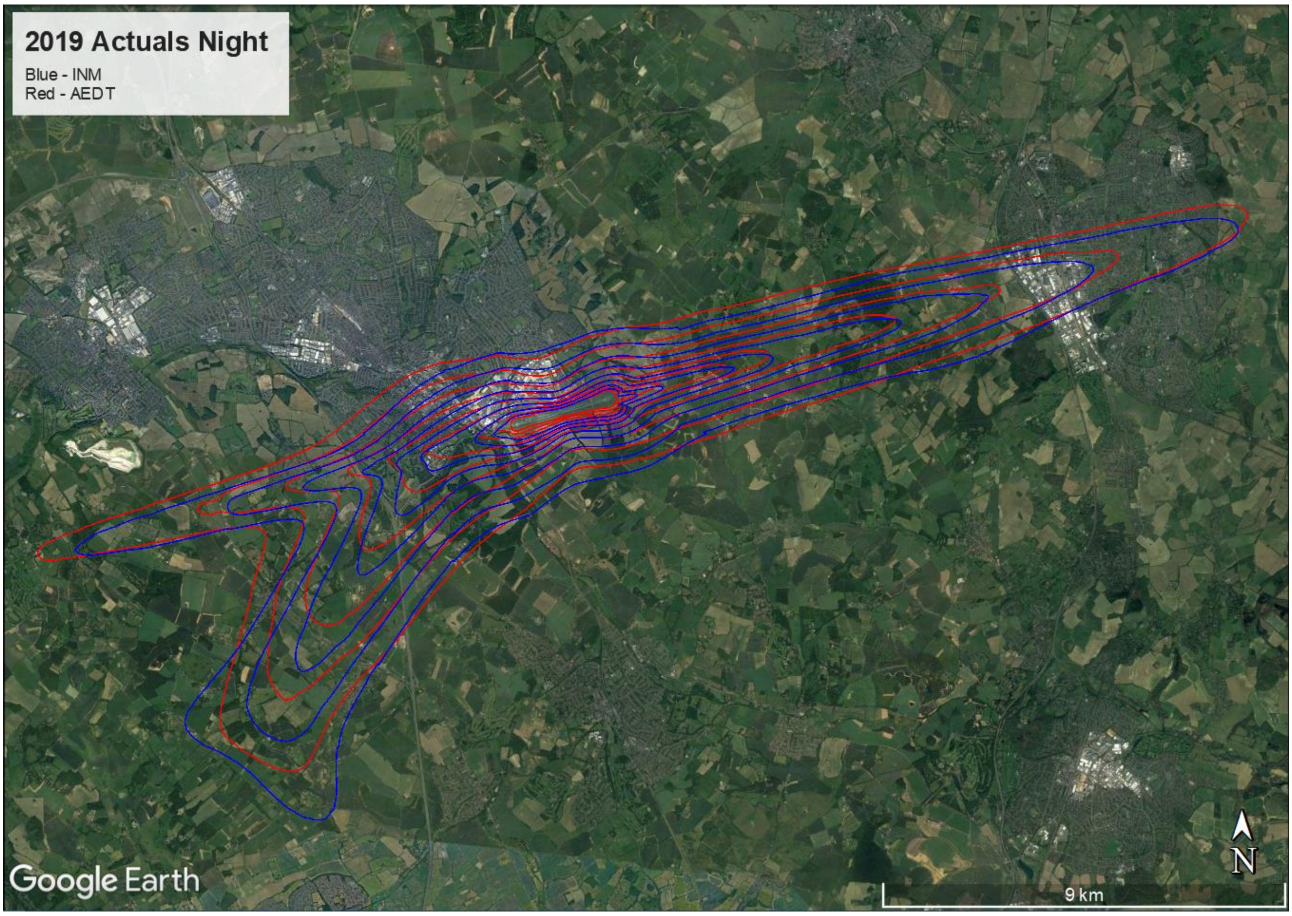
6.16.1 Although AEDT and INM use the same aircraft movement data, the two noise model types and their associated input assumptions produce different noise contours, which are not directly comparable. The difference between the 2019 baseline noise contours produced by the INM and AEDT at Inset 6.42 and Inset 6.43, which show daytime and night-time noise contours for 2019.

6.16.2 The noise contours produced by the two show a good correlation as both noise models have been validated with measured noise data. Noise contours show some difference along the 25 departure routes, which is expected as it is understood that departure profiles in INM were adjusted to account for different departure profiles for this route. This difference was noted in the 2022 PEIR from analysis of 2017 radar track data; however, analysis of 2019 radar track data shows a good correlation between departure profiles on both the 07 and 25--runways.

6.16.3 Whilst the two different modelling types produce different contours, it is important to note that switching from one model to the other (e.g. from INM modelling to AEDT) does not have any impact on the noise that is experienced on the ground, just the way it is described.



Inset 6.42: Daytime noise contours produced by INM (red) and AEDT (blue) for 2019



Inset 6.43: Night-time noise contours produced by INM (red) and AEDT (blue) for 2019

6.17 2019 Consented Fleet

6.17.1 Current consented short-term noise contour limits for the airport were established in 2014 under Condition 10 of granted planning consent 12/01400/FUL. Noise contour limits, as modelled using INM, were set at 19.4 km^2 for the daytime 57dB $L_{Aeq,16h}$ noise contour and 37.2 km^2 for the night-time $L_{Aeq,8h}$ noise contour. As these noise contour limits were exceeded in the 2019 baseline year, a fleet that would be compliant with 2019 noise contour limits has been developed.

6.17.2 A fleet that is compliant with the Condition 10 noise contour limits was developed by increasing the number of new generation aircraft and reducing current generation aircraft by an equivalent amount. The fleet was tested by comparing the difference between INM and AEDT noise contours from 2019 actuals at the 57dB $L_{Aeq,16h}$ contour and the 48dB $L_{Aeq,8h}$ contour. AEDT noise contours were found to be approximately 2% smaller at 57dB $L_{Aeq,16h}$ than 2019 actuals calculated in INM and the 48dB $L_{Aeq,8h}$ contour was found to be 2% bigger. Consequently, 57dB $L_{Aeq,16h}$ AEDT contour outputs were adjusted by +2% and 48dB $L_{Aeq,8h}$ contours were adjusted by -2% to test for compliance with Condition 10 noise contour limits.

6.17.3 The developed 2019 fleet that is AEDT compliant with Condition 10 noise contour limits is presented in Table 6.44.

Table 6.44: 2019 Consented Average Summer Day Aircraft Movement Data

Aircraft	Day	Night
AIRBUS A300-600	2.4	1.7
AIRBUS A319	48.3	5.4
AIRBUS A320	96.5	10.7
AIRBUS A320Neo	38.8	20.6
AIRBUS A321	45.7	4.7
AIRBUS A321Neo	8.2	3.0
AIRBUS A330-200	0.1	0.0
BOEING 737-300	0.3	0.0
BOEING 737-400	1.2	1.2
BOEING 737-500	0.7	0.0
BOEING 737-800	32.6	3.5
BOEING 737-900	0.8	0.2
BOEING 737-MAX8	13.3	4.4
BOEING 757-200	2.9	2.5
BOEING 767-300	0.1	0.0
BOEING 777-200	0.5	0.0
BOEING 787-8	0.0	0.0

7 AIR NOISE ASSESSMENT

7.1 Air Noise Assessment Methodology – residential receptors

7.1.1 Increases in aircraft movements as a result of the Proposed Development have the potential to impact on local communities due to increases in noise. Policies for assessing air noise effects relating to concepts introduced in the NPSE are set out in the Consultation Response on UK Airspace Policy: A framework for balanced decisions on the design and use of airspace (October 2017) (Ref. 21), the Department for Transport (DfT), which states:

"…we will set a LOAEL at 51dB LAeq 16 hr for daytime, and based on feedback and further discussion with CAA we are making one minor change to the LOAEL night metric to be 45dB LAeq 8hr rather than Lnight to be consistent with the daytime metric."

7.1.2 These indicators refer to the 92-day summer[5] average day and night respectively.

7.1.3 To account for this definition of the LOAEL, impacts have been identified within the 51dB $L_{Aeq,16h}$ noise contour and the 45dB $L_{Aeq,8h}$ noise contour. Consequently, the range of average mode noise contours that have been considered in the assessment are as follows:

a. $L_{Aeq,16h}$ – average summer's day: 51dB and above in 3dB increments; and
b. $L_{Aeq,8h}$ – average summer's night: 45dB and above in 3dB increments.

7.1.4 For the purposes of this assessment, SOAEL has been regarded as 63dB $L_{Aeq,16h}$. The equivalent night-time SOAEL is considered to be 55dB $L_{Aeq,8h}$. This is common practice in UK airport planning application, as detailed in Table 7.1. No justification or explanation for the difference in night-time SOAEL was provided in the Stansted Environmental Statement.

Table 7.1: Adopted SOAEL in UK Airport Planning Applications

Time Period	Adopted SOAEL	
	Daytime	Night-time
Bristol	63dB $L_{Aeq,16h}$	55dB $L_{Aeq,8h}$
London City	63dB $L_{Aeq,16h}$	n/a
Stansted	63dB $L_{Aeq,16h}$	54dB $L_{Aeq,8h}$
Manston	63dB $L_{Aeq,16h}$	55dB $L_{Aeq,8h}$
Southampton	63dB $L_{Aeq,16h}$	n/a
Leeds Bradford	63dB $L_{Aeq,16h}$	55dB $L_{Aeq,8h}$

[5]The 92-day summer period is from 16 June to the 15 September inclusive

7.1.5 The defined air noise LOAEL and SOAEL are presented in Table 7.2. A precautionary UAEL for air noise has been defined at 69dB $L_{Aeq,16h}$[6] and 63dB $L_{Aeq,8h}$[7]; however, no properties are exposed to noise exceeding these levels in any assessment scenarios.

Table 7.2: Air Noise LOAEL and SOAEL

Time Period	Threshold Level dB $L_{Aeq,T}$ for Average Day in the 92-day Summer Period		
	LOAEL	SOAEL	UAEL
07:00 to 23:00	51	63	69
23:00 to 07:00	45	55	63

7.1.6 The criteria that have been used to define the significance of effect in terms of changes in air noise are presented in Table 7.3. As there is no published guidance for identifying the significance of effect due to changes in air noise, the criteria are based upon the Institute of Environmental Management and Assessment's (IEMA) 'Guidelines for Environmental Noise Impact' (~~Ref.~~ 4343), Planning Practice Guidance Noise (PPGN) (~~Ref.~~ 12222) and professional judgement. The criteria for noise change below the SOAEL were also adopted in the Bristol Airport application to increase airport capacity (Ref. 23) and were described as follows in the "Change Criteria" section of the Appeal Decision for the application, paragraph 258 (Ref. 24): "*the 3dB is current best practice for assessment within an ES. In light of this, the Panel consider it an appropriate threshold as part of the EIA process.*"

7.1.7 The criteria set different levels for identifying a significant effect depending on whether noise in the DS scenario is either above or below the SOAEL. This addresses the following point in PPGN, which states:

"In cases where existing noise sensitive locations already experience high noise levels, a development that is expected to cause even a small increase in the overall noise level may result in a significant adverse effect occurring even though little to no change in behaviour would be likely to occur".

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[6] NPPF (para 174e) states: "*Planning …decisions should contribute to and enhance the natural and local environment by: e) preventing new .. development from contributing to .. unacceptable levels of .. noise pollution* ..". The PPG(N) definition of unacceptable adverse effect is: "*Extensive and regular changes in behaviour and/or an inability to mitigate effect of noise leading to psychological stress or physiological effects, e.g. regular sleep deprivation/awakening; loss of appetite, significant, medically definable harm, e.g. auditory and nonauditory" and that "this situation should be prevented from occurring*" (para 005)
The threshold for these effects is described as an Unacceptable Adverse Effect Level (UAEL).
As an example of an action to prevent unacceptable adverse effects, the NPS for National Networks sets out that "*the applicant may consider it appropriate to provide noise mitigation through the compulsory acquisition of affected properties in order to gain consent for what might otherwise be unacceptable development*." (para 5.199). The APF states *"The Government continues to expect airport operators to offer households exposed to levels of noise of 69dB LAeq,16h or more, assistance with the costs of moving."* 69dB LAeq,16h may therefore be considered a 'precautionary UAEL' for daytime noise (because this is the threshold for assisting with the costs of moving rather than mandatory acquisition of homes that would be expected to be required at a high level of noise exposure where the actual UAEL is reached).
[7] The night-time UAEL is informed by the approach adopted in the Bristol Airport Application to increase airport capacity.

Table 7.3: Magnitude of Impact Criteria for Changes in Air and Ground Noise

Magnitude of Effect	Change in Noise Level	
	DS Noise Between LOAEL and SOAEL	DS Noise Exceeding SOAEL
Major	6.0dB or more	4.0dB or more
Moderate	3.0dB – 5.9dB	2.0dB – 3.9dB
Minor	2.0 – 2.9dB	1.0 – 1.9dB
Negligible	0.1 – 1.9dB	0.1 – 0.9dB
No change	0.0dB	0.0dB

7.1.8 For DS noise levels between LOAEL and SOAEL, Moderate and Major Adverse effects due to changes in air and ground noise levels are defined as significant effects. For DS noise levels above SOAEL, Minor, Moderate and Major Adverse effects due to changes in air and ground noise levels are defined as significant effects.

7.2 Methodology for Calculating Awakenings

7.2.1 The methodology proposed by Basner et al (Ref. 25) has been used to calculate additional awakenings at each assessment location. The method involves calculating the L_{ASmax} noise level of each aircraft movement at night and applying equation (2) from the Basner et al methodology. Internal L_{Asmax} noise levels have been calculated assuming that a partially open window in the façade of a residential property provides 15dB of attenuation and a closed window provides 26dB of attenuation. The sum of the calculated awakenings from each aircraft movement at night provides the total awakenings at each assessment location.

7.2.2 An assessment of objective sleep disturbance using the awakenings metric is presented in **Chapter 13** Health and Community of this ES **[TR020001/APP/5.01]**.

7.3 2019 Baseline Modelling Results

7.3.1 The results of noise predictions undertaken at assessment locations for the 2019 Actuals Baseline and the 2019 Consented Baseline are presented in Table 7.4. The results are presented for the daytime $L_{Aeq,16h}$ period from 07:00 to 23:00 and the night-time $L_{Aeq,8h}$ from 23:00 to 07:00. Air noise assessment locations are defined in Section 16.7 of Chapter 16 Noise and Vibration of the ES **[TR020001/APP/5.01]**.

Table 7.4: 2019 Baseline 92-day Summer Average Aircraft Noise Prediction Result

Receptor ID	2019 Actuals Baseline		2019 Consented Baseline	
	$L_{Aeq,16h}$dB	$L_{Aeq,8h}$dB	$L_{Aeq,16h}$dB	$L_{Aeq,8h}$dB
AR1	62.4	57.4	62.1	56.2
AR2	63.0	58.7	62.8	58.0
AR3	49.7	45.5	49.5	45.1
AR4	56.6	51.8	56.3	50.7
AR5	61.6	57.8	61.4	57.3
AR7	50.9	45.8	50.5	44.2
AR8	44.4	40.8	44.2	40.1
AR9	56.3	51.1	55.8	49.7
AR10	48.5	44.3	48.1	43.3
AR11	56.5	52.0	56.2	50.9
AR12	60.3	55.0	59.9	53.7
AR13	64.1	59.0	63.8	57.9
AR14	51.2	46.2	50.9	44.8
AR15	49.5	44.5	49.1	43.2
AR16	51.5	46.5	51.1	45.0
AR17	50.5	47.2	50.4	46.9
AR18	46.9	43.2	46.6	42.4
AR19	51.2	46.0	50.8	45.0
AR20	48.1	42.9	47.9	42.2
AR21	43.4	38.9	43.0	37.7
AR22	45.9	42.5	45.7	41.8
AR30	40.5	37.1	40.3	36.6
AR31	53.6	49.5	53.3	48.8
AR32	60.1	54.9	59.8	53.6
AR33	54.8	49.7	54.4	48.2
AR34	50.6	45.7	50.1	44.3
AR35	52.9	47.8	52.5	46.4
AR36	47.0	42.0	46.6	40.6
AR37	60.0	55.7	59.8	54.9
AR38	54.3	50.6	54.1	50.1
AR39	59.0	53.8	58.6	52.4
AR40	65.9	60.9	65.6	59.8

7.4 2027 Assessment Phase 1 Modelling Results

7.4.1 The results of noise predictions undertaken for 2027 DM and DS scenarios are presented in Table 7.5. The results are presented for the daytime L~~a~~$_{Aeq,16h}$ period from 07:00 to 23:00 and the night-time L~~a~~$_{Aeq,8h}$ from 23:00 to 07:00. Receptors experiencing exceedance of the SOAEL in the DS scenario are marked in red and receptors in the DS scenario experiencing exceedances of the LOAEL are marked in orange.

Table 7.5: 2027 92-day Summer Average Aircraft Noise Prediction Result

Receptor ID	DM $L_{Aeq,16h}$dB	DS $L_{Aeq,16h}$dB	Change in $L_{Aeq,16h}$dB	DM $L_{Aeq,8h}$dB	DS $L_{Aeq,8h}$dB	Change in $L_{Aeq,8h}$dB
AR1	60.2	60.8	+0.6	55.1	56.4	+1.3
AR2	61.5	62.3	+0.8	56.9	58.1	+1.2
AR3	49.0	49.9	+0.9	44.3	45.5	+1.2
AR4	54.5	55.2	+0.7	49.6	51.1	+1.5
AR5	60.6	61.4	+0.8	56.1	57.2	+1.1
AR7	48.0	48.8	+0.8	43.1	44.8	+1.7
AR8	43.7	44.5	+0.8	39.2	40.2	+1.0
AR9	54.3	55.0	+0.7	49.0	50.9	+1.9
AR10	46.9	47.7	+0.8	42.2	43.6	+1.4
AR11	54.7	55.5	+0.8	49.9	51.4	+1.5
AR12	58.2	58.9	+0.7	52.9	54.8	+1.9
AR13	61.9	62.6	+0.7	56.9	58.4	+1.5
AR14	48.7	49.3	+0.6	43.8	45.2	+1.4
AR15	47.5	48.1	+0.6	42.6	44.1	+1.5
AR16	49.3	49.9	+0.6	44.3	45.9	+1.6
AR17	50.1	51.0	+0.9	45.8	46.7	+0.9
AR18	45.9	46.7	+0.8	41.4	42.4	+1.0
AR19	49.8	50.6	+0.8	44.5	46.3	+1.8
AR20	47.4	48.3	+0.9	42.2	43.9	+1.7
AR21	41.7	42.4	+0.7	36.8	38.5	+1.7
AR22	44.8	45.6	+0.8	40.5	41.4	+0.9
AR30	40.0	40.7	+0.7	35.6	36.5	+0.9
AR31	52.6	53.4	+0.8	47.9	49.2	+1.3
AR32	57.6	58.3	+0.7	52.5	54.2	+1.7
AR33	52.1	52.9	+0.8	47.1	48.8	+1.7
AR34	48.1	48.8	+0.7	43.2	44.8	+1.6
AR35	50.1	50.8	+0.7	45.3	46.8	+1.5
AR36	44.8	45.4	+0.6	40.0	41.5	+1.5
AR37	58.4	59.3	+0.9	53.8	55.1	+1.3
AR38	53.3	54.1	+0.8	48.9	50.0	+1.1
AR39	56.9	57.7	+0.8	51.7	53.5	+1.8
AR40	63.8	64.5	+0.7	58.9	60.4	+1.5

7.5 2039 Assessment Phase 2a Modelling Results

7.5.1 The results of noise predictions undertaken for 2039 DM and DS scenarios are presented in Table 7.6. The results are presented for the daytime $L_{Aeq,16h}$ period from 07:00 to 23:00 and the night-time $L_{Aeq,8h}$ from 23:00 to 07:00. Receptors experiencing exceedance of the SOAEL in the DS scenario are marked in red and receptors in the DS scenario experiencing exceedances of the LOAEL are marked in orange.

Table 7.6: 2039 92-day Summer Average Aircraft Noise Prediction Result

Receptor ID	DM $L_{Aeq,16h}$dB	DS $L_{Aeq,16h}$dB	Change in $L_{Aeq,16h}$dB	DM $L_{Aeq,8h}$dB	DS $L_{Aeq,8h}$dB	Change in $L_{Aeq,8h}$dB
AR1	59.4	60.7	+1.3	53.5	55.0	+1.5
AR2	60.8	62.1	+1.3	56.3	58.0	+1.7
AR3	48.4	49.7	+1.3	43.9	45.6	+1.7
AR4	53.6	54.9	+1.3	48.9	50.5	+1.6
AR5	60.1	61.4	+1.3	55.7	57.4	+1.7
AR7	46.8	48.1	+1.3	41.9	43.2	+1.3
AR8	43.4	44.8	+1.4	39.0	40.8	+1.8
AR9	53.0	54.4	+1.4	48.2	49.5	+1.3
AR10	46.1	47.5	+1.4	41.8	43.3	+1.5
AR11	53.8	55.2	+1.4	49.3	50.8	+1.5
AR12	56.9	58.3	+1.4	52.0	53.4	+1.4
AR13	60.8	62.1	+1.3	56.0	57.6	+1.6
AR14	47.8	49.0	+1.2	42.2	43.6	+1.4
AR15	46.5	47.7	+1.2	41.1	42.4	+1.3
AR16	47.9	49.1	+1.2	42.6	43.9	+1.3
AR17	49.9	51.2	+1.3	45.6	47.4	+1.8
AR18	45.2	46.5	+1.3	41.0	42.7	+1.7
AR19	48.9	50.2	+1.3	43.8	45.2	+1.4
AR20	47.1	48.5	+1.4	41.9	43.4	+1.5
AR21	40.7	42.0	+1.3	36.3	37.7	+1.4
AR22	44.3	45.7	+1.4	40.2	41.9	+1.7
AR30	39.5	40.9	+1.4	35.2	37.1	+1.9
AR31	52.0	53.2	+1.2	47.5	49.1	+1.6
AR32	56.5	57.8	+1.3	51.6	53.1	+1.5
AR33	51.0	52.3	+1.3	46.2	47.6	+1.4
AR34	46.9	48.3	+1.4	42.3	43.7	+1.4
AR35	49.2	50.5	+1.3	43.8	45.2	+1.4
AR36	43.5	44.8	+1.3	38.4	39.7	+1.3
AR37	57.7	59.0	+1.3	53.2	54.9	+1.7
AR38	52.9	54.1	+1.2	48.5	50.2	+1.7
AR39	55.7	57.1	+1.4	50.8	52.2	+1.4
AR40	62.8	64.1	+1.3	58.0	59.6	+1.6

7.6 2043 Assessment Phase 2b Modelling Results

7.6.1 The results of noise predictions undertaken for 2043 DM and DS scenarios are presented in Table 7.7. The results are presented for the daytime $L_{Aeq,16h}$ period from 07:00 to 23:00 and the night-time $L_{Aeq,8h}$ from 23:00 to 07:00. Receptors experiencing exceedance of the SOAEL in the DS scenario are marked in red and receptors in the DS scenario experiencing exceedances of the LOAEL are marked in orange.

Table 7.7: 2043 92-day Summer Average Aircraft Noise Prediction Result

Receptor ID	DM $L_{Aeq,16h}$dB	DS $L_{Aeq,16h}$dB	Change in $L_{Aeq,16h}$dB	DM $L_{Aeq,8h}$dB	DS $L_{Aeq,8h}$dB	Change in $L_{Aeq,8h}$dB
AR1	59.4	61.4	+2.0	53.4	55.4	+2.0
AR2	60.8	62.7	+1.9	56.3	58.7	+2.4
AR3	48.4	50.3	+1.9	43.9	46.3	+2.4
AR4	53.6	55.5	+1.9	48.8	51.1	+2.3
AR5	60.1	62.0	+1.9	55.6	58.2	+2.6
AR7	46.7	48.8	+2.1	41.7	43.6	+1.9
AR8	43.4	45.5	+2.1	39.0	41.7	+2.7
AR9	52.9	55.0	+2.1	48.0	50.0	+2.0
AR10	46.1	48.1	+2.0	41.7	44.0	+2.3
AR11	53.8	55.8	+2.0	49.2	51.4	+2.2
AR12	56.9	58.9	+2.0	51.9	53.9	+2.0
AR13	60.8	62.7	+1.9	56.0	58.2	+2.2
AR14	47.7	49.7	+2.0	42.1	44.0	+1.9
AR15	46.4	48.4	+2.0	41.0	42.9	+1.9
AR16	47.8	49.8	+2.0	42.5	44.3	+1.8
AR17	49.9	51.8	+1.9	45.6	48.3	+2.7
AR18	45.1	47.2	+2.1	41.0	43.6	+2.6
AR19	48.8	50.8	+2.0	43.7	45.7	+2.0
AR20	47.0	49.1	+2.1	41.9	43.9	+2.0
AR21	40.6	42.7	+2.1	36.2	38.3	+2.1
AR22	44.3	46.3	+2.0	40.2	42.8	+2.6
AR30	39.5	41.6	+2.1	35.2	38.1	+2.9
AR31	51.9	53.9	+2.0	47.4	49.8	+2.4
AR32	56.4	58.4	+2.0	51.6	53.7	+2.1
AR33	50.9	52.9	+2.0	46.1	48.1	+2.0
AR34	46.8	48.9	+2.1	42.2	44.2	+2.0
AR35	49.1	51.2	+2.1	43.7	45.6	+1.9
AR36	43.5	45.5	+2.0	38.3	40.1	+1.8
AR37	57.7	59.6	+1.9	53.2	55.6	+2.4
AR38	52.8	54.8	+2.0	48.5	51.0	+2.5
AR39	55.6	57.7	+2.1	50.7	52.7	+2.0
AR40	62.8	64.6	+1.8	57.9	60.2	+2.0

7.7 Assessment Location Results

7.7.1 The results of the noise assessment covering both primary and supplementary noise metrics at each air noise assessment location are presented in Table 7.8 to Table 7.39. Air noise assessment locations are defined in Section 16.7 of Chapter 16 Noise and Vibration of the ES **[TR020001/APP/5.01]**.

7.7.2 Primary and supplementary noise metrics show a general increasing trend, which is to be expected as a result of increased aircraft movements. The exception to this increase is the L_{Asmax} level (representative of the noisiest aircraft), which decreases as quieter aircraft come into service. Where larger increases in supplementary noise metrics are noted, these are at assessment locations where significant noise effects from the primary $L_{Aeq,T}$ noise metrics are identified. Consequently, supplementary noise metrics do not change the results of the assessment of air noise; however, they do provide contextual information on how communities will be affected by individual aircraft movements as a result of the Proposed Development.

Table 7.8: AR1 (Someries) – Aircraft Noise Prediction Results

Assessment Phase	Metric	2019 Actuals Baseline	Do-Minimum	Do-Something	Difference (DS-DM))
Baseline	Measured Ambient $L_{Aeq,16h}$dB	61	-	-	-
	Measured Ambient $L_{Aeq,8h}$dB	55	-	-	-
Assessment Phase 1 (2027)	$L_{Aeq,16h}$dB	62.4	60.4	60.8	+0.4
	$L_{Aeq,8h}$dB	57.4	55.4	56.4	+1.0
	L_{Asmax}dB	86.7	86.7	86.7	0
	Daytime N65	217	230	244	+14
	Night-time N60	33	36	45	+9
	Daytime Overflights	1	1	1	0
	Night-time Overflights	1	0	0	0
	Number of Awakenings	2.2	1.9	2.5	+0.6
Assessment Phase 2a (2039)	$L_{Aeq,16h}$dB	62.4	59.5	60.7	+1.2
	$L_{Aeq,8h}$dB	57.4	53.5	55.0	+1.5
	L_{Asmax}dB	86.7	84.0	84.0	0.0

Assessment Phase	Metric	2019 Actuals Baseline	Do-Minimum	Do-Something	Difference (DS-DM))
	Daytime N65	217	230	288	+58
	Night-time N60	33	32	46	+14
	Daytime Overflights	1	1	1	0
	Night-time Overflights	1	0	0	0
	Number of Awakenings	2.2	1.9	2.8	+0.9
Assessment Phase 2b (2043)	$L_{Aeq,16h}$dB	62.4	59.4	61.4	+2.0
	$L_{Aeq,8h}$dB	57.4	53.5	55.4	+2.0
	L_{Asmax}dB	86.7	84.0	84.0	0.0
	Daytime N65	217	219	33.2	+113
	Night-time N60	33	30	51	+22
	Daytime Overflights	1	1	1	1
	Night-time Overflights	1	0	0	0
	Number of Awakenings	2.2	1.8	3.2	+1.4

Table 7.9: AR2 (Lye Hill, Breachwood Green) – Aircraft Noise Prediction Results

Assessment Phase	Metric	2019 Actuals Baseline	Do-Minimum	Do-Something	Difference (DS-DM)
Baseline	Measured Ambient $L_{Aeq,16h}$dB	66	-	-	-
	Measured Ambient $L_{Aeq,8h}$dB	61	-	-	-
Assessment Phase 1 (2027)	$L_{Aeq,16h}$dB	63.0	61.5	62.3	+0.8
	$L_{Aeq,8h}$dB	58.7	56.9	58.1	+1.2
	L_{Asmax}dB	89.2	89.2	89.2	0.0

Assessment Phase	Metric	2019 Actuals Baseline	Do-Minimum	Do-Something	Difference (DS-DM)
	Daytime N65	184	183	205	+22
	Night-time N60	32	26	32	+6
	Daytime Overflights	40	40	44	+4
	Night-time Overflights	4	4	5	+1
	Number of Awakenings	3.5	3.2	4.0	+0.8
Assessment Phase 2a (2039)	$L_{Aeq,16h}$dB	63.0	60.8	62.1	+1.3
	$L_{Aeq,8h}$dB	58.7	56.3	58.0	+1.7
	L_{Asmax}dB	89.2	86.3	86.3	0.0
	Daytime N65	184	183	240	+57
	Night-time N60	32	26	39	+13
	Daytime Overflights	40	40	52	+12
	Night-time Overflights	4	4	6	+2
	Number of Awakenings	3.5	3.1	4.6	+1.5
Assessment Phase 2b (2043)	$L_{Aeq,16h}$dB	63.0	60.8	62.7	+1.9
	$L_{Aeq,8h}$dB	58.7	56.3	58.7	+2.4
	L_{Asmax}dB	89.2	86.3	86.3	0.0
	Daytime N65	184	183	273	+90
	Night-time N60	32	26	47	+19
	Daytime Overflights	40	40	59	+17
	Night-time Overflights	4	4	7	+3
	Number of Awakenings	3.5	3.0	5.4	+2.4

Table 7.10: AR3 (Langley) – Aircraft Noise Prediction Results

Assessment Phase	Metric	2019 Actuals Baseline	Do-Minimum	Do-Something	Difference (DS-DM)
Baseline	Measured Ambient $L_{Aeq,16h}$dB	56	-	-	-
	Measured Ambient $L_{Aeq,8h}$dB	48	-	-	-
Assessment Phase 1 (2027)	$L_{Aeq,16h}$dB	49.7	49.0	49.9	+0.9
	$L_{Aeq,8h}$dB	45.5	44.3	45.5	+1.2
	L_{Asmax}dB	76.1	76.1	76.1	0.0
	Daytime N65	22	13	20	+7
	Night-time N60	16	10	16	+6
	Daytime Overflights	18	18	20	+2
	Night-time Overflights	2	2	2	0
	Number of Awakenings	1.1	1.0	1.2	+0.2
Assessment Phase 2a (2039)	$L_{Aeq,16h}$dB	49.7	48.4	49.7	+1.3
	$L_{Aeq,8h}$dB	45.5	43.9	45.6	+1.7
	L_{Asmax}dB	76.1	73.4	73.4	0.0
	Daytime N65	22	6	9	+3
	Night-time N60	16	9	13	+4
	Daytime Overflights	18	18	23	+5
	Night-time Overflights	2	2	3	+1
	Number of Awakenings	1.1	0.9	1.3	+0.4
Assessment Phase 2b (2043)	$L_{Aeq,16h}$dB	49.7	48.4	50.3	+1.9
	$L_{Aeq,8h}$dB	45.5	43.9	46.3	+2.4
	L_{Asmax}dB	76.1	73.4	73.4	0.0
	Daytime N65	22	5	10	+5

Assessment Phase	Metric	2019 Actuals Baseline	Do-Minimum	Do-Something	Difference (DS-DM)
	Night-time N60	16	8	15	+7
	Daytime Overflights	18	18	26	+8
	Night-time Overflights	2	2	3	+1
	Number of Awakenings	1.1	0.9	1.6	+0.7

Table 7.11: AR4 (Breachwood Green) – Aircraft Noise Prediction Results

Assessment Phase	Metric	2019 Actuals Baseline	Do-Minimum	Do-Something	Difference (DS-DM)
Baseline	Measured Ambient $L_{Aeq,16h}$dB	58	-	-	-
	Measured Ambient $L_{Aeq,8h}$dB	59	-	-	-
Assessment Phase 1 (2027)	$L_{Aeq,16h}$dB	56.6	54.5	55.2	+0.7
	$L_{Aeq,8h}$dB	51.8	49.6	51.1	+1.5
	L_{Asmax}dB	83.3	83.3	83.3	0.0
	Daytime N65	105	64	101	+37
	Night-time N60	32	26	32	+6
	Daytime Overflights	10	10	11	+1
	Night-time Overflights	1	1	1	0
	Number of Awakenings	1.9	1.8	2.4	+0.6
Assessment Phase 2a (2039)	$L_{Aeq,16h}$dB	56.6	53.6	54.9	+1.3
	$L_{Aeq,8h}$dB	51.8	48.9	50.5	+1.6
	L_{Asmax}dB	83.3	78.9	78.9	0.0
	Daytime N65	105	49	68	+19
	Night-time N60	32	26	39	+13

Assessment Phase	Metric	2019 Actuals Baseline	Do-Minimum	Do-Something	Difference (DS-DM)
	Daytime Overflights	10	10	12	+2
	Night-time Overflights	1	1	1	0
	Number of Awakenings	1.9	1.8	2.6	+0.8
Assessment Phase 2b (2043)	$L_{Aeq,16h}$dB	56.6	53.6	55.5	+1.9
	$L_{Aeq,8h}$dB	51.8	48.8	51.1	+2.3
	L_{Asmax}dB	83.3	78.9	78.9	0.0
	Daytime N65	105	48	81	+33
	Night-time N60	32	26	47	+21
	Daytime Overflights	10	10	13	+3
	Night-time Overflights	1	1	1	0
	Number of Awakenings	1.9	1.7	3.1	+1.4

Table 7.12: AR5 (Bendish) – Aircraft Noise Prediction Results

Assessment Phase	Metric	2019 Actuals Baseline	Do-Minimum	Do-Something	Difference (DS-DM)
Baseline	Measured Ambient $L_{Aeq,16h}$dB	62	-	-	-
	Measured Ambient $L_{Aeq,8h}$dB	56	-	-	-
Assessment Phase 1 (2027)	$L_{Aeq,16h}$dB	61.6	60.6	61.4	+0.8
	$L_{Aeq,8h}$dB	57.8	56.1	57.2	+1.1
	L_{Asmax}dB	86.3	86.3	86.3	0.0
	Daytime N65	184	182	204	+22
	Night-time N60	32	26	32	+6
	Daytime Overflights	177	177	198	+21
	Night-time Overflights	31	27	34	+7
	Number of Awakenings	3.2	2.9	3.6	+0.7

Assessment Phase	Metric	2019 Actuals Baseline	Do-Minimum	Do-Something	Difference (DS-DM)
Assessment Phase 2a (2039)	$L_{Aeq,16h}$dB	61.6	60.1	61.4	+1.3
	$L_{Aeq,8h}$dB	57.8	55.7	57.4	+1.7
	L_{Asmax}dB	86.3	82.5	82.5	0.0
	Daytime N65	184	182	239	+57
	Night-time N60	32	26	39	+13
	Daytime Overflights	177	177	233	+56
	Night-time Overflights	31	27	40	+13
	Number of Awakenings	3.2	2.8	4.2	+1.4
Assessment Phase 2b (2043)	$L_{Aeq,16h}$dB	61.6	60.1	62.0	+1.9
	$L_{Aeq,8h}$dB	57.8	55.6	58.2	+2.6
	L_{Asmax}dB	86.3	82.5	82.5	0.0
	Daytime N65	184	182	271	+89
	Night-time N60	32	26	47	+21
	Daytime Overflights	177	177	266	+89
	Night-time Overflights	31	27	47	+20
	Number of Awakenings	3.2	2.7	4.9	+2.2

Table 7.13: AR7 (Luton Hoo) – Aircraft Noise Prediction Results

Assessment Phase	Metric	2019 Actuals Baseline	Do-Minimum	Do-Something	Difference (DS-DM)
Baseline Measurements	Ambient $L_{Aeq,16h}$dB	66	-	-	-
	Ambient $L_{Aeq,8h}$dB	61	-	-	-
Assessment Phase 1 (2027)	$L_{Aeq,16h}$dB	50.9	48.0	48.8	+0.8
	$L_{Aeq,8h}$dB	45.8	43.1	44.8	+1.7
	L_{Asmax}dB	69.0	69.0	69.0	0.0
	Daytime N65	1	1	1	0
	Night-time N60	15	5	8	+3

Assessment Phase	Metric	2019 Actuals Baseline	Do-Minimum	Do-Something	Difference (DS-DM)
	Daytime Overflights	0	0	0	0
	Night-time Overflights	0	0	0	0
	Number of Awakenings	0.3	0.2	0.2	0.0
Assessment Phase 2a (2039)	$L_{Aeq,16h}$dB	50.9	46.8	48.1	+1.3
	$L_{Aeq,8h}$dB	45.8	41.9	43.2	+1.3
	L_{Asmax}dB	69.0	67.3	67.3	0.0
	Daytime N65	1	1	1	0
	Night-time N60	15	2	1	-1*
	Daytime Overflights	0	0	0	0
	Night-time Overflights	0	0	0	0
	Number of Awakenings	0.3	0.1	0.1	0.0
Assessment Phase 2b (2043)	$L_{Aeq,16h}$dB	50.9	46.7	48.8	+2.1
	$L_{Aeq,8h}$dB	45.8	41.7	43.6	+1.9
	L_{Asmax}dB	69.0	67.3	67.3	0.0
	Daytime N65	1	1	1	0
	Night-time N60	15	2	1	-1*
	Daytime Overflights	0	0	0	0
	Night-time Overflights	0	0	0	0
	Number of Awakenings	0.3	0.1	0.2	+0.1
*The reduction in N60 is a result of B737-800 night activity occurring in the DM fleet (see Table 6.40) but not the DS fleet (see Table 6.41).					

Table 7.14: AR8 (Dagnall) – Aircraft Noise Prediction Results

Assessment Phase	Metric	2019 Actuals Baseline	Do-Minimum	Do-Something	Difference (DS-DM)
Baseline	Measured Ambient $L_{Aeq,16h}$dB	60	-	-	-
	Measured Ambient $L_{Aeq,8h}$dB	56	-	-	-
Assessment Phase 1 (2027)	$L_{Aeq,16h}$dB	44.4	43.7	44.5	+0.8
	$L_{Aeq,8h}$dB	40.8	39.2	40.2	+1.0
	L_{Asmax}dB	68.6	68.6	68.6	0.0
	Daytime N65	1	0	0	0
	Night-time N60	8	7	8	+1
	Daytime Overflights	38	38	42	+4
	Night-time Overflights	7	6	8	+2
	Number of Awakenings	0.3	0.2	0.2	0.0
Assessment Phase 2a (2039)	$L_{Aeq,16h}$dB	44.4	43.4	44.8	+1.4
	$L_{Aeq,8h}$dB	40.8	39.0	40.8	+1.8
	L_{Asmax}dB	68.6	66.5	66.5	0.0
	Daytime N65	1	0	0	0
	Night-time N60	8	7	10	+3
	Daytime Overflights	38	38	49	+11
	Night-time Overflights	7	6	10	+4
	Number of Awakenings	0.3	0.2	0.3	+0.1
Assessment Phase 2b (2043)	$L_{Aeq,16h}$dB	44.4	43.4	45.5	+2.1
	$L_{Aeq,8h}$dB	40.8	39.0	41.7	+2.7
	L_{Asmax}dB	68.6	66.5	66.5	0.0
	Daytime N65	1	0	0	0

Assessment Phase	Metric	2019 Actuals Baseline	Do-Minimum	Do-Something	Difference (DS-DM)
	Night-time N60	8	7	12	+5
	Daytime Overflights	38	38	56	+18
	Night-time Overflights	7	6	11	+5
	Number of Awakenings	0.3	0.2	0.3	+0.1

Table 7.15: AR9 (Markyate) – Aircraft Noise Prediction Results

Assessment Phase	Metric	2019 Actuals Baseline	Do-Minimum	Do-Something	Difference (DS-DM)
Baseline	Measured Ambient $L_{Aeq,16h}$dB	56	-	-	-
	Measured Ambient $L_{Aeq,8h}$dB	51	-	-	-
Assessment Phase 1 (2027)	$L_{Aeq,16h}$dB	56.3	54.3	55.0	+0.7
	$L_{Aeq,8h}$dB	51.1	49.0	50.9	+0.9
	L_{Asmax}dB	78.3	78.3	78.3	0.0
	Daytime N65	143	132	147	+15
	Night-time N60	19	18	25	+7
	Daytime Overflights	59	59	65	+6
	Night-time Overflights	6	5	6	+1
	Number of Awakenings	0.5	0.3	0.4	+0.1
Assessment Phase 2a (2039)	$L_{Aeq,16h}$dB	56.3	53.0	54.4	+1.4
	$L_{Aeq,8h}$dB	51.1	48.2	49.5	+1.3
	L_{Asmax}dB	78.3	73.9	73.9	0.0
	Daytime N65	143	132	173	+41
	Night-time N60	19	18	27	+9

Assessment Phase	Metric	2019 Actuals Baseline	Do-Minimum	Do-Something	Difference (DS-DM)
	Daytime Overflights	59	59	74	+15
	Night-time Overflights	6	5	8	+3
	Number of Awakenings	0.5	0.2	0.4	+0.2
Assessment Phase 2b (2043)	$L_{Aeq,16h}$dB	56.3	52.9	55.0	+2.1
	$L_{Aeq,8h}$dB	51.1	48.0	50.0	+2.0
	L_{Asmax}dB	78.3	73.9	73.9	0.0
	Daytime N65	143	132	201	+69
	Night-time N60	19	18	31	+13
	Daytime Overflights	59	59	83	+24
	Night-time Overflights	6	5	9	+4
	Number of Awakenings	0.5	0.2	0.4	+0.2

Table 7.16: AR10 (Caddington) – Aircraft Noise Prediction Results

Assessment Phase	Metric	2019 Actuals Baseline	Do-Minimum	Do-Something	Difference (DS-DM)
Baseline	Measured Ambient $L_{Aeq,16h}$dB	58	-	-	-
	Measured Ambient $L_{Aeq,8h}$dB	53	-	-	-
Assessment Phase 1 (2027)	$L_{Aeq,16h}$dB	48.5	46.9	47.7	+0.8
	$L_{Aeq,8h}$dB	44.3	42.2	43.6	+1.4
	L_{Asmax}dB	70.7	70.7	70.7	0.0
	Daytime N65	3	1	4	+3
	Night-time N60	11	8	10	+2
	Daytime Overflights	0	0	0	0

Assessment Phase	Metric	2019 Actuals Baseline	Do-Minimum	Do-Something	Difference (DS-DM)
	Night-time Overflights	0	0	0	0
	Number of Awakenings	0.4	0.3	0.3	0.0
Assessment Phase 2a (2039)	$L_{Aeq,16h}$dB	48.5	46.1	47.5	+1.4
	$L_{Aeq,8h}$dB	44.3	41.8	43.3	+1.5
	L_{Asmax}dB	70.7	68.4	68.4	0.0
	Daytime N65	3	0	1	+1
	Night-time N60	11	8	10	+2
	Daytime Overflights	0	0	0	0
	Night-time Overflights	0	0	0	0
	Number of Awakenings	0.4	0.2	0.4	+0.2
Assessment Phase 2b (2043)	$L_{Aeq,16h}$dB	48.5	46.1	48.1	+2.0
	$L_{Aeq,8h}$dB	44.3	41.7	44.0	+2.3
	L_{Asmax}dB	70.7	68.4	68.4	0.0
	Daytime N65	3	0	1	+1
	Night-time N60	11	7	12	+5
	Daytime Overflights	0	0	0	0
	Night-time Overflights	0	0	0	0
	Number of Awakenings	0.4	0.2	0.4	+0.2

Table 7.17: AR11 (Woodside Park) – Aircraft Noise Prediction Results

Assessment Phase	Metric	2019 Actuals Baseline	Do-Minimum	Do-Something	Difference (DS-DM)
Baseline	Measured Ambient $L_{Aeq,16h}$dB	59	-	-	-

Assessment Phase	Metric	2019 Actuals Baseline	Do-Minimum	Do-Something	Difference (DS-DM)
	Measured Ambient $L_{Aeq,8h}$dB	57	-	-	-
Assessment Phase 1 (2027)	$L_{Aeq,16h}$dB	56.5	54.7	55.5	+0.8
	$L_{Aeq,8h}$dB	52.0	49.9	51.4	+1.5
	L_{Asmax}dB	80.1	80.1	80.1	0.0
	Daytime N65	174	128	152	+24
	Night-time N60	27	24	32	+8
	Daytime Overflights	4	4	4	0
	Night-time Overflights	0	0	0	0
	Number of Awakenings	1.0	0.6	0.8	+0.2
Assessment Phase 2a (2039)	$L_{Aeq,16h}$dB	56.5	53.8	55.2	+1.4
	$L_{Aeq,8h}$dB	52.0	49.3	50.8	+1.5
	L_{Asmax}dB	80.1	76.9	76.9	0.0
	Daytime N65	174	115	154	+39
	Night-time N60	27	24	37	+13
	Daytime Overflights	4	4	4	0
	Night-time Overflights	0	0	0	0
	Number of Awakenings	1.0	0.6	0.9	+0.3
Assessment Phase 2b (2043)	$L_{Aeq,16h}$dB	56.5	53.8	55.8	+2.0
	$L_{Aeq,8h}$dB	52.0	49.2	51.4	+2.2
	L_{Asmax}dB	80.1	76.9	76.9	0.0
	Daytime N65	174	115	184	+69
	Night-time N60	27	24	42	+18
	Daytime Overflights	4	4	4	0
	Night-time Overflights	0	0	0	0
	Number of Awakenings	1.0	0.6	1.1	+0.5

Table 7.18: AR12 (Slip End) – Aircraft Noise Prediction Results

Assessment Phase	Metric	2019 Actuals Baseline	Do-Minimum	Do-Something	Difference (DS-DM)
Baseline	Measured Ambient $L_{Aeq,16h}$dB	66	-	-	-
	Measured Ambient $L_{Aeq,8h}$dB	60	-	-	-
Assessment Phase 1 (2027)	$L_{Aeq,16h}$dB	60.3	58.2	58.9	+0.7
	$L_{Aeq,8h}$dB	55.0	52.9	54.8	+1.9
	L_{Asmax}dB	83.4	83.4	83.4	0.0
	Daytime N65	147	136	150	+14
	Night-time N60	19	18	25	+7
	Daytime Overflights	146	146	164	+18
	Night-time Overflights	20	18	22	+4
	Number of Awakenings	0.7	0.4	0.5	+0.1
Assessment Phase 2a (2039)	$L_{Aeq,16h}$dB	60.3	56.9	58.3	+1.4
	$L_{Aeq,8h}$dB	55.0	52.0	53.4	+1.4
	L_{Asmax}dB	83.4	77.7	77.7	0.0
	Daytime N65	147	135	180	+45
	Night-time N60	19	18	27	+9
	Daytime Overflights	146	146	193	+47
	Night-time Overflights	20	18	26	+8
	Number of Awakenings	0.7	0.3	0.5	+0.2
Assessment Phase 2b (2043)	$L_{Aeq,16h}$dB	60.3	56.9	58.9	+2.0
	$L_{Aeq,8h}$dB	55.0	51.9	53.9	+2.0
	L_{Asmax}dB	83.4	77.7	77.7	0.0
	Daytime N65	147	136	208	+72

Assessment Phase	Metric	2019 Actuals Baseline	Do-Minimum	Do-Something	Difference (DS-DM)
	Night-time N60	19	18	31	+13
	Daytime Overflights	146	146	221	+75
	Night-time Overflights	20	18	31	+13
	Number of Awakenings	0.7	0.3	0.6	+0.3

Table 7.19: AR13 (Strathmore Avenue, Luton) – Aircraft Noise Prediction Results

Assessment Phase	Metric	2019 Actuals Baseline	Do-Minimum	Do-Something	Difference (DS-DM)
Baseline	Measured Ambient $L_{Aeq,16h}$dB	61	-	-	-
	Measured Ambient $L_{Aeq,8h}$dB	57	-	-	-
Assessment Phase 1 (2027)	$L_{Aeq,16h}$dB	64.1	61.9	62.6	+0.7
	$L_{Aeq,8h}$dB	59.0	56.9	58.4	+1.5
	L_{Asmax}dB	89.8	89.8	89.8	0.0
	Daytime N65	189	181	201	+20
	Night-time N60	27	24	32	+8
	Daytime Overflights	181	181	203	+22
	Night-time Overflights	27	24	30	+6
	Number of Awakenings	1.6	1.0	1.3	+0.3
Assessment Phase 2a (2039)	$L_{Aeq,16h}$dB	64.1	60.8	62.1	+1.3
	$L_{Aeq,8h}$dB	59.0	56.0	57.6	+1.6
	L_{Asmax}dB	89.8	85.7	85.7	0.0
	Daytime N65	189	181	239	+58
	Night-time N60	27	24	37	+13

Assessment Phase	Metric	2019 Actuals Baseline	Do-Minimum	Do-Something	Difference (DS-DM)
	Daytime Overflights	181	181	238	+57
	Night-time Overflights	27	24	36	+12
	Number of Awakenings	1.6	1.0	1.4	+0.4
Assessment Phase 2b (2043)	$L_{Aeq,16h}$dB	64.1	60.8	62.7	+1.9
	$L_{Aeq,8h}$dB	59.0	56.0	58.2	+2.2
	L_{Asmax}dB	89.8	85.7	85.7	0.0
	Daytime N65	189	182	274	+92
	Night-time N60	27	24	42	+18
	Daytime Overflights	181	181	273	+92
	Night-time Overflights	27	24	42	+18
	Number of Awakenings	1.6	1.0	1.7	+0.7

Table 7.20: AR14 (Vauxhall Way, Luton) – Aircraft Noise Prediction Results

Assessment Phase	Metric	2019 Actuals Baseline	Do-Minimum	Do-Something	Difference (DS-DM)
Baseline	Measured Ambient $L_{Aeq,16h}$dB	72	-	-	-
	Measured Ambient $L_{Aeq,8h}$dB	68	-	-	-
Assessment Phase 1 (2027)	$L_{Aeq,16h}$dB	51.2	48.7	49.3	+1.6
	$L_{Aeq,8h}$dB	46.2	43.8	45.2	+1.4
	L_{Asmax}dB	71.5	71.5	71.5	0.0
	Daytime N65	8	2	2	0
	Night-time N60	22	9	17	+8
	Daytime Overflights	0	0	0	0

Assessment Phase	Metric	2019 Actuals Baseline	Do-Minimum	Do-Something	Difference (DS-DM)
	Night-time Overflights	1	0	0	0
	Number of Awakenings	0.5	0.4	0.5	+0.1
Assessment Phase 2a (2039)	$L_{Aeq,16h}$dB	51.2	47.8	49.0	+1.2
	$L_{Aeq,8h}$dB	46.2	42.2	43.6	+1.4
	L_{ASmax}dB	71.5	69.3	69.3	0.0
	Daytime N65	8	1	3	+2
	Night-time N60	22	2	2	0
	Daytime Overflights	0	0	0	0
	Night-time Overflights	1	0	0	0
	Number of Awakenings	0.5	0.3	0.4	+0.1
Assessment Phase 2b (2043)	$L_{Aeq,16h}$dB	51.2	47.7	49.7	+2.0
	$L_{Aeq,8h}$dB	46.2	42.1	44.0	+1.9
	L_{ASmax}dB	71.5	69.3	69.3	0.0
	Daytime N65	8	1	4	+3
	Night-time N60	22	2	2	0
	Daytime Overflights	0	0	0	0
	Night-time Overflights	1	0	0	0
	Number of Awakenings	0.5	0.3	0.4	+0.1

Table 7.21: AR15 (Eaton Green Road, Luton) – Aircraft Noise Prediction Results

Assessment Phase	Metric	2019 Actuals Baseline	Do-Minimum	Do-Something	Difference (DS-DM)
Baseline	Measured Ambient $L_{Aeq,16h}$dB	65	-	-	-

Assessment Phase	Metric	2019 Actuals Baseline	Do-Minimum	Do-Something	Difference (DS-DM)
	Measured Ambient $L_{Aeq,8h}$dB	60	-	-	-
Assessment Phase 1 (2027)	$L_{Aeq,16h}$dB	49.5	47.5	48.1	+0.6
	$L_{Aeq,8h}$dB	44.5	42.6	44.1	+1.5
	L_{Asmax}dB	68.3	68.3	68.3	0.0
	Daytime N65	4	1	1	0
	Night-time N60	13	2	2	0
	Daytime Overflights	0	0	0	0
	Night-time Overflights	0	0	0	0
	Number of Awakenings	0.4	0.3	0.4	+0.1
Assessment Phase 2a (2039)	$L_{Aeq,16h}$dB	49.5	46.5	47.7	+1.2
	$L_{Aeq,8h}$dB	44.5	41.1	42.4	+1.3
	L_{Asmax}dB	68.3	66.3	66.3	0.0
	Daytime N65	4	1	1	0
	Night-time N60	13	1	1	0
	Daytime Overflights	0	0	0	0
	Night-time Overflights	0	0	0	0
	Number of Awakenings	0.4	0.2	0.3	+0.1
Assessment Phase 2b (2043)	$L_{Aeq,16h}$dB	49.5	46.4	48.4	+2.0
	$L_{Aeq,8h}$dB	44.5	41.0	42.9	+1.9
	L_{Asmax}dB	68.3	66.3	66.3	0.0
	Daytime N65	4	1	1	0
	Night-time N60	13	1	1	0
	Daytime Overflights	0	0	0	0

Assessment Phase	Metric	2019 Actuals Baseline	Do-Minimum	Do-Something	Difference (DS-DM)
	Night-time Overflights	0	0	0	0
	Number of Awakenings	0.4	0.2	0.3	+0.1

Table 7.22: AR16 (Malthouse Green, Luton) – Aircraft Noise Prediction Results

Assessment Phase	Metric	2019 Actuals Baseline	Do-Minimum	Do-Something	Difference (DS-DM)
Baseline	Measured Ambient $L_{Aeq,16h}$dB	52	-	-	-
	Measured Ambient $L_{Aeq,8h}$dB	46	-	-	-
Assessment Phase 1 (2027)	$L_{Aeq,16h}$dB	51.5	49.3	49.9	+0.6
	$L_{Aeq,8h}$dB	46.5	44.3	45.9	+1.6
	L_{Asmax}dB	72.8	72.8	72.8	0.0
	Daytime N65	23	3	3	0
	Night-time N60	21	13	19	+6
	Daytime Overflights	0	0	0	0
	Night-time Overflights	0	0	0	0
	Number of Awakenings	0.7	0.6	0.8	+0.2
Assessment Phase 2a (2039)	$L_{Aeq,16h}$dB	51.5	47.9	49.1	+1.2
	$L_{Aeq,8h}$dB	46.5	42.6	43.9	+1.3
	L_{Asmax}dB	72.8	70.9	70.9	0.0
	Daytime N65	23	3	5	+2
	Night-time N60	21	7	10	+3
	Daytime Overflights	0	0	0	0
	Night-time Overflights	0	0	0	0

Assessment Phase	Metric	2019 Actuals Baseline	Do-Minimum	Do-Something	Difference (DS-DM)
	Number of Awakenings	0.7	0.5	0.7	+0.2
Assessment Phase 2b (2043)	$L_{Aeq,16h}$dB	51.5	47.8	49.8	+2.0
	$L_{Aeq,8h}$dB	46.5	42.5	44.3	+1.8
	L_{Asmax}dB	72.8	70.9	70.9	0.0
	Daytime N65	23	3	6	+3
	Night-time N60	21	7	10	+3
	Daytime Overflights	0	0	0	0
	Night-time Overflights	0	0	0	0
	Number of Awakenings	0.7	0.5	0.8	+0.3

Table 7.23: AR17 (Kensworth) – Aircraft Noise Prediction Results

Assessment Phase	Metric	2019 Actuals Baseline	Do-Minimum	Do-Something	Difference (DS-DM)
Baseline	Measured Ambient $L_{Aeq,16h}$dB	49	-	-	-
	Measured Ambient $L_{Aeq,8h}$dB	42	-	-	-
Assessment Phase 1 (2027)	$L_{Aeq,16h}$dB	50.5	50.1	51.0	+0.9
	$L_{Aeq,8h}$dB	47.2	45.8	46.7	+0.9
	L_{Asmax}dB	76.8	76.8	76.8	0.0
	Daytime N65	41	41	46	+5
	Night-time N60	8	6	7	+1
	Daytime Overflights	38	38	42	+4
	Night-time Overflights	7	7	8	+1
	Number of Awakenings	0.4	0.3	0.4	+0.1

Assessment Phase	Metric	2019 Actuals Baseline	Do-Minimum	Do-Something	Difference (DS-DM)
Assessment Phase 2a (2039)	$L_{Aeq,16h}$dB	50.5	49.9	51.2	+1.3
	$L_{Aeq,8h}$dB	47.2	45.6	47.4	+0.8
	L_{Asmax}dB	76.8	75.1	75.1	0.0
	Daytime N65	41	41	52	+11
	Night-time N60	8	6	9	+3
	Daytime Overflights	38	38	50	+12
	Night-time Overflights	7	7	10	+3
	Number of Awakenings	0.4	0.3	0.5	+0.2
Assessment Phase 2b (2043)	$L_{Aeq,16h}$dB	50.5	49.9	51.8	+1.9
	$L_{Aeq,8h}$dB	47.2	45.6	48.3	+2.7
	L_{Asmax}dB	76.8	75.1	75.1	0.0
	Daytime N65	41	41	59	+8
	Night-time N60	8	6	11	+5
	Daytime Overflights	38	38	57	+19
	Night-time Overflights	7	7	12	+5
	Number of Awakenings	0.4	0.3	0.6	+0.3

Table 7.24: AR18 (Stevenage) – Aircraft Noise Prediction Results

Assessment Phase	Metric	2019 Actuals Baseline	Do-Minimum	Do-Something	Difference (DS-DM)
Baseline	Measured Ambient $L_{Aeq,16h}$dB	55	-	-	-
	Measured Ambient $L_{Aeq,8h}$dB	46	-	-	-
	$L_{Aeq,16h}$dB	46.9	45.9	46.7	+1.8

Assessment Phase	Metric	2019 Actuals Baseline	Do-Minimum	Do-Something	Difference (DS-DM)
Assessment Phase 1 (2027)	$L_{Aeq,8h}$dB	43.2	41.4	42.4	+1.0
	L_{Asmax}dB	72.1	72.1	72.1	0.0
	Daytime N65	0	0	2	+2
	Night-time N60	6	4	5	+1
	Daytime Overflights	11	11	13	+2
	Night-time Overflights	1	1	1	0
	Number of Awakenings	0.8	0.7	0.8	+0.1
Assessment Phase 2a (2039)	$L_{Aeq,16h}$dB	46.9	45.2	46.5	+1.3
	$L_{Aeq,8h}$dB	43.2	41.0	42.7	+1.7
	L_{Asmax}dB	72.1	71.9	71.9	0.0
	Daytime N65	0	0	0	0
	Night-time N60	6	3	4	+1
	Daytime Overflights	11	11	16	+5
	Night-time Overflights	1	1	2	+1
	Number of Awakenings	0.8	0.6	0.9	+0.3
Assessment Phase 2b (2043)	$L_{Aeq,16h}$dB	46.9	45.1	47.2	+2.1
	$L_{Aeq,8h}$dB	43.2	41.0	43.6	+1.6
	L_{Asmax}dB	72.1	71.9	71.9	0.0
	Daytime N65	0	0	0	0
	Night-time N60	6	3	4	+1
	Daytime Overflights	11	11	18	+7
	Night-time Overflights	1	1	2	+1
	Number of Awakenings	0.8	0.6	1.0	+0.4

Table 7.25: AR19 (Flamstead) – Aircraft Noise Prediction Results

Assessment Phase	Metric	2019 Actuals Baseline	Do-Minimum	Do-Something	Difference (DS-DM)
Baseline	Measured Ambient $L_{Aeq,16h}$dB	53	-	-	-
	Measured Ambient $L_{Aeq,8h}$dB	47	-	-	-
Assessment Phase 1 (2027)	$L_{Aeq,16h}$dB	51.2	49.8	50.6	+0.8
	$L_{Aeq,8h}$dB	46.0	44.5	46.3	+1.8
	L_{Asmax}dB	73.7	73.7	73.7	0.0
	Daytime N65	33	11	17	+6
	Night-time N60	19	17	23	+6
	Daytime Overflights	55	55	62	+7
	Night-time Overflights	7	6	8	+2
	Number of Awakenings	0.4	0.2	0.2	0.0
Assessment Phase 2a (2039)	$L_{Aeq,16h}$dB	51.2	48.9	50.2	+1.3
	$L_{Aeq,8h}$dB	46.0	43.8	45.2	+1.4
	L_{Asmax}dB	73.7	70.4	70.4	0.0
	Daytime N65	33	4	6	+2
	Night-time N60	19	16	24	+8
	Daytime Overflights	55	55	74	+19
	Night-time Overflights	7	6	9	+3
	Number of Awakenings	0.4	0.2	0.2	0.0
Assessment Phase 2b (2043)	$L_{Aeq,16h}$dB	51.2	48.8	50.8	+2.0
	$L_{Aeq,8h}$dB	46.0	43.7	45.7	+2.0
	L_{Asmax}dB	73.7	70.4	70.4	0.0
	Daytime N65	33	3	5	+2

Assessment Phase	Metric	2019 Actuals Baseline	Do-Minimum	Do-Something	Difference (DS-DM)
	Night-time N60	19	16	28	+12
	Daytime Overflights	55	55	85	+30
	Night-time Overflights	7	6	11	+5
	Number of Awakenings	0.4	0.2	0.3	+0.1

Table 7.26: AR20 (Jockey End) – Aircraft Noise Prediction Results

Assessment Phase	Metric	2019 Actuals Baseline	Do-Minimum	Do-Something	Difference (DS-DM)
Baseline	Measured Ambient $L_{Aeq,16h}$dB	50	-	-	-
	Measured Ambient $L_{Aeq,8h}$dB	45	-	-	-
Assessment Phase 1 (2027)	$L_{Aeq,16h}$dB	48.1	47.4	48.3	+0.9
	$L_{Aeq,8h}$dB	42.9	42.2	43.9	+1.7
	L_{Asmax}dB	73.9	73.9	73.9	0.0
	Daytime N65	15	18	28	+10
	Night-time N60	9	8	11	+3
	Daytime Overflights	17	17	20	+3
	Night-time Overflights	3	3	4	+1
	Number of Awakenings	0.3	0.1	0.2	+0.1
Assessment Phase 2a (2039)	$L_{Aeq,16h}$dB	48.1	47.1	48.5	+1.4
	$L_{Aeq,8h}$dB	42.9	41.9	43.4	+1.5
	L_{Asmax}dB	73.9	73.4	73.4	0.0
	Daytime N65	15	6	11	+5
	Night-time N60	9	9	14	+5

Assessment Phase	Metric	2019 Actuals Baseline	Do-Minimum	Do-Something	Difference (DS-DM)
	Daytime Overflights	17	17	23	+6
	Night-time Overflights	3	3	4	+1
	Number of Awakenings	0.3	0.1	0.2	+0.1
Assessment Phase 2b (2043)	$L_{Aeq,16h}$dB	48.1	47.0	49.1	+2.1
	$L_{Aeq,8h}$dB	42.9	41.9	43.9	+2.0
	L_{Asmax}dB	73.9	73.4	73.4	0.0
	Daytime N65	15	6	12	+6
	Night-time N60	9	9	15	+6
	Daytime Overflights	17	17	27	+10
	Night-time Overflights	3	3	5	+2
	Number of Awakenings	0.3	0.1	0.2	+0.1

Table 7.27: AR21 (Preston) – Aircraft Noise Prediction Results

Assessment Phase	Metric	2019 Actuals Baseline	Do-Minimum	Do-Something	Difference (DS-DM)
Baseline	Measured Ambient $L_{Aeq,16h}$dB	58	-	-	-
	Measured Ambient $L_{Aeq,8h}$dB	47	-	-	-
Assessment Phase 1 (2027)	$L_{Aeq,16h}$dB	43.4	41.7	42.4	+0.7
	$L_{Aeq,8h}$dB	38.9	36.8	38.5	+1.7
	L_{Asmax}dB	65.5	65.5	65.5	0.0
	Daytime N65	0	0	0	0
	Night-time N60	1	1	1	0
	Daytime Overflights	0	0	0	0
	Night-time Overflights	0	0	0	0
	Number of Awakenings	0.2	0.2	0.3	+0.1

Assessment Phase	Metric	2019 Actuals Baseline	Do-Minimum	Do-Something	Difference (DS-DM)
Assessment Phase 2a (2039)	$L_{Aeq,16h}$dB	43.4	40.7	42.0	+1.3
	$L_{Aeq,8h}$dB	38.9	36.3	37.7	+1.4
	L_{Asmax}dB	65.5	63.3	63.3	0.0
	Daytime N65	0	0	0	0
	Night-time N60	1	1	0	-1*
	Daytime Overflights	0	0	0	0
	Night-time Overflights	0	0	0	0
	Number of Awakenings	0.2	0.2	0.2	0.0
Assessment Phase 2b (2043)	$L_{Aeq,16h}$dB	43.4	40.6	42.7	+2.1
	$L_{Aeq,8h}$dB	38.9	36.2	38.3	+2.1
	L_{Asmax}dB	65.5	63.3	63.3	0.0
	Daytime N65	0	0	0	0
	Night-time N60	1	0	0	0
	Daytime Overflights	0	0	0	0
	Night-time Overflights	0	0	0	0
	Number of Awakenings	0.2	0.1	0.2	+0.1
*The reduction in N60 is a result of B737-800 night activity occurring in the DM fleet (see Table 6.40) but not the DS fleet (see Table 6.41).					

Table 7.28: AR22 (Holywell) – Aircraft Noise Prediction Results

Assessment Phase	Metric	2019 Actuals Baseline	Do-Minimum	Do-Something	Difference (DS-DM)
Baseline	Measured Ambient $L_{Aeq,16h}$dB	50	-	-	-
	Measured Ambient $L_{Aeq,8h}$dB	45	-	-	-
Assessment Phase 1 (2027)	$L_{Aeq,16h}$dB	45.9	44.8	45.6	+0.8
	$L_{Aeq,8h}$dB	42.5	40.5	41.4	+0.9
	L_{Asmax}dB	70.6	70.6	70.6	0.0
	Daytime N65	20	7	9	+2

Assessment Phase	Metric	2019 Actuals Baseline	Do-Minimum	Do-Something	Difference (DS-DM)
	Night-time N60	8	6	7	+1
	Daytime Overflights	20	20	23	+3
	Night-time Overflights	4	4	5	+1
	Number of Awakenings	0.3	0.2	0.3	+0.1
Assessment Phase 2a (2039)	$L_{Aeq,16h}$dB	45.9	44.3	45.7	+1.4
	$L_{Aeq,8h}$dB	42.5	40.2	41.9	+1.7
	L_{Asmax}dB	70.6	69.8	69.8	0.0
	Daytime N65	20	1	3	+2
	Night-time N60	8	6	9	+3
	Daytime Overflights	20	20	26	+6
	Night-time Overflights	4	4	6	+2
	Number of Awakenings	0.3	0.2	0.3	+0.1
Assessment Phase 2b (2043)	$L_{Aeq,16h}$dB	45.9	44.3	46.3	+2.0
	$L_{Aeq,8h}$dB	42.5	40.2	42.8	+2.6
	L_{Asmax}dB	70.6	69.8	69.8	0.0
	Daytime N65	20	1	3	+2
	Night-time N60	8	6	11	+5
	Daytime Overflights	20	20	30	+10
	Night-time Overflights	4	4	7	+3
	Number of Awakenings	0.3	0.2	0.4	+0.2

Table 7.29: AR30 (Pitstone) – Aircraft Noise Prediction Results

Assessment Phase	Metric	2019 Actuals Baseline	Do-Minimum	Do-Something	Difference (DS-DM)
Baseline	Measured Ambient $L_{Aeq,16h}$dB	50	-	-	-
	Measured Ambient $L_{Aeq,8h}$dB	42	-	-	-
Assessment Phase 1 (2027)	$L_{Aeq,16h}$dB	40.5	40.0	40.7	+0.7
	$L_{Aeq,8h}$dB	37.1	35.6	36.5	+0.9
	L_{Asmax}dB	65.1	65.1	65.1	0.0
	Daytime N65	0	0	0	0
	Night-time N60	4	2	3	+1
	Daytime Overflights	33	33	37	+4
	Night-time Overflights	7	6	8	+2
	Number of Awakenings	0.2	0.1	0.2	+0.1
Assessment Phase 2a (2039)	$L_{Aeq,16h}$dB	40.5	39.5	40.9	+1.4
	$L_{Aeq,8h}$dB	40.5	35.2	37.1	+1.9
	L_{Asmax}dB	65.1	64.3	64.3	0.0
	Daytime N65	37.1	0	0	0
	Night-time N60	0	1	2	+1
	Daytime Overflights	33	33	43	+10
	Night-time Overflights	7	6	9	+3
	Number of Awakenings	0.2	0.1	0.2	+0.1
Assessment Phase 2b (2043)	$L_{Aeq,16h}$dB	40.5	39.5	41.6	+1.1
	$L_{Aeq,8h}$dB	37.1	35.2	38.1	+2.9
	L_{Asmax}dB	65.1	64.3	64.3	0.0
	Daytime N65	0	0	0	0

Assessment Phase	Metric	2019 Actuals Baseline	Do-Minimum	Do-Something	Difference (DS-DM)
	Night-time N60	4	1	3	+2
	Daytime Overflights	33	33	50	+17
	Night-time Overflights	7	6	11	+5
	Number of Awakenings	0.2	0.1	0.2	+0.1

Table 7.30: AR31 (St Paul's Walden) – Aircraft Noise Prediction Results

Assessment Phase	Metric	2019 Actuals Baseline	Do-Minimum	Do-Something	Difference (DS-DM)
Baseline	Measured Ambient $L_{Aeq,16h}$dB	53	-	-	-
	Measured Ambient $L_{Aeq,8h}$dB	48	-	-	-
Assessment Phase 1 (2027)	$L_{Aeq,16h}$dB	53.6	52.6	53.4	+0.8
	$L_{Aeq,8h}$dB	49.5	47.9	49.2	+1.3
	L_{Asmax}dB	77.6	77.6	77.6	0.0
	Daytime N65	91	63	94	+31
	Night-time N60	32	26	32	+8
	Daytime Overflights	35	35	39	+4
	Night-time Overflights	4	3	4	+1
	Number of Awakenings	1.7	1.6	2.0	+0.4
Assessment Phase 2a (2039)	$L_{Aeq,16h}$dB	53.6	52.0	53.2	+1.2
	$L_{Aeq,8h}$dB	49.5	47.5	49.1	+1.6
	L_{Asmax}dB	77.6	73.7	73.7	0.0
	Daytime N65	91	56	77	+19
	Night-time N60	32	26	39	+13

Assessment Phase	Metric	2019 Actuals Baseline	Do-Minimum	Do-Something	Difference (DS-DM)
	Daytime Overflights	35	35	46	+11
	Night-time Overflights	4	3	5	+2
	Number of Awakenings	1.7	1.5	2.2	+0.7
Assessment Phase 2b (2043)	$L_{Aeq,16h}$dB	53.6	51.9	53.9	+2.0
	$L_{Aeq,8h}$dB	49.5	47.4	49.8	+2.4
	L_{Asmax}dB	77.6	73.7	73.7	0.0
	Daytime N65	91	55	91	+36
	Night-time N60	32	26	47	+21
	Daytime Overflights	35	35	53	+18
	Night-time Overflights	4	3	6	+3
	Number of Awakenings	1.7	1.5	2.6	+1.1

Table 7.31: AR32 (Tennyson Road Primary School and surrounding residential) – Aircraft Noise Prediction Results

Assessment Phase	Metric	2019 Actuals Baseline	Do-Minimum	Do-Something	Difference (DS-DM)
Baseline	Measured Ambient $L_{Aeq,16h}$dB	53	-	-	-
	Measured Ambient $L_{Aeq,8h}$dB	48	-	-	-
Assessment Phase 1 (2027)	$L_{Aeq,16h}$dB	60.1	57.6	58.3	+0.7
	$L_{Aeq,8h}$dB	54.9	52.5	54.2	+0.7
	L_{Asmax}dB	84.1	84.1	84.1	0.0
	Daytime N65	181	173	193	+20
	Night-time N60	27	24	32	+8

Assessment Phase	Metric	2019 Actuals Baseline	Do-Minimum	Do-Something	Difference (DS-DM)
	Daytime Overflights	8	8	8	0
	Night-time Overflights	1	1	1	0
	Number of Awakenings	1.1	0.7	0.9	+0.2
Assessment Phase 2a (2039)	$L_{Aeq,16h}$dB	60.1	56.5	57.8	+1.3
	$L_{Aeq,8h}$dB	54.9	51.6	53.1	+1.5
	L_{Asmax}dB	84.1	78.5	78.5	0.0
	Daytime N65	181	173	229	+56
	Night-time N60	27	24	37	+13
	Daytime Overflights	8	8	9	+1
	Night-time Overflights	1	1	1	0
	Number of Awakenings	1.1	0.7	1.0	+0.3
Assessment Phase 2b (2043)	$L_{Aeq,16h}$dB	60.1	56.4	58.4	+2.0
	$L_{Aeq,8h}$dB	54.9	51.6	53.7	+2.1
	L_{Asmax}dB	84.1	78.5	78.5	0.0
	Daytime N65	181	173	264	+91
	Night-time N60	27	24	42	+18
	Daytime Overflights	8	8	9	+1
	Night-time Overflights	1	1	1	0
	Number of Awakenings	1.1	0.6	1.2	+0.6

Table 7.32: AR33 (Hillborough Junior and surrounding residential) – Aircraft Noise Prediction Results

Assessment Phase	Metric	2019 Actuals Baseline	Do-Minimum	Do-Something	Difference (DS-DM)
Baseline	Measured Ambient $L_{Aeq,16h}$dB	-	-	-	-
	Measured Ambient $L_{Aeq,8h}$dB	-	-	-	-
Assessment Phase 1 (2027)	$L_{Aeq,16h}$dB	54.8	52.1	52.9	+0.8
	$L_{Aeq,8h}$dB	49.7	47.1	48.8	+1.7
	L_{Asmax}dB	77.2	77.2	77.2	0.0
	Daytime N65	118	65	94	+29
	Night-time N60	27	24	32	+8
	Daytime Overflights	0	0	0	0
	Night-time Overflights	0	0	0	0
	Number of Awakenings	0.7	0.4	0.5	+0.1
Assessment Phase 2a (2039)	$L_{Aeq,16h}$dB	54.8	51.0	52.3	+1.3
	$L_{Aeq,8h}$dB	49.7	46.2	47.6	+1.4
	L_{Asmax}dB	77.2	71.6	71.6	0.0
	Daytime N65	118	45	62	+17
	Night-time N60	27	24	36	+12
	Daytime Overflights	0	0	0	0
	Night-time Overflights	0	0	0	0
	Number of Awakenings	0.7	0.4	0.5	+0.1
Assessment Phase 2b (2043)	$L_{Aeq,16h}$dB	54.8	50.9	52.9	+2.0
	$L_{Aeq,8h}$dB	49.7	46.1	48.1	+2.0
	L_{Asmax}dB	77.2	71.6	71.6	0.0

Assessment Phase	Metric	2019 Actuals Baseline	Do-Minimum	Do-Something	Difference (DS-DM)
	Daytime N65	118	45	77	+32
	Night-time N60	27	24	42	+18
	Daytime Overflights	0	0	0	0
	Night-time Overflights	0	0	0	0
	Number of Awakenings	0.7	0.4	0.6	+0.2

Table 7.33: AR34 (St Margaret of Scotland Primary School and surrounding residential) – Aircraft Noise Prediction Results

Assessment Phase	Metric	2019 Actuals Baseline	Do-Minimum	Do-Something	Difference (DS-DM)
Baseline	Measured Ambient $L_{Aeq,16h}$dB	-	-	-	-
	Measured Ambient $L_{Aeq,8h}$dB	-	-	-	-
Assessment Phase 1 (2027)	$L_{Aeq,16h}$dB	50.6	48.1	48.8	+0.7
	$L_{Aeq,8h}$dB	45.7	43.2	44.8	+1.6
	L_{Asmax}dB	70.8	70.8	70.8	0.0
	Daytime N65	16	5	5	0
	Night-time N60	20	8	16	+8
	Daytime Overflights	0	0	0	0
	Night-time Overflights	1	0	0	0
	Number of Awakenings	0.4	0.2	0.3	+0.1
Assessment Phase 2a (2039)	$L_{Aeq,16h}$dB	50.6	46.9	48.3	+1.4
	$L_{Aeq,8h}$dB	45.7	42.3	43.7	+1.4
	L_{Asmax}dB	70.8	66.0	66.0	0.0
	Daytime N65	16	1	1	0
	Night-time N60	20	3	4	+1

Assessment Phase	Metric	2019 Actuals Baseline	Do-Minimum	Do-Something	Difference (DS-DM)
	Daytime Overflights	0	0	0	0
	Night-time Overflights	1	0	0	0
	Number of Awakenings	0.4	0.2	0.3	+0.1
Assessment Phase 2b (2043)	$L_{Aeq,16h}$dB	50.6	46.8	48.9	+2.1
	$L_{Aeq,8h}$dB	45.7	42.2	44.2	+2.0
	L_{Asmax}dB	70.8	66.0	66.0	0.0
	Daytime N65	16	1	1	0
	Night-time N60	20	3	5	+2
	Daytime Overflights	0	0	0	0
	Night-time Overflights	1	0	0	0
	Number of Awakenings	0.4	0.2	0.4	+0.2

Table 7.34: AR35 (Wenlock Primary School and surrounding residential) – Aircraft Noise Prediction Results

Assessment Phase	Metric	2019 Actuals Baseline	Do-Minimum	Do-Something	Difference (DS-DM)
Baseline	Measured Ambient $L_{Aeq,16h}$dB	-	-	-	-
	Measured Ambient $L_{Aeq,8h}$dB	-	-	-	-
Assessment Phase 1 (2027)	$L_{Aeq,16h}$dB	52.9	50.1	50.8	+0.7
	$L_{Aeq,8h}$dB	47.8	45.3	46.8	+1.5
	L_{Asmax}dB	73.7	73.7	73.7	0.0
	Daytime N65	87	19	19	0
	Night-time N60	23	20	28	+8
	Daytime Overflights	0	0	0	0

Assessment Phase	Metric	2019 Actuals Baseline	Do-Minimum	Do-Something	Difference (DS-DM)
	Night-time Overflights	0	0	0	0
	Number of Awakenings	0.7	0.4	0.6	+0.2
Assessment Phase 2a (2039)	$L_{Aeq,16h}$dB	52.9	49.2	50.5	+1.3
	$L_{Aeq,8h}$dB	47.8	43.8	45.2	+1.4
	L_{Asmax}dB	73.7	72.2	72.2	0.0
	Daytime N65	87	9	15	+6
	Night-time N60	23	19	28	+9
	Daytime Overflights	0	0	0	0
	Night-time Overflights	0	0	0	0
	Number of Awakenings	+0.7	0.3	0.5	+0.2
Assessment Phase 2b (2043)	$L_{Aeq,16h}$dB	52.9	49.1	51.2	+2.1
	$L_{Aeq,8h}$dB	47.8	43.7	45.6	+1.9
	L_{Asmax}dB	73.7	72.2	72.2	0.0
	Daytime N65	87	8	21	+13
	Night-time N60	23	18	31	+13
	Daytime Overflights	0	0	0	0
	Night-time Overflights	0	0	0	0
	Number of Awakenings	+0.7	0.3	0.5	+0.2

Table 7.35: AR36 (Wigmore Primary School and surrounding residential) – Aircraft Noise Prediction Results

Assessment Phase	Metric	2019 Actuals Baseline	Do-Minimum	Do-Something	Difference (DS-DM)
Baseline	Measured Ambient $L_{Aeq,16h}$dB	-	-	-	-
	Measured Ambient $L_{Aeq,8h}$dB	-	-	-	-
Assessment Phase 1 (2027)	$L_{Aeq,16h}$dB	47.0	44.8	45.4	+0.6
	$L_{Aeq,8h}$dB	42.0	40.0	41.5	+1.5
	L_{Asmax}dB	64.5	64.5	64.5	0.0
	Daytime N65	0	0	0	0
	Night-time N60	1	1	1	0
	Daytime Overflights	0	0	0	0
	Night-time Overflights	0	0	0	0
	Number of Awakenings	0.2	0.1	0.2	+0.1
Assessment Phase 2a (2039)	$L_{Aeq,16h}$dB	47.0	43.5	44.8	+1.3
	$L_{Aeq,8h}$dB	42.0	38.4	39.7	+1.3
	L_{Asmax}dB	64.5	62.7	62.7	0.0
	Daytime N65	0	0	0	0
	Night-time N60	1	0	0	0
	Daytime Overflights	0	0	0	0
	Night-time Overflights	0	0	0	0
	Number of Awakenings	0.2	0.1	0.1	0.0
Assessment Phase 2b (2043)	$L_{Aeq,16h}$dB	47.0	43.5	45.5	+2.0
	$L_{Aeq,8h}$dB	42.0	38.3	40.1	+1.8
	L_{Asmax}dB	64.5	62.7	62.7	0.0

Assessment Phase	Metric	2019 Actuals Baseline	Do-Minimum	Do-Something	Difference (DS-DM)
	Daytime N65	0	0	0	0
	Night-time N60	1	0	0	0
	Daytime Overflights	0	0	0	0
	Night-time Overflights	0	0	0	0
	Number of Awakenings	0.2	0.0	0.1	+0.1

Table 7.36: AR37 (Breachwood Green JMI School and surrounding residential) – Aircraft Noise Prediction Results

Assessment Phase	Metric	2019 Actuals Baseline	Do-Minimum	Do-Something	Difference (DS-DM)
Baseline	Measured Ambient $L_{Aeq,16h}$dB	-	-	-	-
	Measured Ambient $L_{Aeq,8h}$dB	-	-	-	-
Assessment Phase 1 (2027)	$L_{Aeq,16h}$dB	60.0	58.4	59.3	+0.9
	$L_{Aeq,8h}$dB	55.7	53.8	55.1	+1.3
	L_{Asmax}dB	86.2	86.2	86.2	0.0
	Daytime N65	184	179	201	+22
	Night-time N60	32	26	32	+6
	Daytime Overflights	47	47	52	+5
	Night-time Overflights	5	4	5	+1
	Number of Awakenings	2.8	2.6	3.3	+0.7
Assessment Phase 2a (2039)	$L_{Aeq,16h}$dB	60.0	57.7	59.0	+1.3
	$L_{Aeq,8h}$dB	55.7	53.2	54.9	+1.7
	L_{Asmax}dB	86.2	80.9	80.9	0.0

Assessment Phase	Metric	2019 Actuals Baseline	Do-Minimum	Do-Something	Difference (DS-DM)
	Daytime N65	184	179	236	+57
	Night-time N60	32	26	39	+13
	Daytime Overflights	47	47	61	+14
	Night-time Overflights	5	4	6	+2
	Number of Awakenings	2.8	2.5	3.7	+1.2
Assessment Phase 2b (2043)	$L_{Aeq,16h}$dB	60.0	57.7	59.6	+1.9
	$L_{Aeq,8h}$dB	55.7	53.2	55.6	+2.4
	L_{Asmax}dB	86.2	80.9	80.9	0.0
	Daytime N65	184	179	268	+89
	Night-time N60	32	26	47	+21
	Daytime Overflights	47	47	69	+22
	Night-time Overflights	5	4	7	+3
	Number of Awakenings	2.8	2.5	4.4	+1.9

Table 7.37: AR38 (Caddington Village School and surrounding residential) – Aircraft Noise Prediction Results

Assessment Phase	Metric	2019 Actuals Baseline	Do-Minimum	Do-Something	Difference (DS-DM)
Baseline	Measured Ambient $L_{Aeq,16h}$dB	-	-	-	-
	Measured Ambient $L_{Aeq,8h}$dB	-	-	-	-
Assessment Phase 1 (2027)	$L_{Aeq,16h}$dB	54.3	53.3	54.1	+0.8
	$L_{Aeq,8h}$dB	50.6	48.9	50.0	+1.1
	L_{Asmax}dB	83.4	83.4	83.4	0.0

Assessment Phase	Metric	2019 Actuals Baseline	Do-Minimum	Do-Something	Difference (DS-DM)
	Daytime N65	48	46	51	+5
	Night-time N60	25	10	13	+3
	Daytime Overflights	38	38	53	+15
	Night-time Overflights	7	7	8	+1
	Number of Awakenings	0.8	0.5	0.7	+0.2
Assessment Phase 2a (2039)	$L_{Aeq,16h}$dB	54.3	52.9	54.1	+1.2
	$L_{Aeq,8h}$dB	50.6	48.5	50.2	+1.7
	L_{Asmax}dB	83.4	79.8	79.8	0.0
	Daytime N65	48	42	56	+14
	Night-time N60	25	8	11	+3
	Daytime Overflights	38	38	50	+12
	Night-time Overflights	7	7	10	+3
	Number of Awakenings	0.8	0.5	0.8	+0.3
Assessment Phase 2b (2043)	$L_{Aeq,16h}$dB	54.3	52.8	54.8	+2.0
	$L_{Aeq,8h}$dB	50.6	48.5	51.0	+2.5
	L_{Asmax}dB	83.4	79.8	79.8	0.0
	Daytime N65	48	42	62	+20
	Night-time N60	25	8	14	+6
	Daytime Overflights	38	38	57	+19
	Night-time Overflights	7	7	12	+5
	Number of Awakenings	0.8	0.5	1.0	+0.5

Table 7.38: AR39 (Slip End Lower School and surrounding residential) – Aircraft Noise Prediction Results

Assessment Phase	Metric	2019 Actuals Baseline	Do-Minimum	Do-Something	Difference (DS-DM)
Baseline	Measured Ambient $L_{Aeq,16h}$dB	-	-	-	-
	Measured Ambient $L_{Aeq,8h}$dB	-	-	-	-
Assessment Phase 1 (2027)	$L_{Aeq,16h}$dB	59.0	56.9	57.7	+0.8
	$L_{Aeq,8h}$dB	53.8	51.7	53.5	+1.8
	L_{Asmax}dB	82.4	82.4	82.4	0.0
	Daytime N65	147	135	150	+15
	Night-time N60	19	18	25	+7
	Daytime Overflights	143	143	160	+17
	Night-time Overflights	20	17	22	+5
	Number of Awakenings	0.7	0.4	0.5	+0.1
Assessment Phase 2a (2039)	$L_{Aeq,16h}$dB	59.0	55.7	57.1	+1.4
	$L_{Aeq,8h}$dB	53.8	50.8	52.2	+1.4
	L_{Asmax}dB	82.4	76.4	76.4	0.0
	Daytime N65	147	135	180	+45
	Night-time N60	19	18	27	+9
	Daytime Overflights	143	143	189	+46
	Night-time Overflights	20	17	26	+9
	Number of Awakenings	0.7	0.3	0.5	+0.2
Assessment Phase 2b (2043)	$L_{Aeq,16h}$dB	59.0	55.6	57.7	+2.1
	$L_{Aeq,8h}$dB	53.8	50.7	52.7	+2.0
	L_{Asmax}dB	82.4	76.4	76.4	0.0

Assessment Phase	Metric	2019 Actuals Baseline	Do-Minimum	Do-Something	Difference (DS-DM)
	Daytime N65	147	135	208	+73
	Night-time N60	19	18	31	+13
	Daytime Overflights	143	143	216	+73
	Night-time Overflights	20	17	30	+13
	Number of Awakenings	0.7	0.3	0.6	+0.3

Table 7.39: AR40 (Surrey Street Primary and surrounding residential) – Aircraft Noise Prediction Results

Assessment Phase	Metric	2019 Actuals Baseline	Do-Minimum	Do-Something	Difference (DS-DM)
Baseline	Measured Ambient $L_{Aeq,16h}$dB	-	-	-	-
	Measured Ambient $L_{Aeq,8h}$dB	-	-	-	-
Assessment Phase 1 (2027)	$L_{Aeq,16h}$dB	65.9	63.8	64.5	+0.7
	$L_{Aeq,8h}$dB	60.9	58.9	60.4	+0.5
	L_{Asmax}dB	92.6	92.6	92.6	0.0
	Daytime N65	189	181	201	+20
	Night-time N60	27	24	32	+8
	Daytime Overflights	185	185	207	+22
	Night-time Overflights	27	24	30	+6
	Number of Awakenings	1.7	1.1	1.4	+0.3
Assessment Phase 2a (2039)	$L_{Aeq,16h}$dB	65.9	62.8	64.1	+1.3
	$L_{Aeq,8h}$dB	60.9	58.0	59.6	+1.6
	L_{Asmax}dB	92.6	88.2	88.2	0.0

Assessment Phase	Metric	2019 Actuals Baseline	Do-Minimum	Do-Something	Difference (DS-DM)
	Daytime N65	189	181	239	+58
	Night-time N60	27	24	37	+13
	Daytime Overflights	185	185	243	+58
	Night-time Overflights	27	24	36	+12
	Number of Awakenings	1.7	1.1	1.6	+0.5
Assessment Phase 2b (2043)	$L_{Aeq,16h}$dB	65.9	62.8	64.6	+1.8
	$L_{Aeq,8h}$dB	60.9	57.9	60.2	+2.3
	L_{Asmax}dB	92.6	88.2	88.2	0.0
	Daytime N65	189	182	274	+92
	Night-time N60	27	24	42	+18
	Daytime Overflights	185	185	278	+93
	Night-time Overflights	27	24	43	+19
	Number of Awakenings	1.7	1.1	1.9	+0.8

7.8 Population Analysis

7.8.1 To analyse the population and number of households within the relevant noise contours, mid-2019 population estimation data at Census Output Areas level (the smallest census output area available) were downloaded from the Office of National Statistics website. This population estimation dataset was analysed against a commercial Ordnance Survey AddressBase Plus database to determine a representable spatial distribution of households and population throughout the study area. The census data was proportioned across the building dataset and was then intersected with the ES baseline noise contour outputs to show the total population and number of households within each contour. Results of household and population analysis are rounded to the nearest 50.

7.9 Aircraft Noise Modelling Results Comparison with 2019 Actuals Baseline

7.9.1 This section provides analysis of DS scenario noise contours compared against the 2019 Actuals Baseline. A sensitivity test is provided in Section 11 to show how the DS scenario contours would compare against the 2019 Consented Baseline contours that comply with existing Condition 10 noise contour limits. A comparison of the DS scenarios against equivalent DM scenarios is presented in Section 16.7 of **Chapter 16** Noise and Vibration of the ES **[TR020001/APP/5.01]**.

Assessment Phase 1

7.9.2 The comparison of the 2027 DM and DS scenarios represents a worst-case as the extent of noise contours for the 2027 DM scenario is less than the 2019 Actuals Baseline due to the future fleet comprising new generation aircraft. However, to provide additional context, the results of the 2027 DS scenario have been compared to the 2019 Actuals Baseline scenario. The results of analysis are presented in the following tables below:

a. aAnalysis of area coverage by 2019 Actuals Baseline and assessment Phase 1 2027 DS air noise contours are presented in Table 7.40 for daytime $L_{Aeq,16h}$ (see Figure 16.13 and Figure 16.15 of this ES **[TR020001/APP/5.03]**) and Table 7.43 for night-time $L_{Aeq,8h}$ (see Figure 16.14 and Figure 16.16 of this ES **[TR020001/APP/5.03]**);

b. aAnalysis of households within 2019 Actuals Baseline and assessment Phase 1 2027 DS air noise contours are presented in Table 7.41 for daytime $L_{Aeq,16h}$ and Table 7.44 for night-time $L_{Aeq,8h}$; and

c. aAnalysis of population within 2019 Actuals Baseline and assessment Phase 1 2027 DS air noise contours are presented in Table 7.42 for daytime $L_{Aeq,16h}$ and Table 7.43 for night-time $L_{Aeq,8h}$.

Table 7.40: Daytime 2019 Actuals Baseline v DS 2027 Air Noise Analysis – Area

$L_{Aeq,16h}$ dB Noise Contour	2019 Actuals Baseline Cumulative Area (km^2)	2027 DS Cumulative Area (km^2)	Change in Cumulative Area (km^2)
51 (LOAEL)	**58.1**	**52.3**	**-5.8**
54	35.4	30.6	-4.8
57	20.3	16.3	-4.0
60	10.4	8.0	-2.4
63 (SOAEL)	**5.6**	**4.2**	**-1.4**
66	2.6	1.9	-0.7
69 (UAEL)	**1.4**	**1.1**	**-0.3**

Table 7.41: Daytime 2019 Actuals Baseline v DS 2027 Air Noise Analysis – Households

$L_{Aeq,16h}$ dB Noise Contour	2019 Actuals Baseline Cumulative Number of Households	2027 DS Cumulative Number of Households	Change in Cumulative Number of Households
51 (LOAEL)	**20,900**	**16,500**	**-4,400**
54	11,400	7,750	-3,650
57	6,000	4,400	-1,600
60	2,800	1,450	-1,350
63 (SOAEL)	**650**	**150**	**-500**
66	<50	0	-<50
69 (UAEL)	**0**	**0**	**0**

Table 7.42: Daytime 2019 Actuals Baseline v DS 2027 Air Noise Analysis – Population

$L_{Aeq,16h}$ dB Noise Contour	2019 Actuals Baseline Cumulative Population	2027 DS Cumulative Population	Change in Cumulative Population
51 (LOAEL)	**41,000**	**32,050**	**-8,950**
54	21,650	15,500	-6,150
57	11,900	8,550	-3,350
60	5,350	2,800	-2,550
63 (SOAEL)	**1,650**	**450**	**-1,200**
66	<50	0	-<50
69 (UAEL)	**0**	**0**	**0**

Table 7.43: Night-time 2019 Actuals Baseline v DS 2027 Air Noise Analysis – Area

$L_{Aeq,8h}$ dB Noise Contour	2019 Actuals Baseline Cumulative Area (km^2)	2027 DS Cumulative Area (km^2)	Change in Cumulative Area (km^2)
45 (LOAEL)	**74.6**	**70.8**	**-3.8**
48	45.3	42.2	-3.1
51	26.5	24.1	-2.4
54	14.1	12.5	-1.6
55 (SOAEL)	**11.2**	**9.7**	**-1.5**
57	7.0	6.2	-0.8
60	3.6	3.1	-0.5
63 (UAEL)	**1.7**	**1.5**	**-0.2**

Table 7.44: Night-time 2019 Actuals Baseline v DS 2027 Air Noise Analysis – Households

$L_{Aeq,8h}$ dB Noise Contour	2019 Actuals Baseline Cumulative Number of Households	2027 DS Cumulative Number of Households	Change in Cumulative Number of Households
45 (LOAEL)	**32,950**	**27,150**	**-5,800**
48	15,200	12,000	-3,200
51	7,100	6,200	-900
54	3,950	3,100	-850
55 (SOAEL)	**2,650**	**1,950**	**-700**
57	1,150	700	-450
60	50	<50	-<50
63 (UAEL)	**0**	**0**	**0**

Table 7.45: Night-time 2019 Actuals Baseline v DS 2027 Air Noise Analysis – Population

$L_{Aeq,8h}$ dB Noise Contour	2019 Actuals Baseline Cumulative Population	2027 DS Cumulative Population	Change in Cumulative Population
45 (LOAEL)	**67,800**	**55,850**	**-11,950**
48	29,050	23,050	-6,000
51	14,050	12,100	-1,950
54	7,500	5,950	-1,550
55 (SOAEL)	**4,950**	**3,800**	**-1,150**
57	2,350	1,850	-500
60	**150**	**50**	**-100**
63 (UAEL)	0	0	0

Assessment Phase 2a

7.9.3 The comparison of the 2039 DM and DS scenarios represents a worst-case as the extent of noise contours for the 2039 DM scenario is less than the 2019 Actuals Baseline due to the future fleet comprised of new generation aircraft. However, to provide additional context, the results of the 2039 DS scenario have been compared to the 2019 Actuals Baseline scenario. The results of analysis are presented in the following tables below:

a. Analysis of area coverage by 2019 Actuals Baseline and assessment Phase 2a 2039 DS air noise contours are presented in Table 7.46 for daytime $L_{Aeq,16h}$ (see Figure 16.13 and Figure 16.15 of this ES **[TR020001/APP/5.03]**) and Table 7.49 for night-time $L_{Aeq,8h}$ (see Figure 16.14 and Figure 16.16 of this ES **[TR020001/APP/5.03]**);

d. Analysis of households within 2019 Actuals Baseline and assessment Phase 2a 2039 DS air noise contours are presented in Table 7.47 for daytime $L_{Aeq,16h}$ and Table 7.50 for night-time $L_{Aeq,8h}$; and

e. Analysis of population within 2019 Actuals Baseline and assessment Phase 2a 2039 DS air noise contours are presented in Table 7.48 for daytime $L_{Aeq,16h}$ and Table 7.51 for night-time $L_{Aeq,8h}$.

Table 7.46: Daytime 2019 Actuals Baseline v DS 2039 Air Noise Analysis – Area

$L_{Aeq,16h}$ dB Noise Contour	2019 Actuals Baseline Cumulative Area (km^2)	2039 DS Cumulative Area (km^2)	Change in Cumulative Area (km^2)
51 (LOAEL)	**58.1**	**50.1**	**-8.0**
54	35.4	28.8	-6.6
57	20.3	15.2	-5.1
60	10.4	7.4	-3.0
63 (SOAEL)	**5.6**	**3.8**	**-1.8**
66	2.6	1.8	-0.8
69 (UAEL)	**1.4**	**1.0**	**-0.3**

Table 7.47: Daytime 2019 Actuals Baseline v DS 2039 Air Noise Analysis – Households

$L_{Aeq,16h}$ dB Noise Contour	2019 Actuals Baseline Cumulative Number of Households	2039 DS Cumulative Number of Households	Change in Cumulative Number of Households
51 (LOAEL)	**20,900**	**16,000**	**-4,900**
54	11,400	7,000	-4,400
57	6,000	3,900	-2,100
60	2,800	1,150	-1,650
63 (SOAEL)	**650**	**100**	**-550**
66	<50	0	0
69 (UAEL)	**0**	**0**	**0**

Table 7.48: Daytime 2019 Actuals Baseline v DS 2039 Air Noise Analysis – Population

$L_{Aeq,16h}$ dB Noise Contour	2019 Actuals Baseline Cumulative Population	2039 DS Cumulative Population	Change in Cumulative Population
51 (LOAEL)	**41,000**	**31,000**	**-10,000**
54	21,650	13,850	-7,800

$L_{Aeq,16h}$ dB Noise Contour	2019 Actuals Baseline Cumulative Population	2039 DS Cumulative Population	Change in Cumulative Population
57	11,900	7,400	-4,500
60	5,350	2,300	-3,050
63 (SOAEL)	**1,650**	**200**	**-1,450**
66	<50	0	0
69 (UAEL)	**0**	**0**	**0**

Table 7.49: Night-time 2019 Actuals Baseline v DS 2039 Air Noise Analysis – Area

$L_{Aeq,8h}$ dB Noise Contour	2019 Actuals Baseline Cumulative Area (km^2)	2039 DS Cumulative Area (km^2)	Change in Cumulative Area (km^2)
45 (LOAEL)	**74.6**	**65.2**	**-9.4**
48	45.3	37.8	-7.4
51	26.5	21.1	-5.4
54	14.1	10.6	-3.5
55 (SOAEL)	**11.2**	**8.3**	**-2.8**
57	7.0	5.2	-1.8
60	3.6	2.5	-1.1
63 (UAEL)	**1.7**	**1.3**	**-0.4**

Table 7.50: Night-time 2019 Actuals Baseline v DS 2039 Air Noise Analysis – Households

$L_{Aeq,8h}$ dB Noise Contour	2019 Actuals Baseline Cumulative Number of Households	2039 DS Cumulative Number of Households	Change in Cumulative Number of Households
45 (LOAEL)	**32,950**	**26,600**	**-6,350**
48	15,200	10,550	-4,650
51	7,100	5,300	-1,800
54	3,950	1,950	-2,000
55 (SOAEL)	**2,650**	**1,250**	**-1,400**
57	1,150	450	-700
60	50	<50	-<50
63 (UAEL)	**0**	**0**	**0**

Table 7.51: Night-time 2019 Actuals Baseline v DS 2039 Air Noise Analysis – Population

$L_{Aeq,8h}$ dB Noise Contour	2019 Actuals Baseline Cumulative Population	2039 DS Cumulative Population	Change in Cumulative Population
45 (LOAEL)	**67,800**	**54,950**	**-12,850**
48	29,050	20,350	-8,700
51	14,050	10,300	-3,750
54	7,500	3,800	-3,700
55 (SOAEL)	**4,950**	**2,600**	**-2,350**
57	2,350	1,100	-1,250
60	150	<50	-<150
63 (UAEL)	**0**	**0**	**0**

Assessment Phase 2b

7.9.4 The comparison of the 2043 DM and DS scenarios represents a worst-case as the extent of noise contours for the 2043 DM scenario is less than the 2019 Actuals Baseline due to the future fleet comprised of new generation aircraft. However, to provide additional context, the results of the 2043 DS scenario have been compared to the 2019 Actuals Baseline scenario. The results of analysis are presented in the following tables below:

a. Analysis of area coverage by 2019 Actuals Baseline and assessment Phase 2b 2043 DS air noise contours are presented in Table 7.52 for daytime $L_{Aeq,16h}$ (see Figure 16.13 and Figure 16.15 of this ES **[TR020001/APP/5.03]**) and Table 7.55 for night-time $L_{Aeq,8h}$ (see Figure 16.14 and Figure 16.16 of this ES **[TR020001/APP/5.03]**);

b. Analysis of households within 2019 Actuals Baseline and assessment Phase 2b 2043 DS air noise contours are presented in Table 7.53 for daytime $L_{Aeq,16h}$ and Table 7.56 for night-time $L_{Aeq,8h}$; and

c. Analysis of population within 2019 Actuals Baseline and assessment Phase 2b 2043 DS air noise contours are presented in Table 7.54 for daytime $L_{Aeq,16h}$ and Table 7.57 for night-time $L_{Aeq,8h}$.

Table 7.52: Daytime 2019 Actuals Baseline v DS 2043 Air Noise Analysis – Area

$L_{Aeq,16h}$ dB Noise Contour	2019 Actuals Baseline Cumulative Area (km^2)	2043 DS Cumulative Area (km^2)	Change in Cumulative Area (km^2)
51 (LOAEL)	**58.1**	**56.1**	**-2.0**
54	35.4	32.6	-2.8
57	20.3	17.4	-2.9
60	10.4	8.6	-1.8
63 (SOAEL)	**5.6**	**4.4**	**-1.2**
66	2.6	2.1	-0.5
69 (UAEL)	**1.4**	**1.2**	**-0.2**

Table 7.53: Daytime 2019 Actuals Baseline v DS 2043 Air Noise Analysis – Households

$L_{Aeq,16h}$ dB Noise Contour	2019 Actuals Baseline Cumulative Number of Households	2043 DS Cumulative Number of Households	Change in Cumulative Number of Households
51 (LOAEL)	**20,900**	**19,400**	**-1,500**
54	11,400	8,300	-3,100
57	6,000	4,550	-1,450
60	2,800	1,550	-1,250
63 (SOAEL)	**650**	**200**	**-450**
66	<50	<50	-<50
69 (UAEL)	**0**	**0**	**0**

Table 7.54: Daytime 2019 Actuals Baseline v DS 2043 Air Noise Analysis – Population

$L_{Aeq,16h}$ dB Noise Contour	2019 Actuals Baseline Cumulative Population	2043 DS Cumulative Population	Change in Cumulative Population
51 (LOAEL)	**41,000**	**38,750**	**-2,250**
54	21,650	16,500	-5,150
57	11,900	8,800	-3,100
60	5,350	2,950	-2,400
63 (SOAEL)	**1,650**	**500**	**-1,150**
66	<50	<50	-<50
69 (UAEL)	**0**	**0**	**0**

Table 7.55: Night-time 2019 Actuals Baseline v DS 2043 Air Noise Analysis – Area

$L_{Aeq,8h}$ dB Noise Contour	2019 Actuals Baseline Cumulative Area (km^2)	2043 DS Cumulative Area (km^2)	Change in Cumulative Area (km^2)
45 (LOAEL)	**74.6**	**73.2**	**-1.4**
48	45.3	43.2	-2.1
51	26.5	24.0	-2.5
54	14.1	12.4	-1.7
55 (SOAEL)	**11.2**	**9.8**	**-1.4**
57	7.0	6.0	-1.0
60	3.6	3.0	-0.6
63 (UAEL)	**1.7**	**1.4**	**-0.3**

Table 7.56: Night-time 2019 Actuals Baseline v DS 2043 Air Noise Analysis – Households

$L_{Aeq,8h}$ dB Noise Contour	2019 Actuals Baseline Cumulative Number of Households	2043 DS Cumulative Number of Households	Change in Cumulative Number of Households
45 (LOAEL)	**32,950**	**30,050**	**-2,900**
48	15,200	14,100	-1,100
51	7,100	5,950	-1,150
54	3,950	2,600	-1,350
55 (SOAEL)	**2,650**	**1,650**	**-1,000**
57	1,150	600	-550
60	50	<50	-<50
63 (UAEL)	**0**	**0**	**0**

Table 7.57: Night-time 2019 Actuals Baseline v DS 2043 Air Noise Analysis – Population

$L_{Aeq,8h}$ dB Noise Contour	2019 Actuals Baseline Cumulative Population	2043 DS Cumulative Population	Change in Cumulative Population
45 (LOAEL)	**67,800**	**62,800**	**-5,000**
48	29,050	28,250	-800
51	14,050	11,600	-2,450
54	7,500	4,750	-2,750
55 (SOAEL)	**4,950**	**3,250**	**-1,700**
57	2,350	1,550	-800

$L_{Aeq,8h}$ dB Noise Contour	2019 Actuals Baseline Cumulative Population	2043 DS Cumulative Population	Change in Cumulative Population
60	150	<50	-150
63 (UAEL)	**0**	**0**	**0**

8 GROUND NOISE ASSESSMENT

8.1 Ground Noise Assessment Criteria – residential receptors

8.1.1 The Proposed Development will result in an intensification of ground activities at the airport. However, new building infrastructure will provide screening for some residential areas to the north of the airport and improved aircraft taxi routes will reduce time spent by aircraft travelling between aircraft stands and the runway.

8.1.2 Although air and ground noise both originate from aircraft, it is recognised that the nature of noise is different from aircraft when they are in the air and on the ground (for example direction and duration). Consequently, in line with the approaches detailed in the Bristol Airport application and the Heathrow PEIR, the LOAEL and SOAEL for air noise presented in Table 7.2 are considered applicable to ground noise. The change in airside ground noise at nearby sensitive receptors has been assessed in line with the magnitude of impact criteria presented in Table 7.3.

8.2 Ground Noise Calculation Methodology

8.2.1 Ground noise predictions provide an indication of how noise from ground-based activities may change as a result of the Proposed Development. As ground noise seeks to represent a reasonable worst-case day's activity during the 92-day summer period, the models are based on a combination of average activity based on actual movements, assumptions activity durations and noise source data from a variety of sources. This approach has been consulted with the NWG, as detailed in Table 16.8 of the ES **[TR020001/APP/5.03]**.

8.2.2 Noise sources that are covered in the ground noise assessment are:

a. aircraft taxiing;
b. aircraft ground running;
c. Auxiliary Power Units (APUs) and Ground Power Units (GPUs); and
d. fire training activities.

8.2.3 Noise predictions of ground noise activities have been undertaken using Cadna-A noise modelling software, which applies the prediction methodology set out in ISO 9613-2 (Ref. 26). This methodology is referenced in Annex II of the Environmental Noise Directive (Ref. 27) for the calculation of transport infrastructure noise, which includes aircraft ground noise.

8.2.4 For the purposes of assessing ground-based aircraft noise sources, aircraft were grouped into categories. Sound power data for each category of aircraft was estimated from AEDT predictions of aircraft at 10 % power. Taxiing aircraft have been calculated at a speed of 20 km/h. The derived sound power data was checked against ground noise assessments from other airports[8] and found to be reasonably equivalent.

[8] Stansted, Heathrow and Gatwick

8.2.5 Ground-running is estimated to last for 25 minutes at 7% power and 10 minutes at 100% power during a reasonable worst-case day. The typical operating aircraft is the A320Neo, so it has been used to model a representative engine test during the day. Sound power data for ground running aircraft was estimated from AEDT predictions and checked against data in the Basis of Calculations for Engine Test Runs (Ref. 28).

8.2.6 The average taxi time for arrivals and departures during the 2019 summer at the airport was referenced from Eurocontrol[9]. This indicated an average taxi time of approximately 15.6 minutes of departures and 6.3 minutes for arrivals.

8.2.7 Spectral data for jet engines was referenced from Spectral Class ID 103 from the ANP Spectral Classes database (Ref. 29). This data is for a two-engine high bypass ratio turbofan aircraft, which is the representative of the most common aircraft at the airport.

8.2.8 The on-time for GPUs at each stand has been based on the average number of aircraft at each stand during the 92-day summer period and the average hourly GPU use per aircraft. The average hourly GPU use is calculated from the total GPU use of 171,148 for 2018 divided by the total number of movements for 2018 of 136,270. This average GPU use of approximately 75 minutes per movement is considered to be representative of GPU use in 2019.

8.2.9 APU use has been applied to private aircraft only at stands 80, 81, 71, 62, 58, 56 and 54 during the day and night, with additional stands 16, 17, 18 and 19 being used during the daytime.

8.2.10 A summary of average GPU and APU use per stand is presented in Table 8.1. As GPU use is averaged per stand, this results in some stands having more GPU minutes than are in the 16-hour daytime period. Consequently, GPU noise may be more focussed in some areas of Terminal 1 than happens in reality. However, as the main sources of ground noise are from taxiing aircraft, the contribution to overall ground noise levels at assessment locations minimal. Consequently, the noise model is considered robust as it includes the total sound energy from GPU noise at Terminal 1.

Table 8.1: Average GPU and APU use per Stand

Stand	Average Movements per Stand		Average GPU Minutes per Stand		Average APU Minutes per Stand	
	Day	Night	Day	Night	Day	Night
1	17.8	4.3	1,338	326	0	0
2	8.1	1.8	613	138	0	0
3	8.5	1.7	640	130	0	0
4	9.2	1.8	696	136	0	0
5	11.7	2.2	881	168	0	0
6	11.8	2.0	893	148	0	0
7	11.8	2.5	887	188	0	0
8	11.7	2.3	885	171	0	0

[9] https://www.eurocontrol.int/publication/taxi-times-summer-2019

Stand	Average Movements per Stand		Average GPU Minutes per Stand		Average APU Minutes per Stand	
	Day	Night	Day	Night	Day	Night
9	22.8	4.2	1,715	313	0	0
10	0.1	0.2	7	12	0	0
11R	1.0	1.0	76	78	0	0
11L	0.8	1.3	61	98	0	0
12	0.7	1.3	54	101	0	0
13R	1.0	1.0	74	77	0	0
13L	0.9	1.0	70	77	0	0
14	0.3	0.1	20	4	0	0
15	0.8	1.5	62	114	0	0
17	0.4	1.2	32	89	4	0
18	0.7	1.3	54	95	7	0
19	1.3 (0.3 GA)	1.3 (0.1 GA)	77	100	3	0
20	0.7	1.1	49	86	0	0
21	1.3	2.8	101	211	0	0
22	0.6	1.5	42	110	0	0
23	1.4	2.6	106	199	0	0
30	1.9 (0.9 GA)	2.5	147	190	0	0
31	1.6	2.0	120	153	0	0
41R	12.5	2.5	939	186	0	0
41L	12.7	2.5	958	192	0	0
42R	12.0	2.7	908	202	0	0
42L	12.0	2.5	905	185	0	0
42	0.6	0.0	44	3	0	0
43	12.4	2.4	935	182	0	0
44L	11.3	2.6	855	197	0	0
44	1.2	0.0	87	2	0	0
44R	10.9	2.7	824	200	0	0
45	12.5	2.6	941	196	0	0
46	12.3	2.5	927	186	0	0
47	11.9	2.5	898	189	0	0
48	12.3	2.5	929	189	0	0
49	11.7	2.5	878	188	0	0
54	16.1	1.0	1,215	74	154	7
56	5.3	0.5	399	34	161	10
58	6.1	0.4	459	29	61	4
60	3.5	1.7	265	128	0	0
61	2.3	1.6	170	118	0	0
62	10.6	0.6	800	42	106	6
71	15.3	0.7	1,157	54	154	7
80	0.4	0.0	29	2	4	0
81	0.1	0.0	6	1	1	0
N16	13.1	0.4	987	29	0	0

Stand	Average Movements per Stand		Average GPU Minutes per Stand		Average APU Minutes per Stand	
	Day	Night	Day	Night	Day	Night
N19	11.1	0.0	837	1	0	0

8.2.11 There is a commitment in place as part of the Proposed Development to reduce emissions affecting air quality and climate from GPUs and APUs. There is uncertainty as to whether technological upgrades to reduce air quality and climate emissions would also result in noise improvements. Consequently, GPUs/-APUs at Terminal 1 for DS scenarios have been modelled assuming that noise from GPUs and APUs at tTerminal 1 is equivalent to, but no worse, than current operating conditions.

8.2.12 Terminal 2 stands will use fixed electrical ground power and will not require GPUs.

8.2.13 Measurements of fire training activities were undertaken to determine a noise source term. Training for a ground spill fire and an undercarriage fire was measured over a 10-minute period as 86dB $L_{Aeq,10min}$ at an average distance of approximately 15 metres from the main sources of noise (the fire engine and the fire). This data was used to determine a sound power level of 120dB to represent fire training activities. Fire training was assumed to occur for no longer than 120 minutes in a reasonable worst-case day.

8.2.14 Noise source data applied in ground noise modelling are presented in Table 8.2.

Table 8.2: Ground Noise Data

Noise Source	Sound Power Level, LwA (dB)
Taxiing small aircraft (general aviation)	133
Taxiing medium aircraft (commercial next gen)	132
Taxiing medium aircraft (commercial)	136
Taxiing large aircraft (freight)	142
Ground running aircraft A320Neo	145
GPU	88
APU	120
Fire Training Activities	120

8.3 Ground Noise Modelling Results

8.3.1 Ground noise predictions were undertaken at multiple points and heights around sensitive receptors. Consequently, when presenting the results of nose predictions, the values presented are the highest from all the prediction locations. Consequently, the difference between the prediction locations where the highest DM and DS values were obtained from is unlikely to correlate with the prediction location that experiences the highest change in noise level. For some receptor groups, the highest predicted noise level decreases from the DM to DS scenarios; however, there is still a prediction location in the receptor group that experiences an increase in noise.

8.3.2 The results of 2027 ground noise predictions are presented in Table 8.3, 2039 ground noise predictions are presented in Table 8.4 and 2043 ground noise predictions are presented in Table 8.5**.**

8.3.3 The results show the highest predicted ground noise level at an individual property from the groups of properties represented by an assessment location for the DM and DS scenarios, and the worst-case change in noise level. Assessment locations where there is an exceedance of the SOAEL in the DS scenario are marked in red and assessment locations in the DS scenario where there is an exceedance of the LOAEL are marked in orange.

8.3.4 Ground noise assessment locations are defined in Section 16.9 of **Chapter 16** Noise and Vibration of the ES **[TR020001/APP/5.01]**.

Table 8.3: 2027 Ground Noise Prediction Results

Receptor Group	Daytime $L_{Aeq,16h}$dB			Night-time $L_{Aeq,8h}$dB		
	Highest DM	Highest DS	Worst-case Change	Highest DM	Highest DS	Worst-case Change
GR1	59.2	59.9	+0.7	54.6	55.8	+1.2
GR2	52.3	52.5	+0.2	47.8	48.8	+1.0
GR3	55.3	55.6	+0.6	50.3	51.3	+1.1
GR4	62.3	62.5	+0.2	57.6	58.7	+1.1
GR5	61.8	62.5	+0.7	57.2	58.6	+1.4
GR6	58.0	58.8	+0.8	53.5	54.6	+1.5
GR7	55.8	56.3	+0.5	51.2	52.3	+1.1
GR8	56.1	56.5	+0.4	51.4	52.4	+1.0
GR9	56.0	56.6	+0.6	51.4	52.5	+1.1
GR10	55.2	56.7	+1.5	50.3	52.6	+2.4
GR11	57.2	57.5	+0.7	52.5	53.5	+1.4
GR12	58.4	58.4	+0.9	53.8	54.3	+1.5
GR13	58.8	59.0	+0.2	54.6	54.8	+0.8
GR14	58.4	57.8	-0.1	54.4	54.0	+0.4
GR15	59.8	58.7	-0.8	55.8	54.7	-0.1
GR16	55.3	55.5	+0.2	51.5	52.2	+1.5
GR17	55.6	55.7	+0.1	51.5	52.1	+0.6
GR18	58.9	58.4	+0.4	54.1	54.0	+0.9
GR19	59.6	57.7	-0.8	55.9	54.0	-0.7
GR20	59.6	59.1	-0.5	55.9	54.9	-1.0
GR21	52.4	52.1	-0.3	47.9	47.3	-0.6
GR22	54.5	54.6	+1.2	51.2	52.0	+2.7
GR23	55.3	55.4	+0.1	50.8	51.3	+0.5
GR24	57.0	56.5	+0.1	51.4	51.7	+0.6

Table 8.4: 2039 Ground Noise Prediction Results

Receptor Group	Daytime $L_{Aeq,16h}$dB			Night-time $L_{Aeq,8h}$dB		
	Highest DM	Highest DS	Worst-case Change	Highest DM	Highest DS	Worst-case Change
GR1	58.4	59.5	+1.3	53.7	55.2	+1.6
GR2	51.4	52.9	+1.5	46.7	48.5	+1.8
GR3	54.5	55.5	+1.3	49.5	50.8	+1.6

Receptor Group	Daytime $L_{Aeq,16h}$dB			Night-time $L_{Aeq,8h}$dB		
	Highest DM	Highest DS	Worst-case Change	Highest DM	Highest DS	Worst-case Change
GR4	61.4	62.8	+1.4	57.0	58.0	+1.0
GR5	60.9	62.2	+1.3	56.6	57.6	+1.0
GR6	57.5	58.3	+0.8	53.3	54.2	+0.9
GR7	55.0	55.7	+0.7	50.6	51.4	+0.8
GR8	55.2	55.7	+0.5	50.9	51.5	+0.6
GR9	55.2	55.6	+0.4	50.8	51.4	+0.6
GR10	54.4	54.8	+0.4	49.8	50.6	+0.8
GR11	56.6	57.3	+0.8	52.5	53.5	+1.1
GR12	57.5	58.3	+1.6	53.4	54.4	+1.9
GR13	57.9	58.0	+0.7	54.4	53.7	+0.3
GR14	57.5	59.0	+1.7	53.6	54.9	+0.7
GR15	58.8	57.8	+0.2	55.2	53.7	0.0
GR16	54.6	53.8	-0.5	51.5	50.7	-0.5
GR17	54.7	54.8	+0.1	50.9	50.8	-0.1
GR18	58.3	57.3	+0.1	53.9	52.9	-0.1
GR19	58.6	57.1	-0.2	55.0	53.5	-0.8
GR20	58.5	58.4	-0.1	54.7	54.3	-0.4
GR21	51.4	51.5	+0.1	47.3	47.0	-0.3
GR22	54.1	54.3	+2.5	51.6	51.8	+1.9
GR23	54.4	54.1	-0.3	50.0	49.8	-0.2
GR24	55.2	54.1	+1.2	49.9	49.5	+1.1

Table 8.5: 2043 Ground Noise Prediction Results

Receptor Group	Daytime $L_{Aeq,16h}$dB			Night-time $L_{Aeq,8h}$dB		
	Highest DM	Highest DS	Worst-case Change	Highest DM	Highest DS	Worst-case Change
GR1	58.4	60.0	+1.6	53.7	55.5	+1.9
GR2	51.4	52.7	+1.8	46.7	48.3	+2.1
GR3	54.5	55.8	+1.6	49.5	51.1	+1.8
GR4	61.4	63.8	+2.4	57.0	58.2	+1.2
GR5	60.9	63.1	+2.2	56.6	57.7	+1.1
GR6	57.5	59.5	+2.0	53.3	54.4	+1.1
GR7	55.0	55.1	+0.1	50.6	50.6	0.0

Receptor Group	Daytime $L_{Aeq,16h}$dB			Night-time $L_{Aeq,8h}$dB		
	Highest DM	Highest DS	Worst-case Change	Highest DM	Highest DS	Worst-case Change
GR8	55.2	55.0	-0.2	50.9	50.5	-0.4
GR9	55.2	55.0	-0.2	50.8	50.6	-0.2
GR10	54.4	55.2	+0.8	49.8	50.9	+1.2
GR11	56.6	56.9	+0.7	52.5	53.0	+1.3
GR12	57.5	57.5	+0.1	53.4	53.0	+0.2
GR13	57.9	57.9	+1.2	54.4	53.4	+0.4
GR14	57.5	56.3	-0.5	53.6	51.9	-0.7
GR15	58.8	56.5	-1.2	55.2	52.4	-1.5
GR16	54.6	54.1	0.0	51.5	50.2	-0.3
GR17	54.7	54.9	+0.2	50.9	50.8	-0.1
GR18	58.3	57.2	+1.0	53.9	52.8	0.0
GR19	58.6	57.3	0.0	55.0	53.6	-0.9
GR20	58.5	58.3	-0.2	54.7	54.1	-0.6
GR21	51.4	51.7	+0.3	47.3	47.4	+0.1
GR22	54.1	54.1	+2.6	51.6	51.7	+2.0
GR23	54.4	52.1	-2.3	50.0	48.2	-1.8
GR24	55.2	51.2	+0.1	49.9	46.8	+0.1

9 SURFACE ACCESS NOISE ASSESSMENT

9.1 Surface access noise assessment methodology – residential receptors

9.1.1 The increase in passenger numbers is likely to result in increases in traffic on the local road network. The road traffic noise assessment considers the likely noise impact on all transport routes covered in the transport assessment. It has been undertaken using the methodology set out in the Design Manual for Roads and Bridges (DMRB) LA 111 Noise and Vibration Rev 2 (Ref. 30). Operational impacts resulting from vibration associated with road traffic are scoped out of further assessment in accordance with DMRB.

9.1.2 An initial study area, usually defined with reference to DMRB as 600 m from the Proposed Development, has been extended to include most of Luton and other areas within approximately 1 km of the airport. This area, termed the surface access noise study area, is illustrated in Figure 16.1 of the ES **[TR020001/APP/5.03]**.

9.1.3 In accordance with DMRB, the study area also includes areas within 50 metres of all existing roads that are predicted to be subject to a change in traffic noise level as a result of the Proposed Development of 1.0dB or more in the short-term (in any assessment Phase).

9.1.4 For the purposes of the assessment, the roads described in ~~p~~Paragraph 9.1.3 are defined as ‘affected routes’ and are identified by the analysis of the surface access traffic data. The identification of affected routes considered all roads with 18-hour (06:00 – 00:00) Annual Average Weekday Traffic (AAWT) traffic flows above the lower cut-off of the CRTN prediction methodology in all scenarios.

9.1.5 In accordance with DMRB, traffic noise levels have been calculated using CRTN (Ref. 31) with modifications to determine the traffic noise change due to each assessment Phase of the Proposed Development for:

a. Short-term: Do-Minimum (DM) Opening Year for assessment Phase 1 (DM2027) compared against the Do-Something (DS) Opening Year for assessment Phase 1 (DS2027).
b. Short-term: DM Opening Year for assessment Phase 2a (DM2039) compared against the DS Opening Year for assessment Phase 2a (DS2039).
c. Short-term: DM Opening Year for assessment Phase 2b (DM2043) compared against the DS Opening Year for assessment Phase 2b (DS2043).
d. Long-term: DM Opening Year for assessment Phase 1 (DM2027) compared against the DS Future Year for assessment Phase 2b (DS2043).
e. Non-project noise change: DM Opening Year for assessment Phase 1 (DM2027) compared against DM Future Year for assessment Phase 2b (DM2043).

9.1.6 Noise from a stream of traffic is not constant, but to assess the traffic noise impact a single figure estimate of the overall noise level is necessary. The index adopted by CRTN to assess traffic noise is $L_{A10,18h}$. This value is the arithmetic mean of the noise level exceeded 10% of the time in each of the 18 one-hour periods between 06:00 and 00:00. For ease of comparison with other noise sources, surface access noise levels are shown in terms of the daytime $L_{Aeq,16h}$ free-field level. This is derived from the CRTN $L_{A10,18h}$ level following WebTAG guidance (Ref. 32).

9.1.7 The CRTN methodology applies a ‘low flow’ correction between 18-hour vehicle flows of 1,000 and 4,000. The low flow correction procedure amplifies the impact of changes in traffic flows that are already low, in particular at receptors very close to the road. The 1,000 18-hour flow cut-off is the lower limit of the reliability of the CRTN prediction methodology.

9.1.8 Although the main focus of the assessment is on daytime impacts, DMRB also requires an assessment of night-time traffic noise levels using the parameter $L_{night,outside}$, which is the traffic noise level over the period 23:00 to 07:00. However, this parameter is not calculated by the standard CRTN methodology. DMRB refers to three methods for calculating night-time traffic noise levels developed by TRL (Ref. 33). ‘Method 3’, which factors the $L_{night,outside}$ from the $L_{A10,18h}$, is based on the typical diurnal pattern of traffic flows in the UK and provides reliable results for most UK roads. This method has been used to derive $L_{night,outside}$, equivalent to the night-time $L_{Aeq,\,8h}$ reported in this assessment.

9.1.9 Predicted daytime and night-time traffic noise levels at noise sensitive receptors within the calculation area have been generated using noise modelling software. The noise model is based on traffic data generated by a traffic model of the surrounding area.

9.1.10 The model also includes the ground topography, ground type and buildings to form a 3D representation of the study area. Further details of the noise model data sources and assumptions are provided in Section 9 of this ~~a~~Appendix, whilst details of the traffic model are available in the **Chapter 18** Traffic and Transportation of the ES **[TR020001/APP/5.01].**

9.1.11 Different façades of the same property can experience different changes in traffic noise level depending on their orientation to the noise source. DMRB requires that the assessment is based on the façade that experiences the greatest magnitude of change i.e. the largest numerical change whether this is an increase or decrease. Where this change is equal on more than one façade, the façade experiencing the highest DS traffic noise level is chosen.

9.1.12 The LOAEL and SOAEL for road traffic noise, used in this assessment for all noise sensitive receptors for the time periods when they are in use, are defined in Table 9.1 and are based on guidance in DMRB. A precautionary UAEL has been set at 74dB $L_{Aeq,16h}$ for daytime and 66dB $L_{Aeq,8h}$ for night-time. The daytime UAEL has been referenced from ES Appendix 14.3: Noise and vibration significance criteria of the A14 Cambridge to Huntingdon Improvement Scheme DCO (Ref. 34) and was accepted in the DCO decision. The night-time UAEL has been defined based on the Association of Noise Consultant’s and

Institute of Acoustics' Professional Practice Guidance on Planning and Noise (Ref. 35) which identifies a night-time target level of 30dB$L_{Aeq,8h}$ for bedrooms and states that *"once internal LAeq levels exceed the target levels by more than 10dB, they are highly likely to be regarded as "unacceptable" by most people, particularly if such levels occur more than occasionally."* Applying a precautionary outdoor to indoor 26dB level difference[10] yields a night-time UAEL of 66dB$L_{Aeq,8h}$ (i.e. 30dB target level, + 10dB to define an indoor threshold for unacceptable levels, +26dB indoor to outdoor level difference).

Table 9.1: Road Traffic Noise LOAEL, SOAEL and UAEL

Time Period	Threshold Level dB$L_{Aeq,T}$ for Average Annual Day (free-field)		
	LOAEL	SOAEL	UAEL
07:00 to 23:00[11]	50	63	74
23:00 to 07:00	40	55	66

9.1.13 The daytime LOAEL is set at 50dB $L_{Aeq,16h}$ (free-field) in accordance with DMRB LA111, which is based on the guidance provided in the 1999 WHO Guidelines for Community Noise regarding the onset of moderate community annoyance (Ref. 36). The WHO published the Environmental Noise Guidelines for the European Region in 2018 (Ref. 37) which provides guidelines for specific noise sources including road traffic. These guidelines suggest a recommended 53dB L_{den} for road traffic noise (note L_{den} correlates approximately to $L_{A10,18h}$) based on a 10% risk of being Highly Annoyed. The guidelines state they are "*not meant to identify effect thresholds*". Instead, they are based on the "*smallest relevant risk increase*" for various effects, and therefore lie slightly above the LOAEL. On this basis a LOAEL of 50dB $L_{Aeq,16h}$ (free-field) is consistent with the latest WHO Guidelines.

9.1.14 For daytime, the SOAEL is equivalent to 68dB $L_{A10,18h}$ (façade), which is consistent with the daytime trigger level in the NIR. The NIR threshold has a history of use in UK noise policy as it has previously been incorporated into planning guidance on the acceptability of sites for new residential developments. It is the external level that corresponds to an internal level with a closed single glazed window, which would meet the internal daytime criteria of 35dB $L_{Aeq,16h}$ specified in BS 8233 (Ref. 38) as desirable for resting in living rooms. It also correlates with the results of Defra Study NANR316 (Ref. 39) and is supported by the guidance in the Professional Practice Guidance: Planning and Noise produced by the Association of Noise Consultants, Institute of Acoustic and Chartered Institute of Environmental Health (Ref. 40).

[10] Note that this is a different outdoor to indoor level difference to the 15dB applied elsewhere representing an open window. This is because the unacceptable effect threshold represents an external exposure above which, without mitigation, people will have exhausted their ability to protect themselves from unacceptable levels indoors (i.e. by closing their existing windows). The 26dB level difference therefore represents a property with a masonry construction and either single glazed windows (closed) or thermal double-glazed windows (closed) with and open trickle vent.
[11] LOAEL and SOAEL for the daytime period are calculated from DMRB $L_{A10,18h}$ values by applying a correction of -3dB to convert from the façade level to a free-field level and by applying a further correction of -2dB to convert from $L_{A10,18h}$ to $L_{Aeq,16h}$.

9.1.15 For night-time, the SOAEL is set at 55dB $L_{night,outside}$ (free--field), which corresponds to an internal level with a closed single glazed window, which would be slightly below the night-time criteria of 30dB $L_{Aeq,8h}$ specified in BS 8233 as desirable for sleeping in bedrooms. It also correlates well with the results of Defra Study NANR316 and is supported by the Professional Practice Guidance: Planning and Noise guidance. The WHO 2009 Night Noise Guidelines for Europe (Ref. 41) explicitly identify the night-time LOAEL as 40dB $L_{Aeq,8h}$ (free-field). Therefore, this LOAEL has been adopted in the assessment. Levels between 40 and 55dB $L_{Aeq,8h}$ are identified in the guidelines as ‘adverse’ but not ‘significant adverse’, where health effects are observed among the exposed population. 55dB $L_{Aeq,8h}$ is identified in the guidelines as the level at which the risk of cardiovascular disease increases.

9.1.16 The 2018 WHO guidelines complement the WHO 2009 Night Noise Guidelines for Europe and suggest a recommended 45dB L_{night} for road traffic noise based on a 3% risk of being Highly Sleep Disturbed. However, as discussed above the 2018 WHO guidelines state they are “*not meant to identify effect thresholds*”. Instead, they are based on the “*smallest relevant risk increase*” for various effects, and therefore lie slightly above the LOAEL, as explicitly defined in the WHO 2009 Night Noise Guidelines for Europe.

9.1.17 DMRB provides two classifications for the magnitude of the traffic noise impact of a proposed road scheme, as shown in Table 9.2. These relate to both short-term changes and long-term changes in traffic noise levels in the scenarios described in pParagraph 9.1.5. The short-term classification detailed in Table 9.2 is the main driver of the initial identification of significant effects.

Table 9.2: Magnitude of traffic noise impacts

Magnitude of Effect	Change in Noise Level	
	Short-term	Long-term
Major	5.0dB or more	10.0dB or more
Moderate	3.0 – 4.9dB	5.0 – 9.9dB
Minor	1.0 – 2.9dB	3.0 – 4.9dB
Negligible	0.1 – 0.9dB	0.1 – 2.9dB
No change	0.0dB	0.0dB

9.1.18 Negligible changes in the short-term would not cause changes to behaviour or responses to noise, and as such would not give rise to significant effects. For short-term minor, moderate and major changes, DMRB outlines a range of additional factors that are considered in identifying significant effects:

a. Where the magnitude of change in the short-term lies relative to the boundaries between the bands outlined in Table 9.2. In some circumstances, such as where the acoustic context or likely perception of traffic noise would change, a change within 1dB of the top of the minor range may be appropriate to be considered a likely significant effect. Conversely a change within 1dB of the bottom of the moderate range, may in some circumstances be more appropriate to be considered as not likely to be a significant effect.

b. The magnitude of change in the long-term is different to that in the short-term - if the short-term change is minor (not significant), but the long-term change is moderate (significant) it may be more appropriate to be considered as a likely significant effect. Conversely, a smaller magnitude of change in the long-term compared to the short-term may indicate that it is more appropriate to be considered as not likely to be a significant effect.

c. The absolute noise levels relative to the SOAEL - if the DS traffic noise levels are high i.e. above the SOAEL, a traffic noise change in the short-term opening year of 1.0dB or more results in a likely significant effect.

d. The location of noise sensitive parts of a receptor - a receptor may contain areas which are more or less sensitive than others e.g. office spaces or kitchens in a school would be considered less sensitive than classrooms. Conversely, if the sensitive parts of the receptor are exposed to the noise source, it can be more appropriate to conclude a minor change in the short--term and/or long--term is a likely significant effect.

e. The acoustic context, if a proposed scheme changes the acoustic character of an area - if a scheme introduces road noise into an area where road noise is not currently a major source, it may be appropriate to conclude a minor short-term change is a likely significant effect.

f. The likely perception of a traffic noise change - if a proposed scheme results in obvious changes to the landscape or setting of a receptor it is likely the traffic noise level changes would be more acutely perceived, and it may be more appropriate to conclude a minor short-term change is a likely significant effect. Conversely if a proposed scheme is not visible it can be more appropriate to conclude a moderate change is not a likely significant effect.

9.2 Data used

9.2.1 Predicted daytime and night-time traffic noise levels at noise sensitive receptors within the surface access study area have been generated using SoundPlan v8.2 noise modelling software which implements the CRTN methodology for calculating road traffic noise.

9.2.2 The following data has been utilised within the process of noise modelling:

a. Ordnance Survey (OS) Mastermap: provided 24/07/2019.

b. Existing areas of soft and hard ground: based on OS Mastermap Topographic layer.

c. OS Address Base Plus: provided 24/08/2022.

d. Road network changes illustrated in the surface access drawing package.

e. Existing 3D topographic ground height data downloaded from the Defra survey website on 29/11/2019.

f. Round 3 Noise Important Areas information downloaded from the data.gov.uk website on 14/12/2021.

g. Operational traffic forecast data: provided by the traffic team on 14/11/2021.

9.3 Modelling assumptions

9.3.1 The following assumptions were applied within the noise model:

a. Ground absorption: 1.0 for soft ground (vegetated), and 0.0 for hard ground (including water and road surfaces).

b. Building heights for residential buildings were generally standardised to 4.0 metres: one storey; 6.0 metres: two storey; 9.0 metres: three storey etc.~~-~~ based on initial information from OS Mastermap. Non-residential buildings used height direct from OS Mastermap. Some adjustments were required to estimate missing heights or remove obvious inaccuracies.

c. Road surfacing corrections applied:

i. Standard hot rolled asphalt~~-~~/~~-~~high friction surfacing: speed <75 km/hr: -1.0dB. ~~-~~ speed ≥75 km/hr: -0.5dB.

ii. Thin surfacing (low noise surfacing) on the ~~a~~Airport A~~a~~ccess ~~r~~Road: speed <50 km/hr: -2.5dB. ~~–~~speed ≥50 km/hr: -3.5dB.

d. 10 metre x 10 metre grid used to produce traffic noise change contour plots at height of 4.0 metres above ground.

9.4 Affected surface access routes

9.4.1 In accordance with DMRB and as described in ~~p~~Paragraphs 9.1.3 and 9.1.4 of this ~~a~~Appendix, traffic data relating to roads inside the study area but outside of the detailed calculation area have been analysed to assess likely road traffic noise impacts on the wider network.

9.4.2 A summary of all affected routes, that is those roads expected to experience a change in short-term road traffic noise of 1dB or more, is provided in this section for each assessment Phase of the Proposed Development.

Assessment Phase 1

9.4.3 In assessment Phase 1 of the Proposed Development no roads outside of the calculation area are expected to experience a change in road traffic noise of more than 1dB. Therefore, changes in road traffic noise on the wider network in assessment Phase 1 are **negligible** and considered **not significant**.

Assessment Phase 2a

9.4.4 The affected routes relating to assessment Phase 2a are shown in Table 9.1. These reflect **minor** increases in road traffic noise in rural locations to the north-east of the airport, where absolute road traffic noise levels are below SOAEL, and a **minor** reduction in road traffic noise on part of the A602 in Hitchin. These changes are considered to result in effects that are **not significant**.

Table 9.1: Summary of affected routes for assessment Phase 2a

Link	Description	Number of receptors within 50 m		$L_{Aeq,16h}$dB 10 m from the road		
		Residential	Non–residential	DM2039	DS2039	Change
141-140	Church Road, the Heath.	3	0	56.5	57.5	1.4
163-144	Lodge Farm Road.	1	0	55.6	56.6	1.0
143-145	Chalk Hill	1	0	55.1	57.8	2.7
148-145	Lilley Bottom	6	0	59.2	60.3	1.1
170-169	Park Way, Hitchin	223	0	70.2	68.8	-2.3

Assessment Phase 2b

9.4.5 The affected routes relating to assessment Phase 2b are shown in **Table 9.2**. These reflect **minor** and **moderate** increases in road traffic noise in rural locations to the north-east of the airport and a **minor** reduction in road traffic noise on part of the A602 in Hitchin. The moderate increase on Chalk Hill is not considered to lead to a significant adverse effect as:

a. The absolute road traffic noise level at the associated residential property is considered to remain relatively low; and

b. The increase in road traffic noise, which is at the lower end of the moderate band, is exacerbated by the CRTN low-flow correction for the L_{A10} metric. Such an increase in $L_{Aeq,T}$ would not be expected.

9.4.6 As such all changes in road traffic noise on affected routes in 2043 are considered to result in effects that are **not significant**.

Table 9.2: Summary of affected routes for assessment Phase 2b

Link	Description	Number of receptors within 50 m		$L_{Aeq,16h}$dB 10 m from the road		
		Residential	Non–residential	DM2043	DS2043	Change
139-140	Darley Road	17	0	58.3	59.3	1.0
141-140	Church Road, the Heath.	3	0	56.6	59.0	1.4
144-141	Lilley Bottom	1	0	56.4	57.3	1.0
163-144	Lodge Farm Road.	1	0	56.0	58.4	2.4
143-145	Chalk Hill	1	0	55.6	59.1	3.5
148-145	Lilley Bottom	6	0	59.4	61.0	1.6
170-169	Park Way	223	0	70.2	69.0	-1.2

9.5 Surface access sensitivity testing

9.5.1 Road traffic noise levels, in 2043 with and without the Proposed Development, were analysed with respect to the scenario in which the National Highways Smart Motorway upgrade (hard shoulder running scheme) for the M1 is not implemented.

9.5.2 The difference between the impact on road traffic noise of the Proposed Development in 2043 in the core scenario and this scenario was found to be **negligible**. Therefore, the conclusions with respect to road traffic noise reported in **Chapter 16** Noise and Vibration of the ES **[TR020001/APP/5.01]** are considered to apply equally to the scenario in which the National Highways Smart Motorway upgrade (hard shoulder running scheme) for the M1 is not implemented.

10 FIXED PLANT NOISE

10.1.1 The level of design detail at the time of the ES for fixed plant is limited, as is normal for any project of this nature. The methodology for assessment of significant effects of fixed plant is therefore to avoid significant adverse effects, and reduce adverse effects as far as is reasonably practicable, through a requirement to design fixed plant following a noise management process derived from guidance in British Standard 4142. This approach is described in further detail in **Appendix 16.3** of this ES **[TR020001/APP/5.02]**. As the building services plant will be designed following this approach; the permanent effect of operational building services noise in all assessment Phases would be **not significant**.

11 NON-RESIDENTIAL RECEPTORS ASSESSMENT METHODOLOGY

11.1 Overview

11.1.1 The screening criteria, assessment criteria, assessment methodology and how criteria have been used to identify likely significant effects for non-residential receptors is described in Section 16.5 of **Chapter 16** of the ES **[TR020001/APP/5.01]**. This section of the ~~a~~Appendix summarises the evidence base for the assessment criteria presented in Table 16.19 of **Chapter 16** of the ES **[TR020001/APP/5.01]** and reproduced here as Table 11.1.

Table 11.1 Assessment criteria for non-residential receptors

Receptor category	Noise level (outdoors, free field)		Change in noise exposure (DS-DM)
	Day (07:00-23:00)	Night (23:00-07:00)	
Educational facilities (schools, colleges, nurseries, further education, higher education, lecture theatres)	55-~~59dBL_{Aeq}~~62dB$L_{Aeq,16h}$	n/a	≥3.0
	≥63dB$L_{Aeq,16h}$	n/a	≥2.0
Doctor's surgeries and medical centres	≥55dB$L_{Aeq,16h}$	n/a	≥3.0
Hospitals	≥55dB$L_{Aeq,16h}$	≥45dB$L_{Aeq,8h}$	≥3.0
Auditoria, concert halls, theatres and sound recording and broadcast studios	≥50dB $L_{Aeq,16h}$	≥50dB $L_{Aeq,8h}$	≥3.0
Places of worship	≥50dB $L_{Aeq,16h}$	n/a	≥3.0
Offices	≥55dB $L_{Aeq,16h}$	n/a	≥3.0
Museums	≥55dB $L_{Aeq,16h}$	n/a	≥3.0
Community and village halls	≥60dB $L_{Aeq,16h}$	n/a	≥3.0
Courts	≥50dB $L_{Aeq,16h}$	n/a	≥3.0
Libraries	≥55dB $L_{Aeq,16h}$	n/a	≥3.0
Hotels	≥50dB$L_{Aeq,16h}$	≥45dB$L_{Aeq,8h}$	≥3.0

11.1.2 Assessment criteria have been derived from relevant guidance and professional judgement as described in the following sections. Where guidance specifies a range of indoor noise levels, professional judgement has been used to select a value within the range based on the anticipated sensitivity of the receptor to noise intrusion and the resulting external noise level criteria.

11.1.3 Where guidance specifies indoor noise levels, these have been converted to outdoor free-field level by assuming an outdoor to indoor reduction of 15dB representing a typical façade with an open window as a reasonable worst case, unless otherwise specified. The 15dB reduction has been applied based results of a Defra research study on open window façade sound insulation (Ref. 42).

11.1.4 Change criteria have been defined following guidance in the Institute of Environmental Management and Assessment's (IEMA) 'Guidelines for Environmental Noise Impact' (Ref. 43), Planning Practice Guidance: Noise (~~Ref.~~ 2222) and the approach adopted for residential receptors (see Table 7.3), where moderate or major effects are identified as significant effects.

11.2 Educational facilities

11.2.1 Recommended limits for indoor noise levels for schools are provided in Building Bulletin 93 Acoustic design of schools: performance standards (Ref. 44). The assessment criteria for schools been informed by the internal ambient noise level limit of 40dB$L_{Aeq,30min}$ for naturally ventilated new builds (i.e. representing a scenario with an open window as a reasonable worst case). Due to the relative consistency of aircraft noise throughout the day it can be assumed that the 40dB$L_{Aeq,30min}$ is broadly equivalent to 40dB$L_{Aeq,16h}$ which is then converted to an outdoor free-field assessment criteria of 55dB$L_{Aeq,16h}$. BB93 also says that *"In order to protect students from regular discrete noise events, eg, aircraft or trains, indoor ambient noise levels should not exceed 60dB$L_{A1,30mins}$"*. Analysis of ambient noise survey data at Breachwood Green school shows that the $L_{A1,30min}$ is on average 12dB higher than the $L_{Aeq,16h}$. Subtracting 12dB for an approximate conversion from $L_{A1,30min}$ to $L_{Aeq,16h}$ and then adding 15dB to represent an open window therefore results in an upper-level assessment criterion for schools of 63dB$L_{Aeq,16h}$.

11.3 Doctor's surgeries and medical centres

11.3.1 Recommended design values for healthcare buildings are provided in Health Technical Memorandum 08-01 (HTM 08-01, Ref 45). The assessment criteria for doctor's surgeries and medical centres has been informed by the criteria for noise intrusion from external sources for "*Private offices, small treatment rooms, interview rooms, consulting rooms*" of 40dB$L_{Aeq,1h}$. Due to the relative consistency of aircraft noise throughout the day it can be assumed that the 40dB$L_{Aeq,1h}$ is broadly equivalent to 40dB$L_{Aeq,16h}$ which is then converted to an outdoor free-field assessment criteria of 55dB$L_{Aeq,16h}$. There is no night-time criterion as these buildings are not expected to be regularly occupied at night.

11.4 Hospitals

11.4.1 The assessment criteria for hospitals have been informed by the criteria for noise intrusion from external sources for *"Single-bed ward, single-bed recovery areas and on-call room, relatives' overnight stay"* in HTM 08-01 of 40dB$L_{Aeq,1h}$ for daytime and 35dB$L_{Aeq,1h}$ for night-time. Due to the relative consistency of aircraft noise throughout the day it can be assumed that the 40dB$L_{Aeq,1h}$ is broadly equivalent to 40dB$L_{Aeq,16h}$ which is then converted to an outdoor façade free-field assessment criterion of 55dB$L_{Aeq,16h}$. At night, as there is less consistency between the $L_{Aeq,8h}$ and $L_{Aeq,1h}$ metric a 5dB penalty has been applied and then converted to a resulting outdoor free-field assessment criterion of 45dB$L_{Aeq,8h}$.

11.5 Auditoria, concert halls, theatres and sound recording and broadcast studios

11.5.1 The assessment criteria for auditoria, concert halls, theatres and sound recording and broadcast studios has been informed by guidance for "good" conditions for indoor ambient sound levels for concert halls and theatres (25dB$L_{Aeq,T}$) and recording studios (20dB$L_{Aeq,T}$) from British Standard 8233:1999 Sound insulation and noise reduction for buildings – code of practice (Ref. 46). Whilst this standard has been replaced by the 2014 version (Ref. 3838), it contains guidance on noise levels that are not contained in the 2014 version and are still considered relevant and appropriate for application in this assessment.

11.5.2 Given the specific sensitivity of these uses to the ingress of noise, and the fact that those receptors identified in the study area are already exposed to aircraft noise, it is assumed that any such receptor would have a building shell (including windows and ventilation penetrations) that would reduce external levels by at least 25-30dB. The outdoor free-field assessment criteria is therefore 50dB$L_{Aeq,16h}$ for the daytime and 50dB$L_{Aeq,8h}$ for the night-time as these spaces have equal sensitivity during the day and when occupied at night.

11.6 Places of worship

11.6.1 The assessment criteria for places of worship has been informed by guidance from British Standard 8233:2014 which recommends that indoor noise levels should not normally exceed 30-35dB$L_{Aeq,T}$ for listening in places of worship. The upper value of this range has been converted to an outdoor free-field assessment criterion of 50dB$L_{Aeq,16h}$. There is no night-time criterion as these buildings are not expected to be regularly occupied at night.

11.7 Offices

11.7.1 The assessment criteria for offices has been informed by guidance from British Standard 8233:2014 which recommends that indoor noise levels should not normally exceed 35-40dB$L_{Aeq,T}$ for work requiring concentration in executive offices. The upper value of this range is then converted to an outdoor free-field assessment criterion of 55dB$L_{Aeq,16h}$. There is no night-time criterion as these buildings are not expected to be regularly occupied at night.

11.8 Museums and libraries

11.8.1 The assessment criteria for museums and libraries has been informed by guidance from British Standard 8233:2014 which recommends that indoor noise levels should not normally exceed 40-50dB$L_{Aeq,T}$ for study and work requiring concentration in libraries, galleries and museums. The lower value of this range is then converted to an outdoor free-field assessment criterion of 55dB$L_{Aeq,16h}$. There is no night-time criterion as these buildings are not expected to be regularly occupied at night.

11.9 Community and village halls

11.9.1 The assessment criteria for museums and libraries has been informed by guidance from British Standard 8233:2014 which recommends that indoor noise levels should not normally exceed 45-55dB$L_{Aeq,T}$ for activity spaces requiring speech communication. The lower value of this range is then converted to an outdoor free-field assessment criterion of 60dB$L_{Aeq,16h}$. There is no night-time criterion as these buildings are not expected to be regularly occupied at night.

11.10 Courts

11.10.1 British Standard 8233:2014 does not provide guidance on indoor noise levels for courts, but the required activities and sensitivity to noise are considered to be similar to those of work requiring concentration of executive offices, for which a recommended range of 35-40dB$L_{Aeq,T}$ is provided. The lower value of this range is then converted to an outdoor free-field assessment criterion of 50dB$L_{Aeq,16h}$. There is no night-time criterion as these buildings are not expected to be regularly occupied at night.

11.11 Hotels

11.11.1 British Standard 8233:2014 states that *“the recommendations for ambient noise in hotel bedrooms are similar to those for living accommodation”* and recommends for dwellings that internal ambient noise levels do not exceed 35dB$L_{Aeq,16h}$ in areas of rest during the daytime and 30dB$L_{Aeq,8h}$ in bedrooms during the night-time. These values have been converted to outdoor free-field assessment criteria of 50dB$L_{Aeq,16h}$ during the daytime and 45dB$L_{Aeq,8h}$ during the night-time.

12 SENSITIVITY TESTING

12.1.1 Additional noise modelling was required for the following sensitivity test scenarios:

a. 2019 Consented baseline;
b. Faster Growth (FG);
c. Slower Growth (SG);
d. Potential noise reductions from next generation aircraft coming into service; and
e. Potential changes to airspace.

12.1.2 A description of sensitivity tests can be found in **Chapter 5** Approach to the Assessment in this ES **[TR020001/APP/5.01]**.

12.2 2019 Consented ~~b~~Baseline

12.2.1 As discussed in Section 6.17, a 2019 fleet was developed by increasing the number of new generation aircraft so noise contours would be compliant with 2019 consented noise contour limits[12], which form the 2019 Consented Baseline. This section provides a sensitivity test of likely significant effects if the 2019 baseline was in compliance with 2019 noise contour limits.

2019 Actuals Baseline and 2019 Consented Baseline Comparison

12.2.2 Daytime and night-time noise contours for the 2019 Consented Baseline are shown in Figure 16.87 and Figure 16.88 **[TR020001/APP/5.02]**. N65 and N60 contours for the 2019 Consented ~~b~~Baseline are shown in Figure 16.89 and Figure 16.90 **[TR020001/APP/5.02]**. The difference between the 2019 Actuals Baseline and the 2019 Consented Baseline contours are show in Figure 16.95 and Figure 16.96 **[TR020001/APP/5.02].**

12.2.3 Comparison of area coverage by 2019 Actuals Baseline and 2019 Consented Baseline air noise contours are presented in Table 12.1 for daytime $L_{Aeq,16h}$ and Table 12.4 for night-time $L_{Aeq,8h}$.

12.2.4 Comparison of households within 2019 Actuals Baseline and 2019 Consented Baseline air noise contours are presented in Table 12.2 for daytime $L_{Aeq,16h}$ and Table 12.5 for night-time $L_{Aeq,8h}$.

12.2.5 Comparison of population within 2019 Actuals Baseline and 2019 Consented Baseline air noise contours are presented in Table 12.3 for daytime $L_{Aeq,16h}$ and Table 12.6 for night-time $L_{Aeq,8h}$.

[12] Current consented noise contour limits for the airport were established in 2014 under Condition 10 of granted planning consent 12/01400/FUL

Table 12.1: Daytime 2019 Actuals Baseline v 2019 Consented Baseline – Area

$L_{Aeq,16h}$dB Noise Contour	2019 Actuals Baseline Cumulative Area (km^2)	2019 Consented Baseline Cumulative Area (km^2)	Difference (km^2)
51 (LOAEL)	**58.1**	**55.4**	**-2.7**
54	35.4	33.5	-2.0
57	20.3	18.9*	-1.4
60	10.4	9.8	-0.6
63 (SOAEL)	**5.6**	**5.3**	**-0.3**
66	2.6	2.4	-0.2
69 (UAEL)	**1.4**	**1.3**	**-0.1**
*AEDT underpredicts by approximately 2% at 57 dB $L_{Aeq,16h}$ in comparison to INM, which is used to test compliance with the existing noise contour limit of 19.4 km^2.			

Table 12.2: Daytime 2019 Actuals Baseline v 2019 Consented Baseline – Households

$L_{Aeq,16h}$dB Noise Contour	2019 Actuals Baseline Cumulative Number of Households	2019 Consented Baseline Cumulative Number of Households	Difference
51 (LOAEL)	**20,900**	**18,650**	**-2,250**
54	11,400	9,900	-1,500
57	6,000	5,500	-500
60	2,800	2,450	-350
63 (SOAEL)	**650**	**500**	**-150**
66	<50	<50	**0**
69 (UAEL)	**0**	**0**	**0**

Table 12.3: Daytime 2019 Actuals Baseline v 2019 Consented Baseline – Population

$L_{Aeq,16h}$dB Noise Contour	2019 Actuals Baseline Cumulative Population	2019 Consented Baseline Cumulative Population	Difference
51 (LOAEL)	**41,000**	**36,500**	**-4,500**
54	21,650	19,050	-2,600
57	11,900	10,900	-1,000
60	5,350	4,550	-800

$L_{Aeq,16h}$dB Noise Contour	2019 Actuals Baseline Cumulative Population	2019 Consented Baseline Cumulative Population	Difference
63 (SOAEL)	**1,650**	**1250**	**-400**
66	<50	0	0
69 (UAEL)	**0**	**0**	**0**

Table 12.4: Night-time 2019 Actuals Baseline v 2019 Consented Baseline – Area

$L_{Aeq,8h}$dB Noise Contour	2019 Actuals Baseline Cumulative Area (km^2)	2019 Consented Baseline Cumulative Area (km^2)	Difference
45 (LOAEL)	**74.6**	**64.3**	**-10.3**
48	45.3	38.0*	-7.3
51	26.5	21.5	-5.0
54	14.1	11.2	-2.9
55 (SOAEL)	**11.2**	**8.8**	**-2.4**
57	7	5.6	-1.4
60	3.6	2.7	-0.9
63 (UAEL)	**1.7**	**1.4**	**-0.3**
*AEDT overpredicts by approximately 2% at 48 dB $L_{Aeq,8h}$ in comparison to INM, which is used to test compliance with the existing noise contour limit of 37.2 km^2.			

Table 12.5: Night-time 2019 Actuals Baseline v 2019 Consented Baseline – Households

$L_{Aeq,8h}$dB Noise Contour	2019 Actuals Baseline Cumulative Number of Households	2019 Consented Baseline Cumulative Number of Households	Difference
45 (LOAEL)	**32,950**	**26,750**	**-6,200**
48	15,200	11,000	-4,200
51	7,100	5,750	-1,350
54	3,950	2,450	-1,500
55 (SOAEL)	**2,650**	**1,600**	**-1,050**
57	1,150	550	-600
60	50	<50	0

63 (UAEL)	**0**	**0**	**0**

Table 12.6: Night-time 2019 Actuals Baseline v 2019 Consented Baseline – Population

$L_{Aeq,8h}$dB Noise Contour	2019 Actuals Baseline Cumulative Population	2019 Consented Baseline Cumulative Population	Difference
45 (LOAEL)	**67,800**	**55,150**	**-12,650**
48	29,050	21,100	-7,950
51	14,050	11,150	-2,900
54	7,500	4,550	-2,950
55 (SOAEL)	**4,950**	**3,100**	**-1,850**
57	2,350	1,350	-1,000
60	150	0	-150
63 (UAEL)	**0**	**0**	**0**

Assessment Phase 1 2027 – 2019 Consented Baseline Sensitivity Test

12.2.6 A summary of population within the assessment Phase 1 2027 LOAEL, SOAEL and UAEL contours is provided in Table 12.7 for the 2019 Actuals Baseline, DM and DS scenarios, as repeated from Section 16.9 of **Chapter 16** of this ES **[TR020001/APP/5.01]**. The 2019 Consented ~~b~~Baseline results have been added to the table in brackets to allow a direct comparison of results.

Table 12.7: Assessment Phase 1 2027 Summary of population within the Air Noise LOAEL, SOAEL and UAEL contours with 2019 Consented Baseline

Noise exposure	Total Population				
	2019 Actuals Baseline (2019 Consented Baseline)	2027 DM	2027 DS	Change DS – 2019 Actuals Baseline (Change DS – 2019 Consented Baseline)	Change DS - DM
Daytime					
Above LOAEL and below SOAEL	39,350 (35,250)	25,000	31,600	-7,750 (-3,650)	6,600
Above SOAEL and below UAEL	1,650 (1,250)	50	450	-1,200 (-800)	400
Newly above the SOAEL in DS compared to the 2019 Actuals Baseline (2019 Consented Baseline)			0 (0)		
Above UAEL	0 (0)	0	0	0 (0)	0
Night-time					
Above LOAEL and below SOAEL	62,850 (52,050)	38,350	52,050	-10,800 (0)	13,700
Above SOAEL and below UAEL	4,950 (3,100)	2,100	3,800	-1,150 (700)	1,700
Newly above the SOAEL in DS compared to the 2019 Actuals Baseline (2019 Consented Baseline)			0 (700)		
Above UAEL	0 (0)	0	0	0 (0)	0

12.2.7 Table 12.7 demonstrates that there is a reduction in the total population exposed above the LOAEL and above the SOAEL during the daytime period in DS 2027 compared to the 2019 Consented Baseline. This reduction in total population exposed is due to a reduction in contour areas as a result of the increase in forecast new-generation aircraft operating in 2027. However, there is an increase in receptors above SOAEL during the night-time period in DS 2027 compared to the 2019 Consented Baseline. There are no receptors in the study area exposed to noise levels above the UAEL in any assessment scenario.

12.2.8 Significant adverse effects on health and quality of life in noise policy terms are determined by noise exposure above the SOAEL as defined in Table 7.2. During the daytime, the population exposed to noise levels above the SOAEL in the DS scenario are also exposed to noise levels above the SOAEL in the 2019 Consented Baseline. However, there would be an increase in communities expose to noise levels above the SOAEL during the night-time.

12.2.9 New communities in the assessment Phase 1 DS night-time SOAEL noise contour would be due to a widening of the contour that would affect properties to the west and the south of the airport. New communities that would be within the assessment Phase 1 DS SOAEL night-time contour in comparison the 2019 Consented Baseline are summarised in Table 12.8.

Table 12.8: Assessment Phase 1 2027 New community areas that experience continuing exposure above the SOAEL

Location	Community area	Daytime / Night-time
To the west of the airport	The majority of the 700 properties on sections of London Road, West Hill Road, Tennyson Road, St Paul’s Road, Harcourt Street, Cowper Street, Baker Street, Strathmore Avenue, Seymour Avenue, Seymour Road and Park Street – represented by AR32	Night-time only
To the south of the airport	Isolated properties on Dane Street	Night-time only

12.2.10 Significant adverse effects on health and quality of life due to continuing exposure above the SOAEL for the communities described above will be avoided by the noise insulation scheme (see Section 16.10 of **Chapter 16** of this ES **[TR020001/APP/5.01]**). Whilst the noise insulation scheme will be rolled out as quickly as is reasonably practicable, it may not be possible to offer and install noise insulation (where the offer is accepted) to all impacted communities before the relevant noise change occurs, due to the capacity of the market to meet immediate demand. In such cases there may be temporary adverse likely **significant** effects in assessment Phase 1 until such time as noise insulation can be provided.

Assessment Phase 2a 2039 – 2019 Consented Baseline Sensitivity Test

12.2.11 A summary of population within the assessment Phase 2a 2039 LOAEL, SOAEL and UAEL contours is provided in Table 12.9 for the 2019 Actuals Baseline, DM and DS scenarios, as repeated from Section 16.9 of **Chapter 16** of this ES **[TR020001/APP/5.01]**. The 2019 Consented ~~b~~Baseline results have been added to the table in brackets to allow a direct comparison of results.

Table 12.9: Assessment Phase 2a 2039 Summary of population within the Air Noise LOAEL, SOAEL and UAEL contours with 2019 Consented Baseline

Noise exposure	Total Population				
	2019 Actuals Baseline (2019 Consented Baseline)	2039 DM	2039 DS	Change DS – 2019 Actuals Baseline (Change DS – 2019 Consented Baseline)	Change DS - DM
Daytime					
Above LOAEL and below SOAEL	39,350 (35,250)	20,100	30,800	-8,550 (-4,450)	10,700
Above SOAEL and below UAEL	1,650 (1,250)	0	200	-1,450 (-1,050)	200
Newly above the SOAEL in DS compared to the 2019 Actuals Baseline (2019 Consented Baseline)			0 (0)		
Above UAEL	0 (0)	0	0	0 (0)	0
Night-time					
Above LOAEL and below SOAEL	62,850 (52,050)	32,850	52,350	-10,500 (300)	19,500
Above SOAEL and below UAEL	4,950 (3,100)	1,500	2,600	-2,350 (-500)	1,100
Newly above the SOAEL in DS compared to the 2019 Actuals Baseline (2019 Consented Baseline)			0 (0)		
Above UAEL	0 (0)	0	0	0 (0)	0

12.2.12 Table 12.9 demonstrates that there is a reduction in the total population exposed above the LOAEL and above the SOAEL during the daytime period in DS 2039 compared to the 2019 Consented Baseline. This reduction in total population exposed is due to a reduction in contour areas as a result of the increase in forecast new-generation aircraft operating in 2039. There are no receptors in the study area exposed to noise levels above the UAEL in any assessment scenario.

12.2.13 Significant adverse effects on health and quality of life in noise policy terms are determined by noise exposure above the SOAEL as defined in Table 7.2. During the daytime and night-time, the population exposed to noise levels above the SOAEL in the DS scenario are also exposed to noise levels above the SOAEL in the 2019 Consented Baseline. Therefore, there are no new significant adverse effects on health of quality life during the daytime or night-time in assessment Phase 2a.

12.2.14 Significant adverse effects on health and quality of life due to continuing exposure above the SOAEL for the communities described above will be avoided by the noise insulation scheme (see Section 16.10 of **Chapter 16** of this ES **[TR020001/APP/5.01]**~~.~~), which will prioritise these communities.

Assessment Phase 2b 2043 – 2019 Consented Baseline Sensitivity Test

12.2.15 A summary of population within the assessment Phase 2b 2043 LOAEL, SOAEL and UAEL contours is provided in Table 12.10 for the 2019 Actuals Baseline, DM and DS scenarios, as repeated from Section 16.9 of **Chapter 16** of this ES **[TR020001/APP/5.01]**. The 2019 Consented ~~b~~Baseline results have been added to the table in brackets to allow a direct comparison of results.

Table 12.10: Assessment Phase 2b 2043 Summary of population within the Air Noise LOAEL, SOAEL and UAEL contours with 2019 Consented Baseline

Noise exposure	Total Population				
	2019 Actuals Baseline (2019 Consented Baseline)	2043 DM	2043 DS	Change DS – 2019 Actuals Baseline (Change DS – 2019 Consented Baseline)	Change DS - DM
Daytime					
Above LOAEL and below SOAEL	39,350 (35,250)	19,950	38,250	-1,100 (3,000)	+18,300
Above SOAEL and below UAEL	1,650 (1,250)	0	500	-1,150 (-750)	+500
Newly above the SOAEL in DS compared to the 2019 Actuals Baseline (2019 Consented Baseline)			0 (0)		
Above UAEL	0 (0)	0	0	0 (0)	0
Night-time					
Above LOAEL and below SOAEL	62,850 (52,050)	32,400	59,550	-3,300 (7,500)	+27,150
Above SOAEL and below UAEL	4,950 (3,100)	1,350	3,250	-1,700 (150)	+1,900
Newly above the SOAEL in DS compared to the 2019 Actuals Baseline (2019 Consented Baseline)			0 (150)		
Above UAEL	0 (0)	0	0	0 (0)	0

12.2.16 Table 12.10 demonstrates that there is a reduction in the total population exposed above the LOAEL and above the SOAEL during the daytime period in DS 2043 compared to the 2019 Consented Baseline. This reduction in total population exposed is due to a reduction in contour areas as a result of the increase in forecast new-generation aircraft operating in 2043. However, there is an increase in receptors above SOAEL during the night-time period in DS 2043 compared to the 2019 Consented Baseline. There are no receptors in the study area exposed to noise levels above the UAEL in any assessment scenario.

12.2.17 Significant adverse effects on health and quality of life in noise policy terms are determined by noise exposure above the SOAEL as defined Table 7.2. During the daytime, the population exposed to noise levels above the SOAEL in the DS scenario are also exposed to noise levels above the SOAEL in the 2019 Consented Baseline. However, there would be an increase in communities expose to noise levels above the SOAEL during the night-time.

12.2.18 Although the assessment Phase 2b DS night-time SOAEL contour covers a larger area than the equivalent assessment Phase 1 DS noise contour, the width of the contour is comparable to the 2019 Consented Baseline with the increased contour area along approach routes, which are not so densely populated. However, the assessment Phase 2b night-time SOAEL contour is marginally wider the 2019 Consented Baseline night-time SOAEL contour, which accounts for the majority of the 150 new properties within the SOAEL.

12.2.19 New communities that would be within the assessment Phase 2b DS SOAEL night-time contour in comparison to the 2019 Consented Baseline are summarised in Table 12.11**.**

Table 12.11: Assessment Phase 2b 2043 New community areas that experience continuing exposure above the SOAEL

Location	Community area	Daytime / Night-time
To the west of the airport	The majority of the 150 properties on sections of London Road, West Hill Road, Tennyson Road, St Paul's Road, Harcourt Street, Cowper Street, Baker Street, Strathmore Avenue, Seymour Avenue, Seymour Road and Park Street.	Night-time only
To the east of the airport	A small number of properties to the north of St Paul's Walden – represented by AR31.	Night-time only

12.2.20 Significant adverse effects on health and quality of life due to continuing exposure above the SOAEL for the communities described above will be avoided by the noise insulation scheme (see Section 16.10 of **Chapter 16** of this ES **[TR020001/APP/5.01]**), which will prioritise these communities.

12.3 Slower Growth and Faster Growth

12.3.1 Noise predictions have been undertaken using the SG and FG fleets. Results of noise contour predictions for each SG and FG scenario are presented in Table 12.12 for daytime contours and Table 12.13 for night-time contours. 2027

~~D~~daytime and night-time FG noise contours are presented in Figure 16.91 and Figure 16.92 **[TR020001/APP/5.02]**. 2030 ~~D~~daytime and night-time SG noise contours are presented in Figure 16.93 and Figure 16.94 **[TR020001/APP/5.02]**.

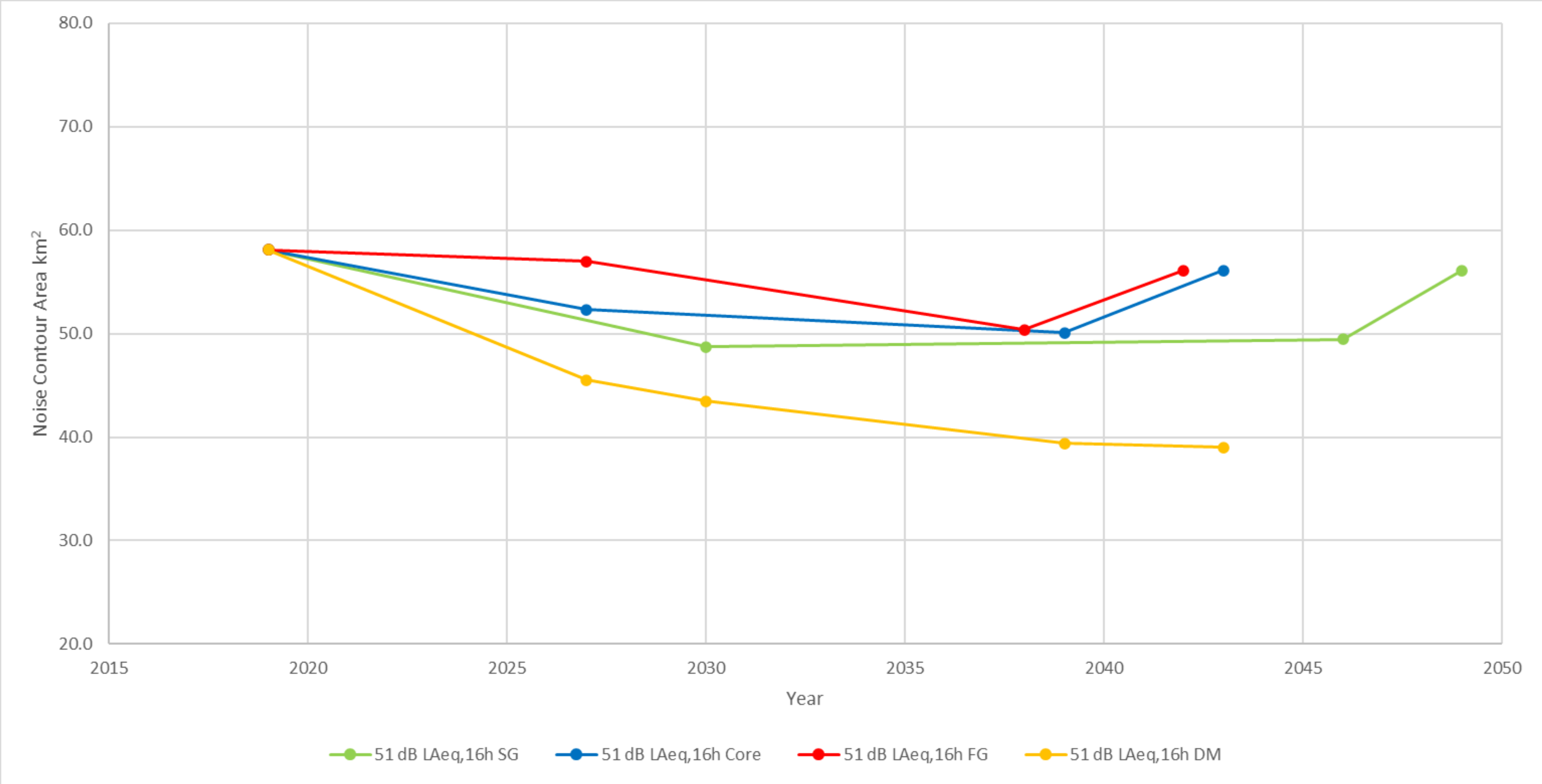
Table 12.12: Faster and Slower Growth Daytime Contour Areas

$L_{Aeq,16h}$dB Contour	Daytime Contour Areas km^2					
	2027 FG	2038 FG	2042 FG	2030 SG	2046 SG	2049 SG
51 (LOAEL)	**57.0**	**50.4**	**56.1**	**48.7**	**49.5**	**56.1**
54	33.6	29.0	32.6	28.3	28.2	32.6
57	18.3	15.3	17.4	14.9	14.7	17.4
60	9.0	7.5	8.6	7.3	7.2	8.6
63 (SOAEL)	**4.7**	**3.9**	**4.4**	**3.7**	**3.7**	**4.4**
66	2.2	1.8	2.1	1.7	1.8	2.1
69 (UAEL)	**1.2**	**1.1**	**1.2**	**1.0**	**1.0**	**1.2**

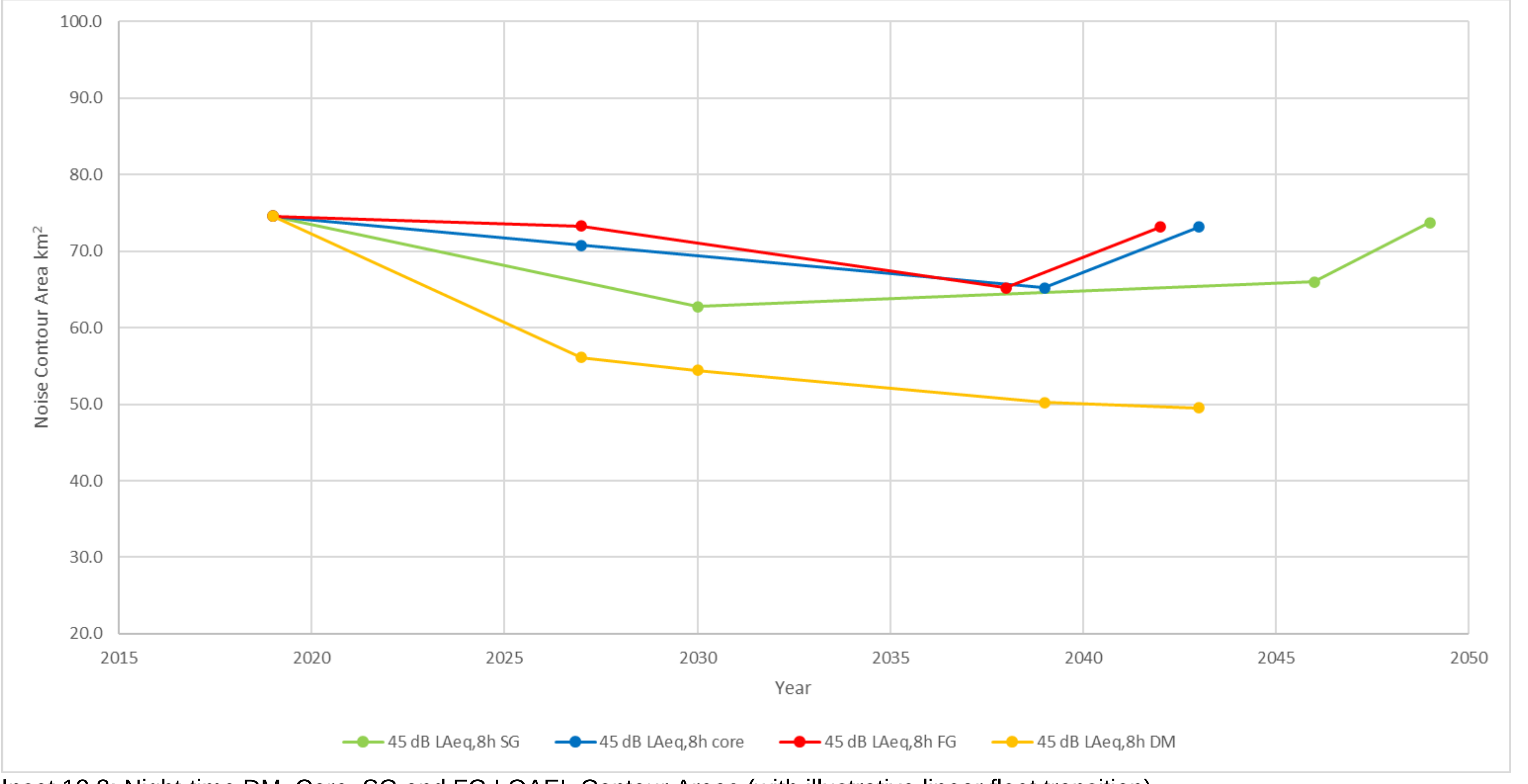
Table 12.13: Faster and Slower Growth Night-time Contour Areas

$L_{Aeq,8h}$dB Contour	Night-time Contour Areas km^2					
	2027 FG	2038 FG	2042 FG	2030 SG	2046 SG	2049 SG
45 (LOAEL)	**73.3**	**65.2**	**73.2**	**62.7**	**66.0**	**73.7**
48	43.8	37.8	43.2	36.8	38.4	43.6
51	25.3	21.1	24.0	20.4	20.9	24.2
54	13.2	10.6	12.4	10.4	10.5	12.3
55 (SOAEL)	**10.3**	**8.3**	**9.8**	**8.1**	**8.1**	**9.6**
57	6.6	5.2	6.0	5.2	5.2	5.9
60	3.3	2.5	3.0	2.5	2.5	3.0
63	1.6	1.3	1.4	1.3	1.3	1.4
66	1.0	0.8	0.8	0.8	0.8	0.8
69 (UAEL)	**0.6**	**0.5**	**0.6**	**0.5**	**0.5**	**0.6**

12.3.2 To provide an indication of how the slower growth and faster growth sensitivity tests affect the contour areas, the LOAEL for daytime and night-time have been plotted along with the core scenario. Daytime LOAEL noise contour areas are illustrated in Inset 12.1 for daytime LOAEL contours and Inset 12.2 for night-time LOAEL contours. The lines connecting each year are for illustrative purposes only and, in reality, fleet transition will not be linear.



Inset 12.1: Daytime DM, Core, SG and FG LOAEL Contour Areas (with illustrative linear fleet transition)



Inset 12.2: Night-time DM, Core, SG and FG LOAEL Contour Areas (with illustrative linear fleet transition)

12.3.3 The SG scenario reaches 21.5 mppa in 2030 when there is a higher proportion of new generation aircraft in the fleet. Consequently, noise contour areas are smaller than in the corresponding assessment Phase 1 core case scenario; however, as the 2030 DM contours are also smaller than the DM 2027 scenario for the core case, additional studies have been undertaken to identify if there would be any additional significant effects.

12.3.4 The SG scenario reaches 27 mppa in 2046 for assessment Phase 2a and 32 mppa in 2049 for assessment Phase 2b. As the contours areas are equivalent to the core case, just happening later, and the DM contour areas are unchanged from the core case, no additional significant effects are identified. Consequently, no additional studies have been undertaken of these scenarios.

12.3.5 The FG scenario reaches a higher assessment Phase 1 throughput of 23 mppa~~million passengers per annum~~ in 2027, then FG continues to grow to 27 mppa in 2038 for assessment Phase 2a and 32 mppa in 2042 for assessment Phase 2b. The 2027 faster growth scenario has a higher throughput than the 2027 core case scenario so noise contour areas are bigger. As such, there is potential for additional significant effects and testing of noise contour outputs has been undertaken.

12.3.6 The 2038 FG scenario is equivalent to the 2039 core case scenario and the 2042 FG scenario is equivalent to the 2043 core case scenario. Consequently, additional studies have not been undertaken for the assessment Phase 2a and assessment Phase 2b FG scenarios as results are equivalent to the core case results, albeit it they occur one year earlier.

12.4 Assessment Phase 1 2027 Faster Growth Assessment

12.4.1 The results of faster growth sensitivity testing for the assessment Phase 1 2027 FG scenario are presented in Table 12.14 to Table 12.16 for daytime noise and Table 12.17 to Table 12.19 for night-time noise. The geographic areas over which these changes occur for daytime and night-time are presented in Figure 16.97 and Figure 16.98 **[TR020001/APP/5.02]**.

Table 12.14: Assessment Phase 1 2027 FG Daytime Air Noise Analysis – Area

$L_{Aeq,16h}$dB Noise Contour	2027 DM Cumulative Area (km²)	2027 FG Cumulative Area (km²)	Change in Cumulative Area (km²)
51 (LOAEL)	**45.5**	**57.0**	**+11.5**
54	26.3	33.6	+7.3
57	13.7	18.3	+4.6
60	6.8	9.0	+2.2
63 (SOAEL)	**3.5**	**4.7**	**+1.2**
66	1.7	2.2	+0.5
69 (UAEL)	**1.0**	**1.2**	**+0.2**

Table 12.15: Assessment Phase 1 2027 FG Daytime Air Noise Analysis – Households

$L_{Aeq,16h}$dB Noise Contour	2027 DM Cumulative Number of Households	2027 FG Cumulative Number of Households	Change in Cumulative Number of Households
51 (LOAEL)	**13,250**	**19,300**	**+6,050**
54	6,450	8,850	+2,400
57	3,650	4,900	+1,250
60	800	1,700	+900
63 (SOAEL)	**50**	**400**	**+350**
66	0	<50	+<50
69 (UAEL)	**0**	**0**	**0**

Table 12.16: Assessment Phase 1 2027 FG Daytime Air Noise Analysis – Population

$L_{Aeq,16h}$dB Noise Contour	2027 DM Cumulative Number of Population	2027 FG Cumulative Number of Population	Change in Cumulative Number of Population
51 (LOAEL)	**25,050**	**38,450**	**+13,400**
54	12,700	17,550	+4,850
57	7,000	9,500	+2,500
60	2,100	3,400	+1,300
63 (SOAEL)	**50**	**1,000**	**+950**
66	0	0	0
69 (UAEL)	**0**	**0**	**0**

Table 12.17: Assessment Phase 1 2027 FG Night-time Air Noise Analysis – Area

$L_{Aeq,8h}$dB Noise Contour	2027 DM Cumulative Area (km^2)	2027 FG Cumulative Area (km^2)	Change in Cumulative Area (km^2)
45 (LOAEL)	**56.1**	**73.3**	**+17.2**
48	32.4	43.8	+11.4
51	17.6	25.3	+7.7
54	8.7	13.2	+4.5
55 (SOAEL)	**7.0**	**10.3**	**+3.3**
57	4.6	6.6	+2.0
60	2.2	3.3	+1.2
63 (UAEL)	**1.2**	**1.6**	**+0.4**

Table 12.18: Assessment Phase 1 2027 FG Night-time Air Noise Analysis – Households

$L_{Aeq,8h}$dB Noise Contour	2027 DM Cumulative Number of Households	2027 FG Cumulative Number of Households	Change in Cumulative Number of Households
45 (LOAEL)	**20,150**	**28,950**	**+8,800**
48	8,400	12,650	+4,250
51	4,650	6,300	+1,650
54	1,600	3,450	+1,850
55 (SOAEL)	**950**	**2,350**	**+1,400**
57	300	800	+500
60	0	<50	+<50
63 (UAEL)	**0**	**0**	**0**

Table 12.19: Assessment Phase 1 2027 FG Night-time Air Noise Analysis – Population

$L_{Aeq,8h}$dB Noise Contour	2027 DM Cumulative Number of Population	2027 FG Cumulative Number of Population	Change in Cumulative Number of Population
45 (LOAEL)	**40,450**	**59,500**	**+19,050**
48	16,700	24,150	+7,450
51	8,950	12,400	+3,450
54	3,100	6,650	+3,550
55 (SOAEL)	**2,100**	**4,250**	**+2,150**
57	700	2,000	+1,300
60	0	50	+50
63 (UAEL)	**0**	**0**	**0**

12.4.2 The results of noise predictions undertaken for 2027 DM and 2027 FG scenarios are presented in Table 12.20. The results are presented for the daytime $L_{Aeq,16h}$ period from 07:00 to 23:00 and the night-time $L_{Aeq,8h}$ from 23:00 to 07:00. Receptors experiencing exceedance of the SOAEL in the 2027 FG scenario are marked in red and receptors in the 2027 FG scenario experiencing exceedances of the LOAEL are marked in orange.

Table 12.20: Assessment Phase 1 2027 FG 92-day Summer Average Aircraft Noise Prediction Result

Receptor ID	2027 DM $L_{Aeq,16h}$dB	2027 FG $L_{Aeq,16h}$dB	Change in $L_{Aeq,16h}$dB	2027 DM $L_{Aeq,8h}$dB	2027 FG $L_{Aeq,8h}$dB	Change in $L_{Aeq,8h}$dB
AR1	60.2	61.3	+1.1	55.1	56.6	+1.6
AR2	61.5	62.7	+1.2	56.9	58.4	+1.5
AR3	49.0	50.3	+1.3	44.3	45.7	+1.5
AR4	54.5	55.8	+1.3	49.6	51.3	+1.7
AR5	60.6	61.8	+1.2	56.1	57.4	+1.3
AR7	48.0	49.4	+1.3	43.1	45.0	+2.0
AR8	43.7	45.0	+1.2	39.2	40.5	+1.2
AR9	54.3	55.6	+1.3	49.0	51.1	+2.1
AR10	46.9	48.1	+1.3	42.2	43.8	+1.6
AR11	54.7	56.0	+1.3	49.9	51.6	+1.7
AR12	58.2	59.5	+1.3	52.9	55.0	+2.1
AR13	61.9	63.1	+1.3	56.9	58.7	+1.8
AR14	48.7	49.9	+1.2	43.8	45.4	+1.7
AR15	47.5	48.7	+1.2	42.6	44.3	+1.7
AR16	49.3	50.5	+1.3	44.3	46.1	+1.9
AR17	50.1	51.3	+1.2	45.8	46.9	+1.2
AR18	45.9	47.2	+1.3	41.4	42.7	+1.3
AR19	49.8	51.1	+1.3	44.5	46.5	+2.0
AR20	47.4	48.8	+1.4	42.2	44.1	+1.9
AR21	41.7	43.0	+1.3	36.8	38.7	+1.9
AR22	44.8	46.1	+1.2	40.5	41.7	+1.2
AR30	40.0	41.1	+1.1	35.6	36.8	+1.2
AR31	52.6	53.9	+1.3	47.9	49.4	+1.5
AR32	57.6	58.9	+1.3	52.5	54.4	+1.9
AR33	52.1	53.5	+1.3	47.1	49.0	+1.9
AR34	48.1	49.4	+1.3	43.2	45.1	+1.9
AR35	50.1	51.3	+1.2	45.3	47.0	+1.7
AR36	44.8	46.1	+1.3	40.0	41.8	+1.8
AR37	58.4	59.7	+1.3	53.8	55.3	+1.5
AR38	53.3	54.5	+1.2	48.9	50.2	+1.3
AR39	56.9	58.3	+1.3	51.7	53.8	+2.1
AR40	63.8	65.1	+1.3	58.9	60.6	+1.8

12.4.3 A summary of population within the LOAEL, SOAEL and UAEL contours is provided in Table 12.21 for the 2019 ~~a~~Actuals ~~b~~Baseline, the DM and the FG scenarios.

Table 12.21: Assessment Phase 1 2027 FG Summary of population within the Air Noise LOAEL, SOAEL and UAEL contours

Noise exposure	Total Population				
	2019 Actuals Baseline	2027 DM	2027 FG	Change FG – 2019 Actuals Baseline	Change FG - DM
Daytime					
Above LOAEL and below SOAEL	39,350	25,000	37,450	-1,900	+12,450
Above SOAEL and below UAEL	1,650	50	1,000	-650	+950
Newly above the SOAEL in 2027 FG compared to the 2019 Actuals Baseline			0		
Above UAEL	0	0	0	0	0
Night-time					
Above LOAEL and below SOAEL	62,850	38,350	55,250	-7,600	+16,900
Above SOAEL and below UAEL	4,950	2,100	4,250	-700	+2,150
Newly above the SOAEL in 2027 FG compared to the 2019 Actuals Baseline			0		
Above UAEL	0	0	0	0	0

12.4.4 Table 12.21 demonstrates that there is a reduction in the total population exposed above the LOAEL and above the SOAEL in the 2027 FG scenario compared to the 2019 Actuals Baseline. This reduction in total population exposed is due to a reduction in contour areas as a result of new-generation aircraft entering the fleet. There are no receptors in the study area exposed to noise levels above the UAEL in any assessment scenario.

12.4.5 Significant adverse effects on health and quality of life in noise policy terms are determined by noise exposure above the SOAEL as defined in Table 7.2. During the daytime and night-time, the population exposed to noise levels above the SOAEL in the 2027 FG scenario are also exposed to noise levels above the SOAEL in the 2019 Actuals Baseline. Therefore, there are no new significant adverse effects on health of quality life during the daytime or night-time in assessment Phase 1.

12.4.6 Adverse likely significant effects in EIA terms are determined by noise change from DM to DS and the resulting DS noise exposure. Table 12.22 provides a summary of the population experiencing changes in noise using the criteria outlined in Table 7.3. The geographic areas over which these changes occur for daytime and night-time are presented in Figure 16.17 and Figure 16.18 of this ES **[TR020001/APP/5.03]**.

Table 12.22: Assessment Phase 1 2027 FG Summary of FG-DM noise change

Significance of effect	Noise increase (FG-DM)	Population experiencing change	
		Day	Night
2027 FG noise above LOAEL and below SOAEL			
Negligible	0.1 - 0.9dB	0	0
	1.1 - 1.9dB	34,350	55,250
Minor	2.0 - 2.9dB	4,100	0
Moderate	3.0 - 5.9dB	0	0
Major	6.0dB or more	0	0
2027 FG noise above SOAEL and below UAEL			
Negligible	0.1 - 0.9dB	0	0
Minor	1.0 - 1.9dB	950	4,250
Moderate	2.0 - 3.9dB	50	0
Major	4.0dB or more	0	0
2027 FG noise above UAEL			
Unacceptable	0.1dB or more	0	0

12.4.7 No receptors within the study area experience a decrease in air noise between the DM and the 2027 FG scenario. The increase in air noise from the DM to the DS scenarios during the daytime period is due to an increase in commercial flights (freight and general aviation movements are unchanged) of approximately 24%. The total increase in aircraft movements during the daytime period is forecast to be approximately 18%.

12.4.8 The increase in air noise during the night-time period is due to an increase in commercial flights (freight and general aviation movements are unchanged) of approximately of 34%. The total increase in aircraft movements during the night-time period is forecast to be approximately 30%. Due to restrictions on movements during the night quota period (from 23:30 to 06:00) the increase in movements during the night-time period will mostly occur in the periods from

06:00 to 07:00 and 23:00 to 23:30. These restrictions will be retained in future as a requirement to the DCO.

12.4.9 During the daytime, the population of 38,450 exposed to noise between the LOAEL and SOAEL experience noise increases of less than 3dB corresponding to a **negligible** to **minor** adverse effect which is **not significant**. Of the population of 1,000 exposed to noise between the SOAEL and UAEL, 950 experience noise increases of less than 2dB corresponding to a **minor** adverse effect which is **significant**. The remaining population of 50 experience noise increases of less than 3dB corresponding to a **moderate** adverse effect which is **significant**.

12.4.10 During the night-time, the population of 52,250 exposed to noise between the LOAEL and SOAEL experience noise increases of less than 3dB corresponding to a **negligible** to **minor** adverse effect which is **not significant**. The population of 4,250 exposed to noise between the SOAEL and UAEL experience noise increases of less than 2dB corresponding to a **minor** adverse effect which is **significant**.

12.5 Assessment Phase 1 2030 Slower Growth Assessment

12.5.1 The results of slower growth sensitivity testing for the assessment Phase 1 2030 SG scenario are presented in Table 12.23 to Table 12.25 for daytime noise and Table 12.26 to Table 12.28 for night-time noise. The geographic areas over which these changes occur for daytime and night-time are presented in Figure 16.99 and Figure 16.100 **[TR020001/APP/5.02]**.

Table 12.23: Assessment Phase 1 2030 SG Daytime Air Noise Analysis – Area

$L_{Aeq,16h}$dB Noise Contour	2030 DM Cumulative Area (km^2)	2030 SG Cumulative Area (km^2)	Change in Cumulative Area (km^2)
51 (LOAEL)	**43.5**	**48.7**	**+5.2**
54	24.9	28.3	+3.4
57	12.8	14.9	+2.1
60	6.3	7.3	+1.0
63 (SOAEL)	**3.2**	**3.7**	**+0.5**
66	1.5	1.7	+0.2
69 (UAEL)	**0.9**	**1.0**	**+0.1**

Table 12.24: Assessment Phase 1 2030 SG Daytime Air Noise Analysis – Households

$L_{Aeq,16h}$dB Noise Contour	2030 DM Cumulative Number of Households	2030 SG Cumulative Number of Households	Change in Cumulative Number of Households
51 (LOAEL)	**11,800**	**14,800**	**+3,000**
54	6,150	6,900	+750

$L_{Aeq,16h}$dB Noise Contour	2030 DM Cumulative Number of Households	2030 SG Cumulative Number of Households	Change in Cumulative Number of Households
57	2,950	3,900	+950
60	700	1,000	+300
63 (SOAEL)	**<50**	**100**	**<100**
66	0	0	0
69 (UAEL)	**0**	**0**	**0**

Table 12.25: Assessment Phase 1 2030 SG Daytime Air Noise Analysis – Population

$L_{Aeq,16h}$dB Noise Contour	2030 DM Cumulative Number of Population	2030 SG Cumulative Number of Population	Change in Cumulative Number of Population
51 (LOAEL)	**22,800**	**28,150**	**+5,350**
54	12,100	13,650	+1,550
57	5,650	7,400	+1,750
60	1,800	2,300	+500
63 (SOAEL)	**50**	**200**	**+150**
66	0	0	0
69 (UAEL)	**0**	**0**	**0**

Table 12.26: Assessment Phase 1 2030 SG Night-time Air Noise Analysis – Area

$L_{Aeq,8h}$dB Noise Contour	2030 DM Cumulative Area (km²)	2030 SG Cumulative Area (km²)	Change in Cumulative Area (km²)
45 (LOAEL)	**54.4**	**62.7**	**+8.3**
48	31.3	36.8	+5.5
51	16.7	20.4	+3.7
54	8.1	10.4	+2.3
55 (SOAEL)	**6.4**	**8.1**	**+1.7**
57	4.1	5.2	+0.9
60	1.9	2.5	+0.6
63 (UAEL)	**1.1**	**1.3**	**+0.2**
66	0.7	0.8	+0.1
69	0.5	0.5	0.0

Table 12.27: Assessment Phase 1 2030 SG Night-time Air Noise Analysis – Households

$L_{Aeq,8h}$dB Noise Contour	2030 DM Cumulative Number of Households	2030 SG Cumulative Number of Households	Change in Cumulative Number of Households
45 (LOAEL)	**19,200**	**23,100**	**+2,900**
48	7,750	9,700	+1,950
51	4,300	5,400	+1,100
54	1,250	2,200	+950
55 (SOAEL)	**750**	**1,400**	**+650**
57	150	450	+300
60	**<50**	**<50**	**<50**
63 (UAEL)	0	0	0
66	0	0	0
69	0	0	0

Table 12.28: Assessment Phase 1 2030 SG Night-time Air Noise Analysis – Population

$L_{Aeq,8h}$dB Noise Contour	2030 DM Cumulative Number of Population	2030 SG Cumulative Number of Population	Change in Cumulative Number of Population
45 (LOAEL)	**38,400**	**47,050**	**+8,650**
48	15,450	19,250	+3,700
51	8,200	10,450	+2,250
54	2,600	3,950	+1,350
55 (SOAEL)	**1,850**	**2,700**	**+850**
57	400	1,100	+700
60	**>50**	**>50**	**>50**
63 (UAEL)	0	0	0
66	0	0	0
69	0	0	0

12.5.2 The results of noise predictions undertaken for 2030 DM and 2030 SG scenarios are presented in Table 12.29. The results are presented for the daytime $L_{Aeq,16h}$ period from 07:00 to 23:00 and the night-time $L_{Aeq,8h}$ from 23:00 to 07:00. Receptors experiencing exceedance of the SOAEL in the 2030 SG scenario are marked in red and receptors in the 2030 SG scenario experiencing exceedances of the LOAEL are marked in orange.

Table 12.29: Assessment Phase 1 2030 SG 92-day Summer Average Aircraft Noise Prediction Result

Receptor ID	2030 DM $L_{Aeq,16h}$dB	2030 SG $L_{Aeq,16h}$dB	Change in $L_{Aeq,16h}$dB	2030 DM $L_{Aeq,8h}$dB	2030 SG $L_{Aeq,8h}$dB	Change in $L_{Aeq,8h}$dB
AR1	59.9	60.4	+0.5	54.0	55.7	+1.7
AR2	61.3	61.9	+0.6	56.7	57.5	+0.8
AR3	49.0	49.6	+0.6	44.4	45.0	+0.6
AR4	54.1	54.8	+0.7	49.4	50.4	+1.0
AR5	60.5	61.2	+0.7	56.0	56.8	+0.8
AR7	47.5	48.2	+0.7	42.5	43.7	+1.2
AR8	43.4	44.1	+0.7	39.1	39.7	+0.6
AR9	53.7	54.4	+0.7	48.8	49.7	+0.9
AR10	46.6	47.3	+0.7	42.2	43.0	+0.8
AR11	54.4	55.1	+0.7	49.7	50.6	+0.9
AR12	57.6	58.3	+0.7	52.7	53.6	+0.9
AR13	61.4	62.1	+0.7	56.5	57.5	+1.0
AR14	48.3	48.9	+0.6	42.7	44.4	+1.7
AR15	47.0	47.6	+0.6	41.6	43.1	+1.5
AR16	48.5	49.2	+0.7	43.2	44.6	+1.4
AR17	50.2	50.9	+0.7	46.0	46.5	+0.5
AR18	45.7	46.3	+0.6	41.5	41.9	+0.4
AR19	49.6	50.2	+0.6	44.5	45.4	+0.9
AR20	47.3	47.8	+0.5	42.1	43.0	+0.9
AR21	41.2	41.9	+0.7	36.7	37.5	+0.8
AR22	44.6	45.2	+0.6	40.5	41.0	+0.5
AR30	39.7	40.3	+0.6	35.4	36.0	+0.6
AR31	52.5	53.1	+0.6	47.9	48.6	+0.7
AR32	57.1	57.8	+0.7	52.2	53.2	+1.0
AR33	51.6	52.3	+0.7	46.7	47.8	+1.1
AR34	47.5	48.3	+0.8	42.8	43.8	+1.0
AR35	49.7	50.3	+0.6	44.4	45.9	+1.5
AR36	44.1	44.8	+0.7	39.0	40.4	+1.4
AR37	58.2	58.9	+0.7	53.6	54.5	+0.9
AR38	53.3	53.9	+0.6	48.9	49.6	+0.7
AR39	56.4	57.1	+0.7	51.5	52.4	+0.9
AR40	63.3	64.0	+0.7	58.5	59.4	+0.9

12.5.3 A summary of population within the LOAEL, SOAEL and UAEL contours is provided in Table 12.30 for the 2019 ~~a~~Actuals ~~b~~Baseline, the DM and the SG scenarios.

Table 12.30: Assessment Phase 1 2030 SG Summary of population within the Air Noise LOAEL, SOAEL and UAEL contours

Noise exposure	Total Population				
	2019 Actuals Baseline	2030 DM	2030 SG	Change SG – 2019 Actuals Baseline	Change SG - DM
Daytime					
Above LOAEL and below SOAEL	39,350	22,750	27,950	-11,400	-5,200
Above SOAEL and below UAEL	1,650	50	200	-1,450	+150
Newly above the SOAEL in 2030 SG compared to the 2019 Actuals Baseline			0		
Above UAEL	0	0	0	0	0
Night-time					
Above LOAEL and below SOAEL	62,850	36,550	44,350	-18,500	+7,800
Above SOAEL and below UAEL	4,950	1,850	2,700	-2,250	+850
Newly above the SOAEL in 203 SG compared to the 2019 Actuals Baseline			0		
Above UAEL	0	0	0	0	0

12.5.4 Table 12.30 demonstrates that there is a reduction in the total population exposed above the LOAEL and above the SOAEL in the 2030 SG scenario compared to the 2019 Actuals Baseline. This reduction in total population exposed is due to a reduction in contour areas as a result of new-generation aircraft entering the fleet. There are no receptors in the study area exposed to noise levels above the UAEL in any assessment scenario.

12.5.5 Significant adverse effects on health and quality of life in noise policy terms are determined by noise exposure above the SOAEL as defined in Table 7.2. During the daytime and night-time, the population exposed to noise levels above the SOAEL in the 2030 SG scenario are also exposed to noise levels above the SOAEL in the 2019 Actuals Baseline. Therefore, there are no new significant adverse effects on health of quality life during the daytime or night-time in assessment Phase 1.

12.5.6 Adverse likely significant effects in EIA terms are determined by noise change from 2030 DM to SG and the resulting SG noise exposure. Table 12.31 provides a summary of the population experiencing changes in noise using the criteria outlined in Table 7.3. The geographic areas over which these changes occur for daytime and night-time are presented in Figure 16.93 and Figure 16.94 of this ES **[TR020001/APP/5.03]**.

Table 12.31: Assessment Phase 1 2030 SG Summary of DS-DM noise change

Significance of effect	Noise increase (SG-DM)	Population experiencing change	
		Day	Night
2030 SG noise above LOAEL and below SOAEL			
Negligible	0.1 - 1.9dB	11,050	44,350
	1.1 - 1.9dB	17,300	0
Minor	2.0 - 2.9dB	0	0
Moderate	3.0 - 5.9dB	0	0
Major	6.0dB or more	0	0
2030 SG noise above SOAEL and below UAEL			
Negligible	0.1 - 0.9dB	200	2,700
Minor	1.0 - 1.9dB	0	0
Moderate	2.0 - 3.9dB	0	0
Major	4.0dB or more	0	0
2030 SG noise above UAEL			
Unacceptable	0.1dB or more	0	0

12.5.7 No receptors within the study area experience a decrease in air noise between the 2030 DM and the 2030 SG scenario. The increase in air noise from the DM to the SG scenarios during the daytime period is due to an increase in commercial flights (freight and general aviation movements are unchanged) of approximately 15%. The total increase in aircraft movements during the daytime period is forecast to be approximately 11%.

12.5.8 The increase in air noise during the night-time period is due to an increase in commercial flights (freight and general aviation movements are unchanged) of approximately of 29%. The total increase in aircraft movements during the night-time period is forecast to be approximately 26%. Due to restrictions on movements during the night quota period (from 23:30 to 06:00) the increase in movements during the night-time period will mostly occur in the periods from

06:00 to 07:00 and 23:00 to 23:30. These restrictions will be retained in future as a requirement to the DCO.

12.5.9 During the daytime, the population of 28,350 exposed to noise between the LOAEL and SOAEL experience noise increases of less than 3dB corresponding to a **negligible** to **minor** adverse effect which is **not significant**. The population of 200 exposed to noise between the SOAEL and UAEL experience noise increases of less than 2dB corresponding to a **minor** adverse effect which is **not significant**.

12.5.10 During the night-time, the population of 43,350 exposed to noise between the LOAEL and SOAEL experience noise increases of less than 3dB corresponding to a **negligible** to **minor** adverse effect which is **not significant**. The population of 2,700 exposed to noise between the SOAEL and UAEL experience noise increases of less than 2dB corresponding to a **minor** adverse effect which is **not significant**.

12.6 Next Generation Aircraft in Future Years

12.6.1 'Next generation' aircraft are aircraft that will utilise future technologies (which includes sustainable aviation fuel, hydrogen and electric) that are currently in development. The 'next generation' aircraft that are expected to start to become available in the mid-2030s (and the subsequent generation expected after that in the 2050s) do not yet exist and their noise performance is unknown.

12.6.2 Information in the ICAO report on Environmental Trends in Aviation to 2050 (Ref. 47), ~~predicts~~ presents sensitivity tests assuming a decrease in next generation aircraft noise levels ranging from 0.1 ~~T~~to 0.3 EPNdB per year as a result of next generation aircraft. Assuming the average reduction of 0.2 ENPdB per year and, all things being relative, this reduction can be assumed as applicable to the sound pressure level~~. O~~, over a period of 12-years from 2027 to 2039, next generation aircraft would result in a 2.4dB noise reduction.

12.6.3 When accounting for the fact that reductions in aircraft noise tend to be biased towards departure noise (dominated by the engine) rather than~~t~~ approach noise (airframe and engine noise), it is considered reasonable to look at how typical noise levels have~~s~~ improved in the transition from current generation aircraft to new generation aircraft. The step from current generation to new generation aircraft showed an approximate improvement of 1dB for arrivals and 4dB for departures. As this change is approximately an average of 2.5dB it was considered reasonable to apply this improvement to next generation aircraft. Consequently, next generation aircraft have been modelled assuming next generation will reduce aircraft noise by a similar level to that provided by new generation aircraft. For example,~~, i.e.~~ departure noise reduces by 4dB and approach noise reduces by 1dB.

12.6.4 The results of sensitivity testing of potential reductions in noise contour area due to next generation aircraft are presented in Table 12.32 and Table 12.33 for the assessment Phase 2a 2039 scenario and Table 12.34 and Table 12.35 for the assessment Phase 2b 2043 scenario. These tables show how noise levels may reduce in assessment Phase 2a and assessment Phase 2b as a result of next generation aircraft compared to the Core Case.

Table 12.32: Next Generation Aircraft Testing – Assessment Phase 2a 2039 Daytime Air Noise Analysis Against Core Case

$L_{Aeq,16h}$dB Noise Contour	2039 DS Core Case Cumulative Area (km^2)	2039 DS Next Generation Cumulative Area (km^2)	Change in Cumulative Area (km^2)
51 (LOAEL)	**50.1**	**48.2**	**-1.9**
54	28.8	27.5	-1.3
57	15.2	14.5	-0.7
60	7.4	7.1	-0.3
63 (SOAEL)	**3.8**	**3.6**	**-0.2**
66	1.8	1.7	-0.1
69 (UAEL)	**1.0**	**1.0**	**0.0**

Table 12.33: Next Generation Aircraft Testing – Assessment Phase 2a 2039 Night-time Air Noise Analysis Against Core Case

$L_{Aeq,8h}$dB Noise Contour	2039 DS Core Case Cumulative Area (km^2)	2039 Next Generation Cumulative Area (km^2)	Change in Cumulative Area (km^2)
45 (LOAEL)	**65.2**	**64.7**	**-0.5**
48	37.8	37.4	-0.4
51	21.1	20.8	-0.3
54	10.6	10.5	-0.1
55 (SOAEL)	**8.3**	**8.2**	**-0.1**
57	5.2	5.2	0.0
60	2.5	2.5	0.0
63 (UAEL)	**1.3**	**1.3**	**0.0**

Table 12.34: Next Generation Aircraft Testing – Assessment Phase 2b 2043 Daytime Air Noise Analysis – Area

$L_{Aeq,16h}$dB Noise Contour	2043 DS Core Case Cumulative Area (km^2)	2043 Next Generation Cumulative Area (km^2)	Change in Cumulative Area (km^2)
51 (LOAEL)	**56.1**	**48.6**	**-7.5**
54	32.6	27.5	-5.1
57	17.4	14.4	-3.0

$L_{Aeq,16h}$dB Noise Contour	2043 DS Core Case Cumulative Area (km²)	2043 Next Generation Cumulative Area (km²)	Change in Cumulative Area (km²)
60	8.6	7.0	-1.6
63 (SOAEL)	**4.4**	**3.6**	**-0.8**
66	2.1	1.7	-0.4
69 (UAEL)	**1.2**	**1.0**	**-0.2**

Table 12.35: Next Generation Aircraft Testing – Assessment Phase 2b 2043 Night-time Air Noise Analysis – Area

$L_{Aeq,8h}$dB Noise Contour	2043 DS Core Case Cumulative Area (km²)	2043 Next Generation Cumulative Area (km²)	Change in Cumulative Area (km²)
45 (LOAEL)	**73.2**	**65.4**	**-6.9**
48	43.2	37.3	-5.9
51	24.0	20.5	-3.5
54	12.4	10.4	-2.0
55 (SOAEL)	**9.8**	**8.3**	**-1.5**
57	6.0	5.0	-1.0
60	3.0	2.5	-0.5
63 (UAEL)	**1.4**	**1.2**	**-0.2**

12.6.5 Analysis to show how the change in contour area between the DM and DS next generation sensitivity test scenarios would be affected is presented in Table 12.36 to Table 12.39.

Table 12.36: Next Generation Aircraft Testing – Assessment Phase 2a 2039 Daytime Air Noise Analysis Against DM Next Generation Case

$L_{Aeq,16h}$dB Noise Contour	2039 DM Next Generation Cumulative Area (km²)	2039 DS Next Generation Cumulative Area (km²)	Change in Cumulative Area (km²)
51 (LOAEL)	**38.0**	**50.1**	**+12.1**
54	21.0	28.8	+7.8
57	10.8	15.2	+4.4
60	5.4	7.4	+2.0
63 (SOAEL)	**2.6**	**3.8**	**+1.2**
66	1.4	1.8	+0.4
69 (UAEL)	**0.8**	**1.0**	**+0.2**

Table 12.37: Next Generation Aircraft Testing – Assessment Phase 2a 2039 Night-time Air Noise Analysis Against DM Next Generation Case

$L_{Aeq,8h}$dB Noise Contour	2039 DM Next Generation Cumulative Area (km^2)	2039 DS Next Generation Cumulative Area (km^2)	Change in Cumulative Area (km^2)
45 (LOAEL)	**49.6**	**64.7**	**+15.1**
48	28.1	37.4	+9.3
51	14.8	20.8	+6.0
54	7.4	10.5	+3.1
55 (SOAEL)	**5.9**	**8.2**	**+2.3**
57	3.7	5.2	+1.5
60	1.9	2.5	+0.6
63 (UAEL)	**1.0**	**1.3**	**+0.3**

Table 12.38: Next Generation Aircraft Testing – Assessment Phase 2a 2043 Daytime Air Noise Analysis Against DM Next Generation Case

$L_{Aeq,16h}$dB Noise Contour	2043 DM Next Generation Cumulative Area (km^2)	2043 DS Next Generation Cumulative Area (km^2)	Change in Cumulative Area (km^2)
51 (LOAEL)	**38.0**	**50.1**	**+12.1**
54	21.0	28.8	+7.8
57	10.8	15.2	+4.4
60	5.4	7.4	+2.0
63 (SOAEL)	**2.6**	**3.8**	**+1.2**
66	1.4	1.8	+0.4
69 (UAEL)	**0.8**	**1.0**	**+0.2**

Table 12.39: Next Generation Aircraft Testing – Assessment Phase 2a 2043 Night-time Air Noise Analysis Against DM Next Generation Case

$L_{Aeq,8h}$dB Noise Contour	2043 DM Next Generation Cumulative Area (km^2)	2043 DS Next Generation Cumulative Area (km^2)	Change in Cumulative Area (km^2)
45 (LOAEL)	**49.6**	**64.7**	**+15.1**
48	28.1	37.4	+9.3
51	14.8	20.8	+6.0
54	7.4	10.5	+3.1

$L_{Aeq,8h}$dB Noise Contour	2043 DM Next Generation Cumulative Area (km^2)	2043 DS Next Generation Cumulative Area (km^2)	Change in Cumulative Area (km^2)
55 (SOAEL)	**5.9**	**8.2**	**+2.3**
57	3.7	5.2	+1.5
60	1.9	2.5	+0.6
63 (UAEL)	**1.0**	**1.3**	**+0.3**

12.7 Potential Changes to Air Space

12.7.1 A sensitivity test of potential changes to airspace has been undertaken. Changes ~~are~~ being made to arrival routes to the airport, through an airspace change known as AD6 were completed on 8 March 2022 and do not affect noise contour areas; however, there may be changes to departure paths in the future that may affect the shape of noise contours.

12.7.2 As the airspace design is in the initial option appraisal stage, only a series of options for airspace change have been submitted to date.~~,~~ ~~t~~The sensitivity test looks to identify how noise contour~~s~~ areas may be affected if options that may result in a change to contour shape are brought forward. Consequently, the sensitivity test is based on an airspace design option that provides the biggest change to the existing flight paths through provision of respite departure routes.

12.7.3 As the airspace change process is still ongoing and will provide an assessment of potential noise impacts as part of the consultation process, a detailed analysis of noise effects has not been undertaken. The sensitivity test aims to demonstrate that airspace changes can be accommodated within the DCO Noise Envelope. Consequently, the assessment only seeks to show how noise contour areas may change as a result of potential changes to departure paths at the noise contour noise limit level of 54dB $L_{Aeq,16h}$ and 48dB $L_{Aeq,8h}$ defined in the **Green Controlled Growth Explanatory Note [TR020001/APP/7.07]** ~~document~~.

12.7.4 As the DS 2043 scenario represents a worst-case in terms of noise impacts, it has been used to assess potential changes to airspace. The results of noise predictions of airspace changes showing the change in contour area in the DS 2043 scenario due to potential air space changes are presented in Table 12.40.

Table 12.40: Assessment Phase 2b DS 2043 Contour Area Changes due to potential Airspace Changes

Noise Contour	Percentage Change in Daytime Noise Contour Area	Percentage Change in Night-time Noise contour Area
48dB $L_{Aeq,8h}$		-2%
54dB $L_{Aeq,16h}$	-6%	

12.7.5 The sensitivity test of potential changes to airspace indicates that there is a reduction in 54dB $L_{Aeq,16h}$ and 48dB $L_{Aeq,8h}$ noise contour~~s~~ areas. The result of the sensitivity test provides confidence that airspace changes can be accommodated within the DCO Noise Envelope.

13 COMMITTED DEVELOPMENT ASSESSMENT

13.1.1 This section provides an assessment of changes in aircraft noise at committed developments identified in **Chapter 21** In-Combination and Cumulative Effects of this ES **[TR020001/APP/5.01].**

13.1.2 Committed developments identified that are located in the LOAEL for any assessment scenario are listed in Table 13.1 along with whether they are residential or non-residential developments.

Table 13.1: Committed Developments

ID	Development	Residential/ Non-residential
28	Airport Way - Century Park Luton Bedfordshire	Non-residential
36	St Nicholas House 15 - 17 George Street Luton LU1 2AF	Non-residential
46	181 - 193 Park Street Luton LU1 3HQ	Residential
47	Land And Buildings R/o 48- 72 Seymour Road ~~A~~and 2-12 Seymour Avenue Luton, LU1 3NR	Residential
49	27-37 Chapel Street Luton LU1 5DA	Residential
51	Former Honda Site Cumberland Street Luton LU1 3BW	Residential
62	Courtyard By Marriott London Luton Airport Airport Way Luton LU2 9LF	Residential
67	Hayward Tyler 1 Kimpton Road Luton LU1 3LD	Residential
68	1-11 Cumberland Street	Residential
69	Power Court Luton Bedfordshire	Residential
70	Land Adjacent Junction 10 To 10A M1 Newlands Road (North Site) Luton Bedfordshire	Non-residential
72	Prudence Place Proctor Way Luton LU2 9PE	Residential
75	Land Adjacent Junction 10 To 10A M1 Newlands Road (South Site) Luton Bedfordshire	Residential
76	Bute Street Shoppers Car Park Church Street Luton	Residential
78	Petrol Filling Station 91 Eaton Green Road Luton LU2 9HD	Non-residential
79	Prologis Park Griffin House And 60 Windmill Road Luton LU1 3X	Non-residential
81	Land Opposite Whitbread House Flowers Way Luton	Residential
82	Car Park Adjacent 1 To 11 Cumberland Street Luton	Residential
83	Land ~~T~~to ~~T~~the ~~R~~rear ~~O~~of Luton Retail Park Kimpton Road Luton LU2 0SX	Residential
91	Land South ~~A~~and North West ~~O~~of Cockernhoe ~~A~~and East ~~O~~of Wigmore (Stubbocks Walk) Brick Kiln Lane Cockernhoe	Residential
109	Land East of Stevenage Gresley Way Stevenage	Residential

13.1.3 Noise criteria in Table 16.19 of **Chapter 16** of the ES **[TR020001/APP/5.01]** identifies assessment criteria for non-residential developments, of a change in noise exposure of greater than 3dB. This criterion is considered applicable to non-residential committed development.

13.1.4 For new residential receptors, it is assumed that buildings will be designed to achieve appropriate internal noise levels such as those set out in BS 8233 (~~Ref.~~ 3846). Assumed internal noise performance standards for new residential development are summarised in Table 13.2. Professional Practice Guidance (~~Ref.~~ 2235) allows some flexibility with reference to individual noise events by stating that the 45dB L_{AFmax} night-time noise threshold should not normally be exceeded more than 10 times a night.

Table 13.2 Target Indoor Ambient Noise Levels

Activity	Location	Daytime (07:00-23:00)	Night-time (23:00-07:00)
Resting	Living Room	35dB $L_{Aeq,16h}$	
Sleeping	Bedroom	35dB $L_{Aeq,16h}$	30dB $L_{Aeq,8h}$ Exceedances of 45dB L_{AFmax} no more than 10-15 times per night

13.1.5 As acoustic attenuation strategies for new developments will be based on existing noise levels, a comparison of the DS 2043 scenario (the worst-case) has been made with the 2019 Baseline Actuals to determine if sound attenuation will be appropriate should the Proposed Development~~roject~~ be consented. The comparison shows the change in noise from the $L_{Aeq,16h}$ (Table 13.3), $L_{Aeq,8h}$ (Table 13.4) and N60 (Table 13.5) noise metrics.

Table 13.3 Change in $L_{Aeq,16h}$ Air Noise Affecting Committed Developments

ID	2019 Actuals Baseline $L_{Aeq,16h}$dB	DS 2043 $L_{Aeq,16h}$dB	ChangedB
28	60.1	58.3	-1.8
36	62.2	60.5	-1.8
46	54.8	52.8	-2.1
47	56.5	54.5	-2.0
49	68.2	66.8	-1.4
51	59.1	57.3	-1.8
62	56.7	54.8	-2.0
67	53.1	51.1	-2.0
68	62.3	60.5	-1.8
69	61.9	60.7	-1.3
70	61.4	59.8	-1.6
72	52.2	50.1	-2.1
75	55.1	53.1	-2.1
76	61.6	59.9	-1.7

ID	2019 Actuals Baseline $L_{Aeq,16h}$dB	DS 2043 $L_{Aeq,16h}$dB	ChangedB
78	48.9	50.0	1.1
79	60.1	58.3	-1.8
81	62.2	60.5	-1.8
82	54.8	52.8	-2.1
83	56.5	54.5	-2.0
91	68.2	66.8	-1.4
109	59.1	57.3	-1.8

Table 13.4 Change in $L_{Aeq,8h}$ Air Noise Affecting Committed Developments

ID	2019 Actuals Baseline $L_{Aeq,8h}$dB	DS 2043 $L_{Aeq,8h}$dB	ChangedB
28	54.8	53.4	-1.4
36	56.9	55.7	-1.2
46	49.6	47.8	-1.7
47	51.2	49.5	-1.7
49	62.9	61.3	-1.6
51	53.8	52.3	-1.6
62	51.4	49.8	-1.6
67	47.9	46.0	-1.9
68	56.9	55.6	-1.3
69	56.8	54.9	-1.9
70	56.0	54.8	-1.3
72	47.0	45.0	-1.9
75	49.8	48.1	-1.7
76	56.3	54.8	-1.4
78	45.7	46.6	1.0
79	54.8	53.4	-1.4
81	56.9	55.7	-1.2
82	49.6	47.8	-1.7
83	51.2	49.5	-1.7
91	62.9	61.3	-1.6
109	53.8	52.3	-1.6

Table 13.5 Change in N60 Air Noise Affecting Committed Developments

ID	2019 Actuals Baseline N60	DS 2043 N60	Change
28	27	42	+15
36	27	42	+15
46	19	31	+12
47	19	31	+12
49	32	51	+19
51	30	35	+5
62	19	31	+12

ID	2019 Actuals Baseline N60	DS 2043 N60	Change
67	19	31	+12
68	27	41	+14
69	32	51	+19
70	19	31	+12
72	19	29	+10
75	19	31	+12
76	31	42	+11
78	26	38	+12
79	27	42	+15
81	27	42	+15
82	19	31	+12
83	19	31	+12
91	32	51	+19
109	30	35	+5

13.1.6 Due to new generation aircraft coming into service, future noise levels are reduced from the 2019 Actuals Baseline despite the increase in movements. However, the increase in movements result~~s~~ in an increase in the N60 movements.

13.1.1 Although maximum aircraft noise levels are measured using ‘slow’ weighting as opposed to ‘fast’ weighting used in BS 8233 criteria~~.~~, ~~A~~as L_{ASmax} levels are lower than L_{AFmax} levels, they identify less operations in the N60 metric than would be identified using the L_{AFmax} metric. Consequently, this is considered to represent a conservative approach when identifying how many night-time movements may affect noise at committed developments.

13.1.2 Although there is an increase in N60 movements, the 2019 Actuals Baseline identifies that there are greater than 15 events at each committed development so sound attenuation would have to take into account aircraft noise from individual movements at night. Due to the transition in aircraft fleet, from current generation to new generation aircraft, the aircraft that have the highest noise emission levels will be phased out and the highest L_{ASmax} noise levels will be reduced in future.

GLOSSARY AND ABBREVIATIONS

Term	Definition
AAWT	Average Annual Weekday Traffic
AEDT	Aviation Environmental Design Tool
ANP	Air Noise Performance
ANPS	Airports National Policy Statement
APU	Auxiliary ~~p~~Power Unit
BNL	Basic Noise Level
BPM	Best Practicable Means
CAA	Civil Aviation Authority
CRTN	Calculation of Road Traffic Noise
dB	Decibel
DfT	Department for Transport
DM	Do-Minimum
DMRB	Design Manual for Roads and Bridges
DS	Do-Something
ECAC	European Civil Aviation Conference
END	Environmental Noise Directive
EPA	Environmental Protection Act
FAA	Federal Aviation Administration
GPU	Ground Power Unit
ICAO	International Civil Aviation Organization
INM	Integrated Noise Model
LLAOL	London Luton Airport Operations Limited
LOAEL	Lowest Observable Adverse Effect Level
NEDG	Noise Envelope Design Group
NOEL	No Observed Effect Level
NPD	Noise-Power-Distance
NPPF	National Planning Policy Framework
NPSE	Noise Policy Statement for England
PPGN	Planning Practice Guidance: Noise
SEL	Sound Exposure Level
SOAEL	Significant Observed Adverse Effect Level
SoNA	Survey of Noise Attitudes
SPL	Sound Pressure Level
UAEL	Unacceptable Adverse Effect Level

WHO	World Health Organization

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