London Luton Airport

wood.

London Luton Airport Operations Limited

# Luton Airport Expansion - 19 mppa

Environmental Impact Assessment Addendum

Volume 3: Figures and Appendices

IEMA
Transforming the world to sustainability
- EIA -

Wood Environment & Infrastructure Solutions UK Limited – January 2021

## Report for

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## Document revisions

| No. | Details | Date |
|---|---|---|
| 1 | Final | January 2021 |

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Figure 1.1

# Site location plan

Key

Airport boundary

0 100 200 300 400 500 600 m

Scale at A3: 1:10,000

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**Figure 1.1**
**Site Location Plan**

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Figure 3.1

# Environmental and heritage constraints

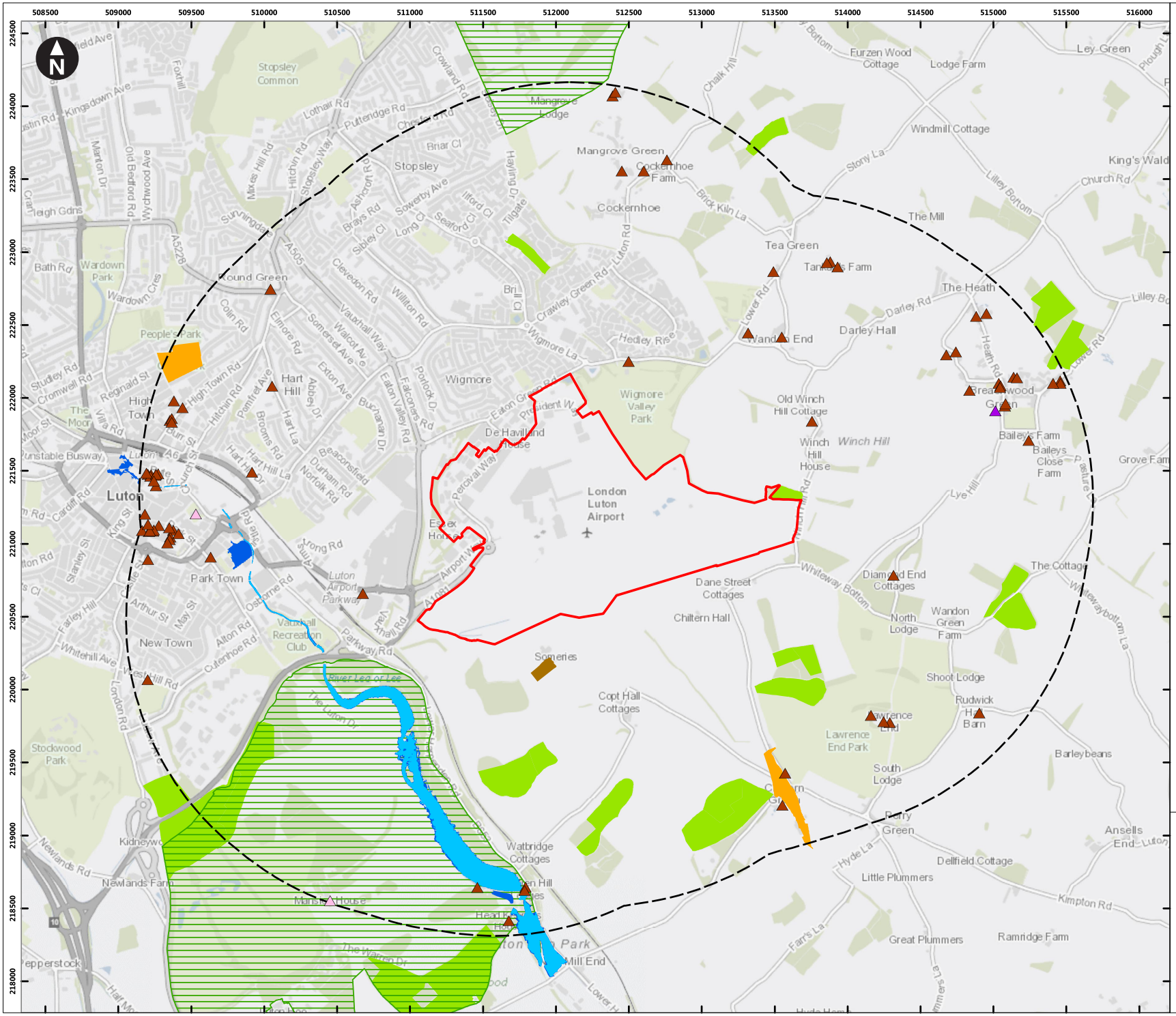


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**Figure 3.1**
**Environmental and heritage constraints**

November 2020

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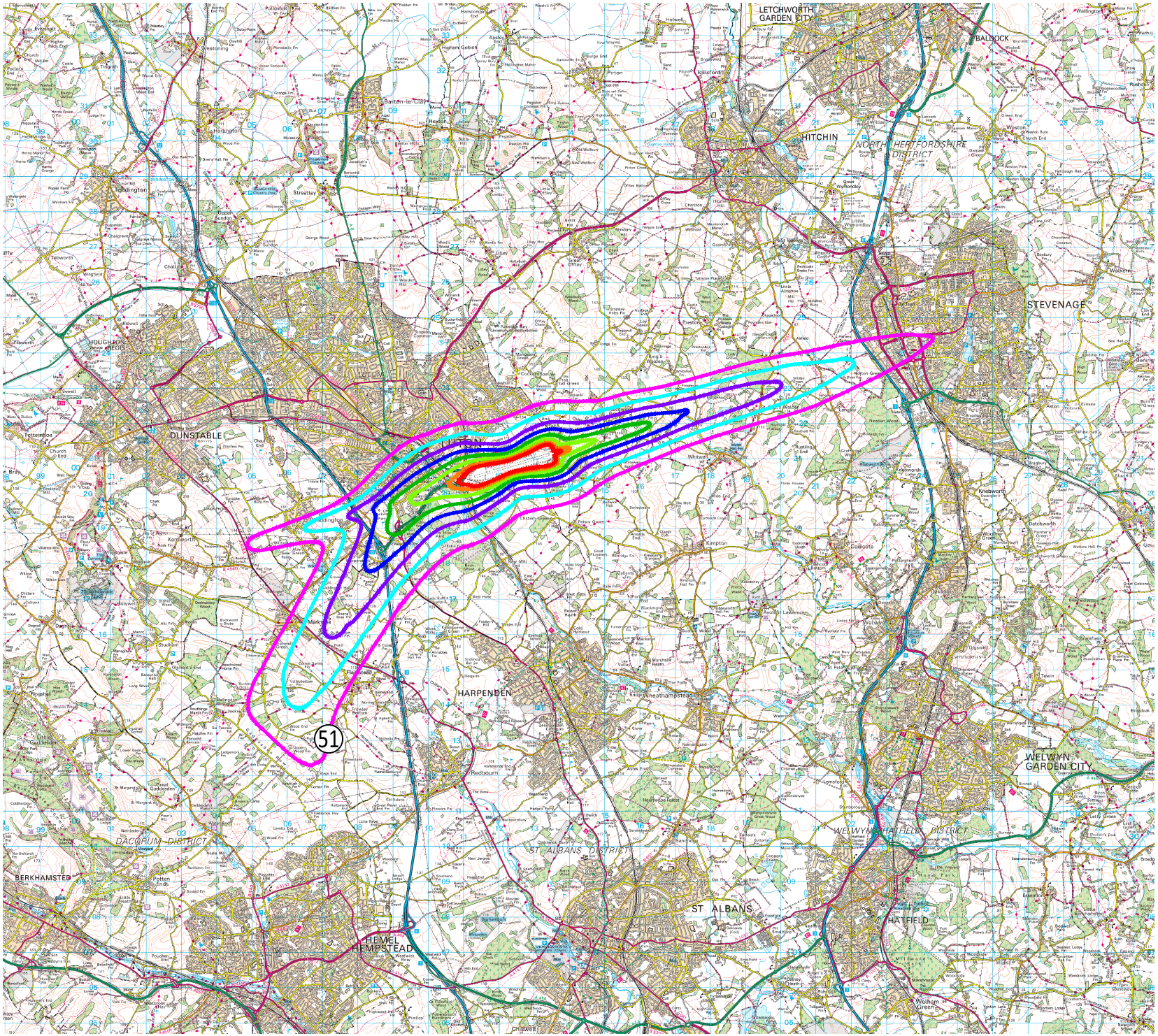
Figure 8.1

# Existing Condition 10 2021-2027 Day

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LEGEND:

$L_{Aeq,16h}$ Daytime Noise Contours,

- 51 dB LOAEL
- 54 dB
- 57 dB
- 60 dB
- 63 dB SOAEL
- 66 dB
- 69 dB
- 71 dB UAEL

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Existing Condition 10 2021-2027
$L_{Aeq,16h}$ Daytime Noise Contours

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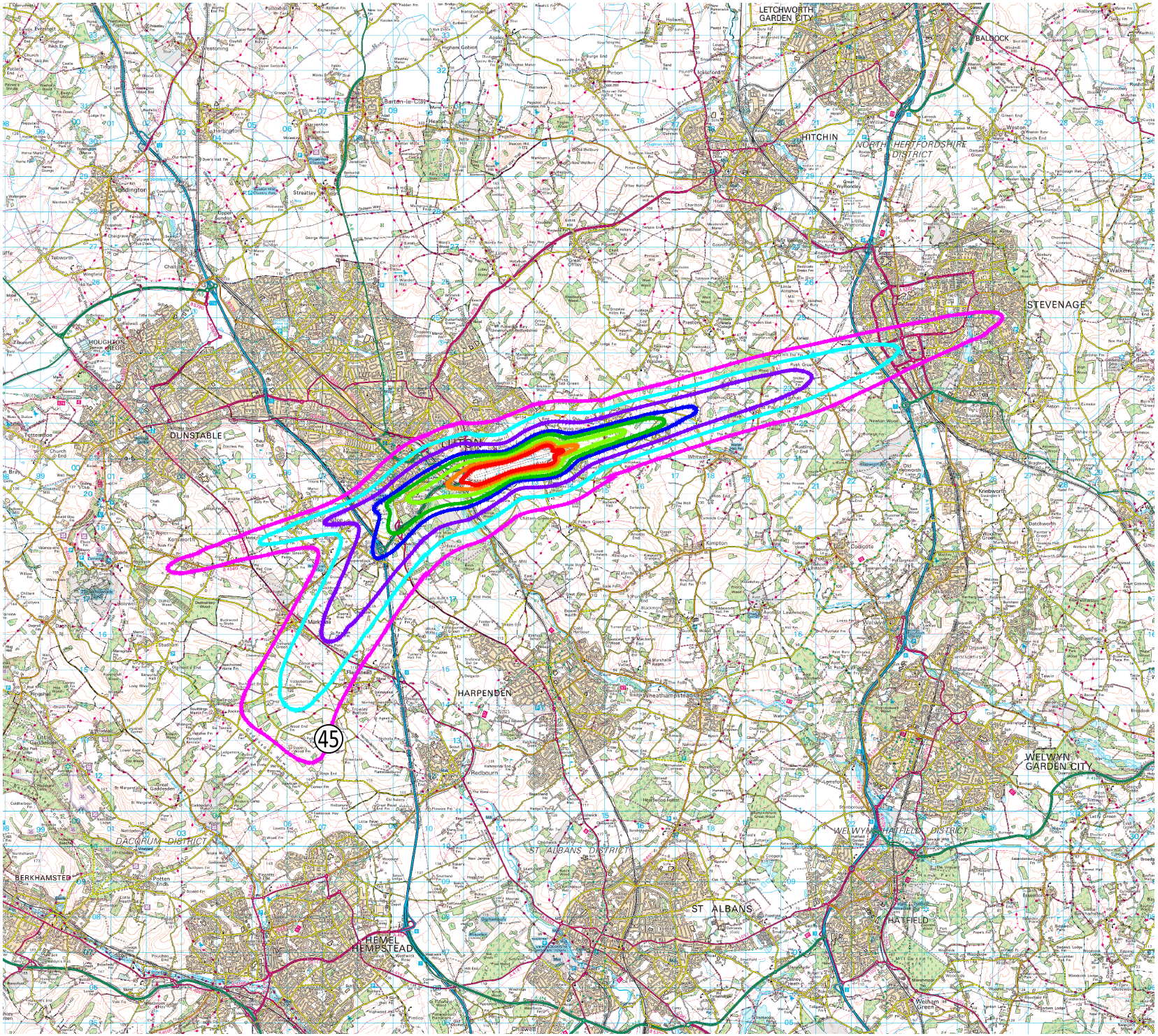
DATE: November 2020 SCALE: 1:150000@A4

FIGURE No:

A11060-S73-35-1.0

Figure 8.2

# Existing Condition 10 2021-2027 Night

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LEGEND:

$L_{Aeq,8h}$ Night-time Noise Contours,

- 45 dB LOAEL
- 48 dB
- 51 dB
- 55 dB SOAEL
- 57 dB
- 60 dB
- 63 dB
- 66 dB UAEL

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FIGURE No:

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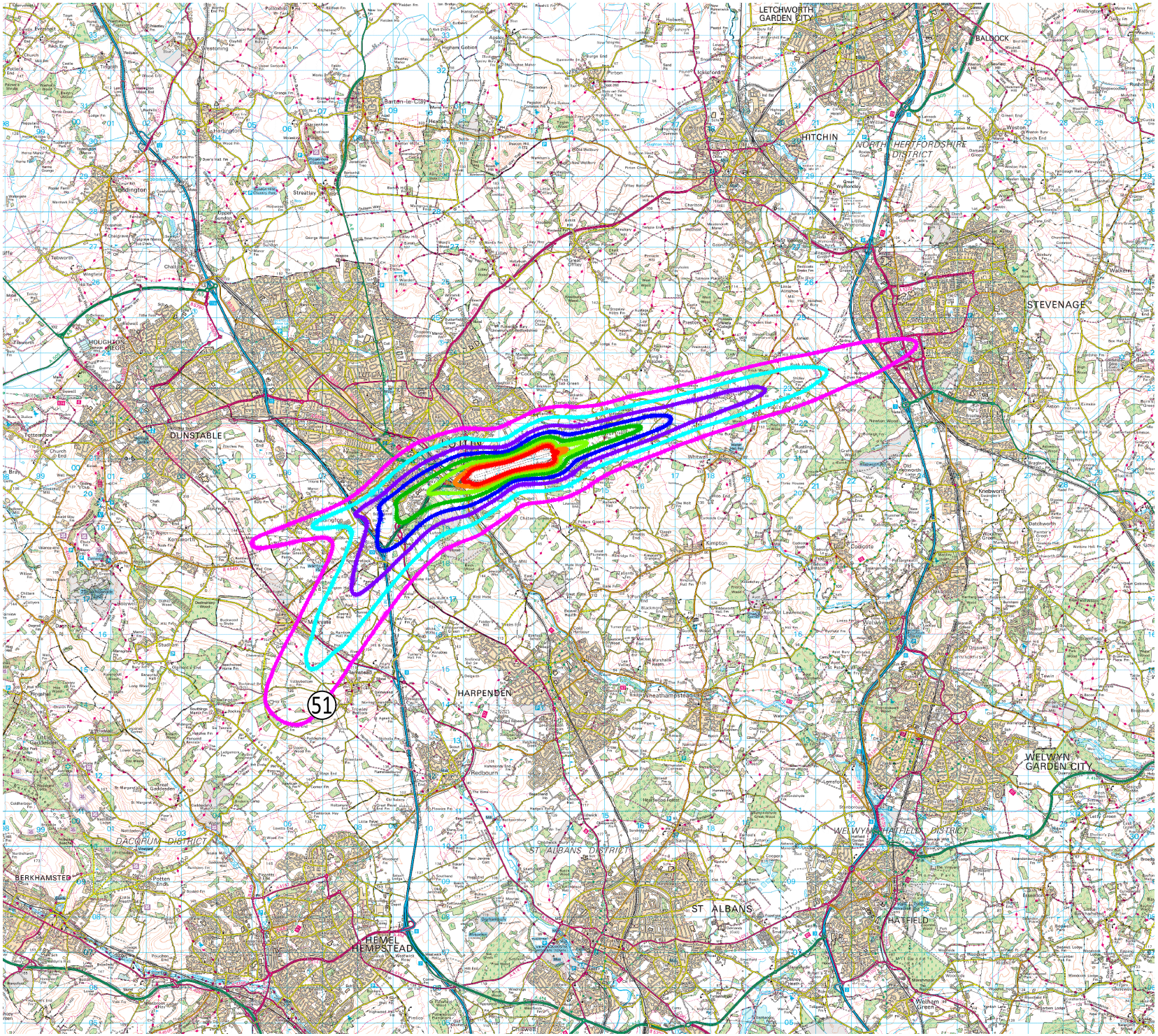
Figure 8.3

# Existing Condition 10 2028+ Day

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LEGEND:

$L_{Aeq,16h}$ Daytime Noise Contours,

- 51 dB LOAEL
- 54 dB
- 57 dB
- 60 dB
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- 66 dB
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- 71 dB UAEL

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$L_{Aeq,16h}$ Daytime Noise Contours

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FIGURE No:

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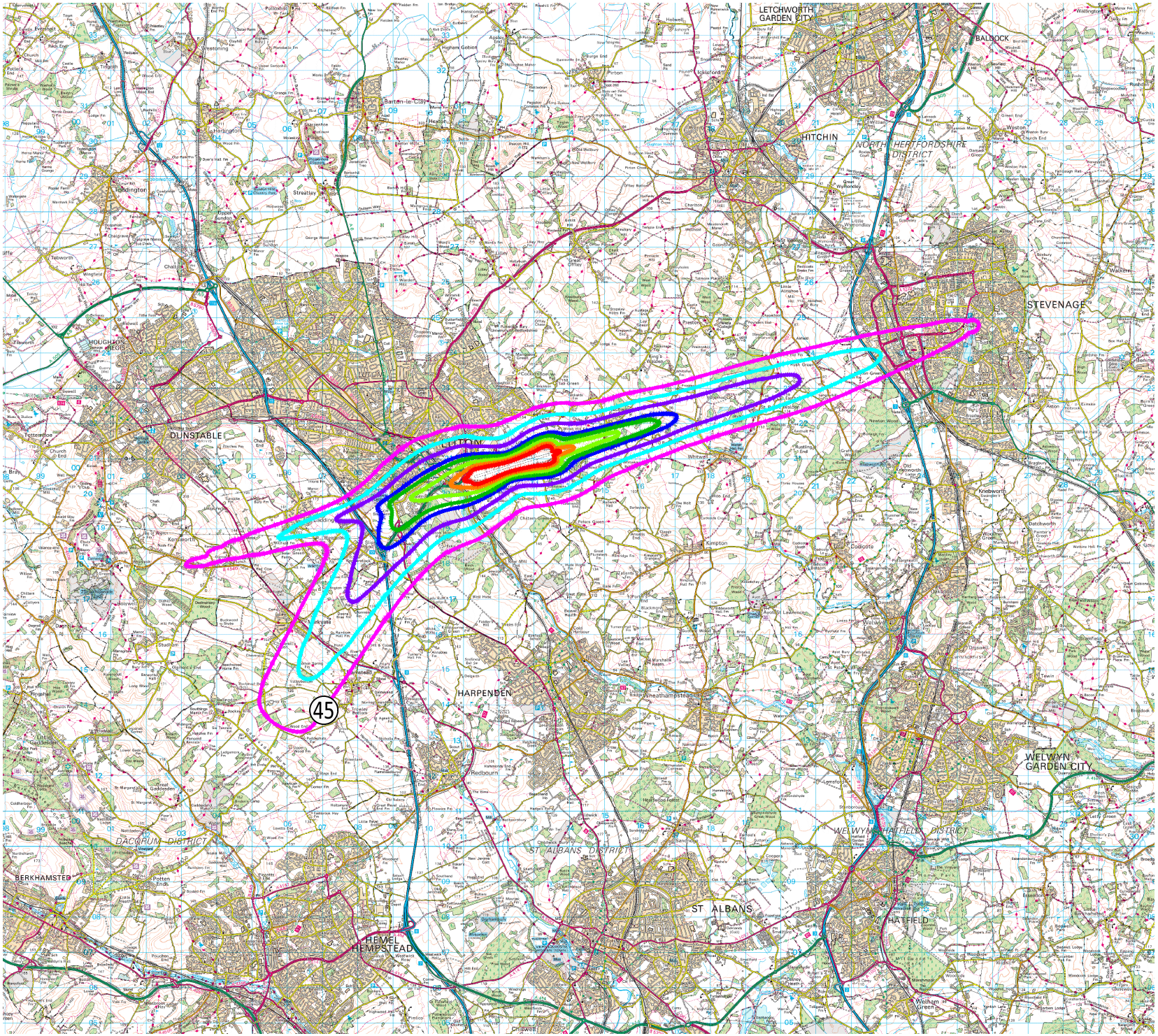
Figure 8.4

# Existing Condition 10 2028+ Night

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LEGEND:

$L_{Aeq,8h}$ Night-time Noise Contours,

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Existing Condition 10 2028+
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FIGURE No:

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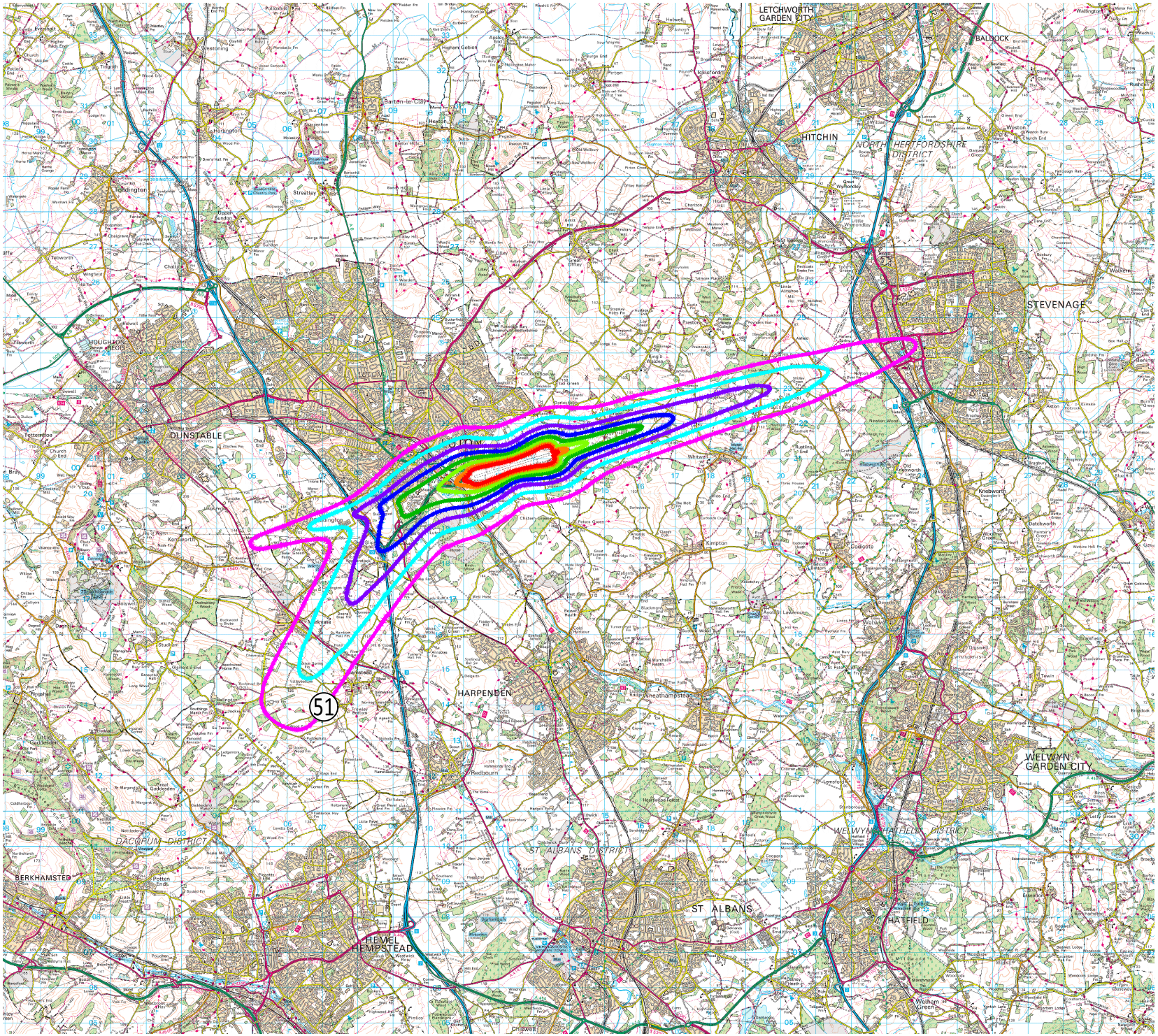
Figure 8.5

# 2028 12.5 mppa Revised Day

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LEGEND:

$L_{Aeq,16h}$ Daytime Noise Contours,

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- 57 dB
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$L_{Aeq,16h}$ Daytime Noise Contours

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FIGURE No:

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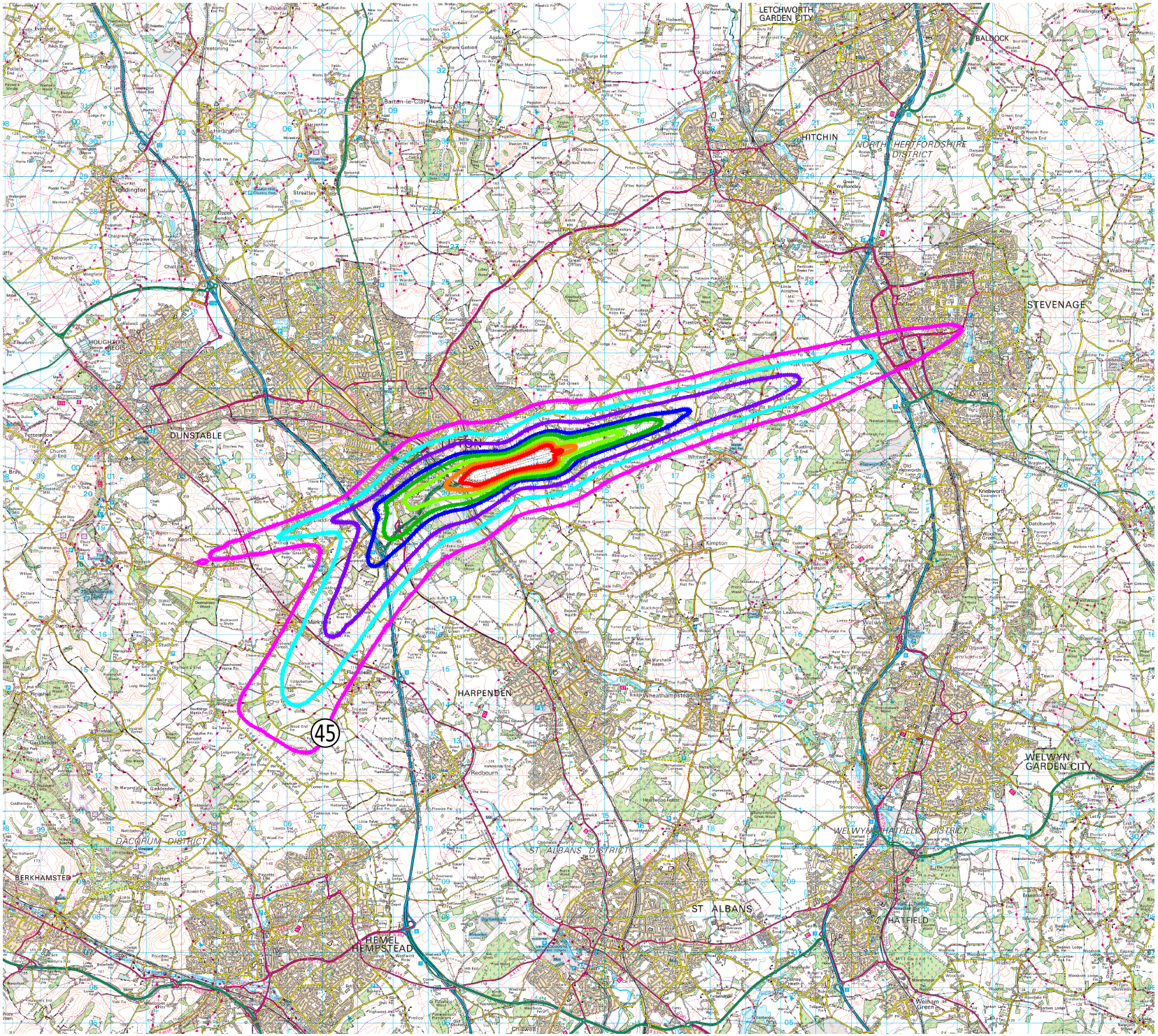
Figure 8.6

# 2028 12.5 mppa Revised Night

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LEGEND:

$L_{Aeq,8h}$ Night-time Noise Contours,

- 45 dB LOAEL
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- 51 dB
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FIGURE No:

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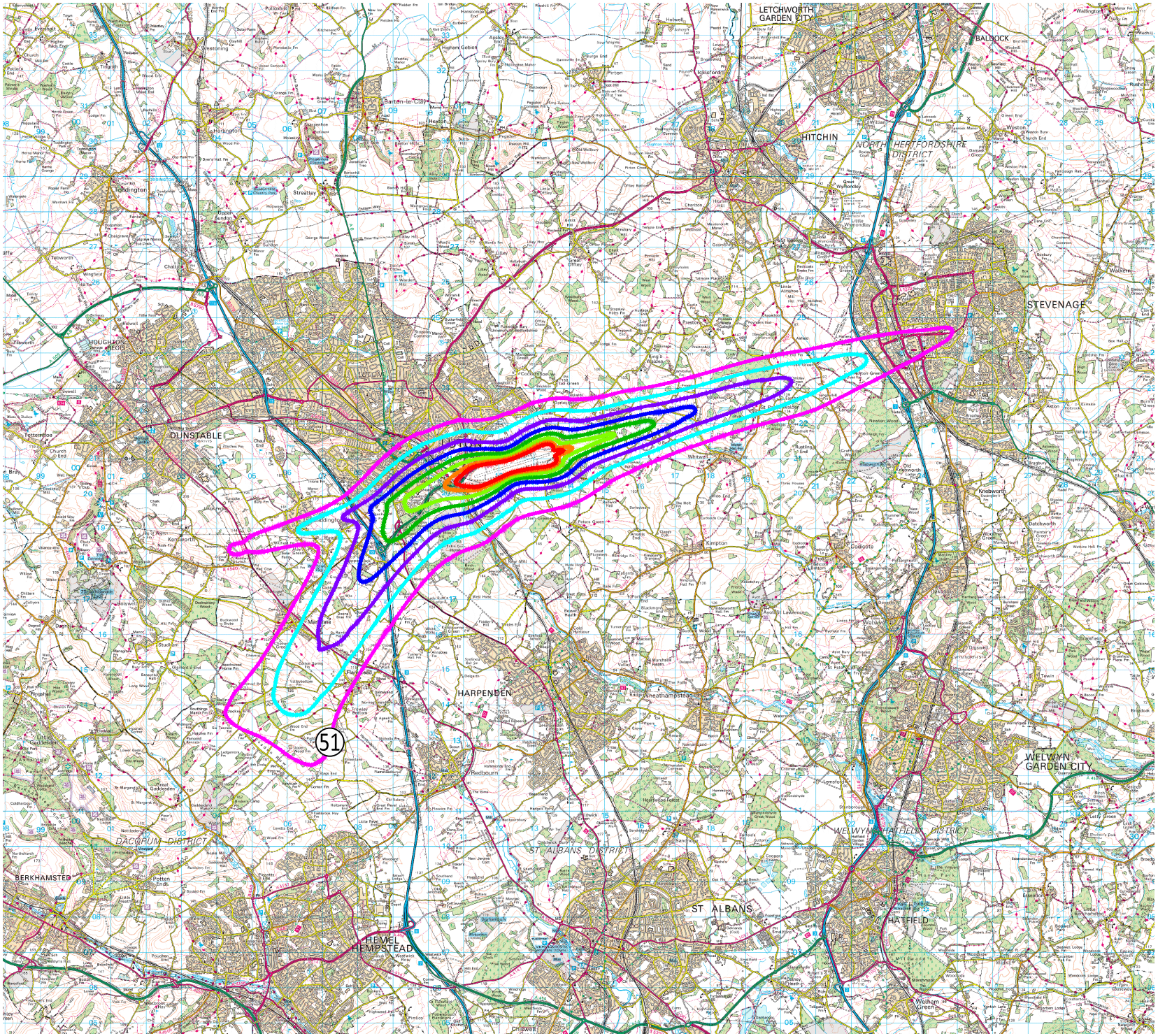
Figure 8.7

# 2021 18 mppa Day

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LEGEND:

$L_{Aeq,16h}$ Daytime Noise Contours,

- 51 dB LOAEL
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FIGURE No:

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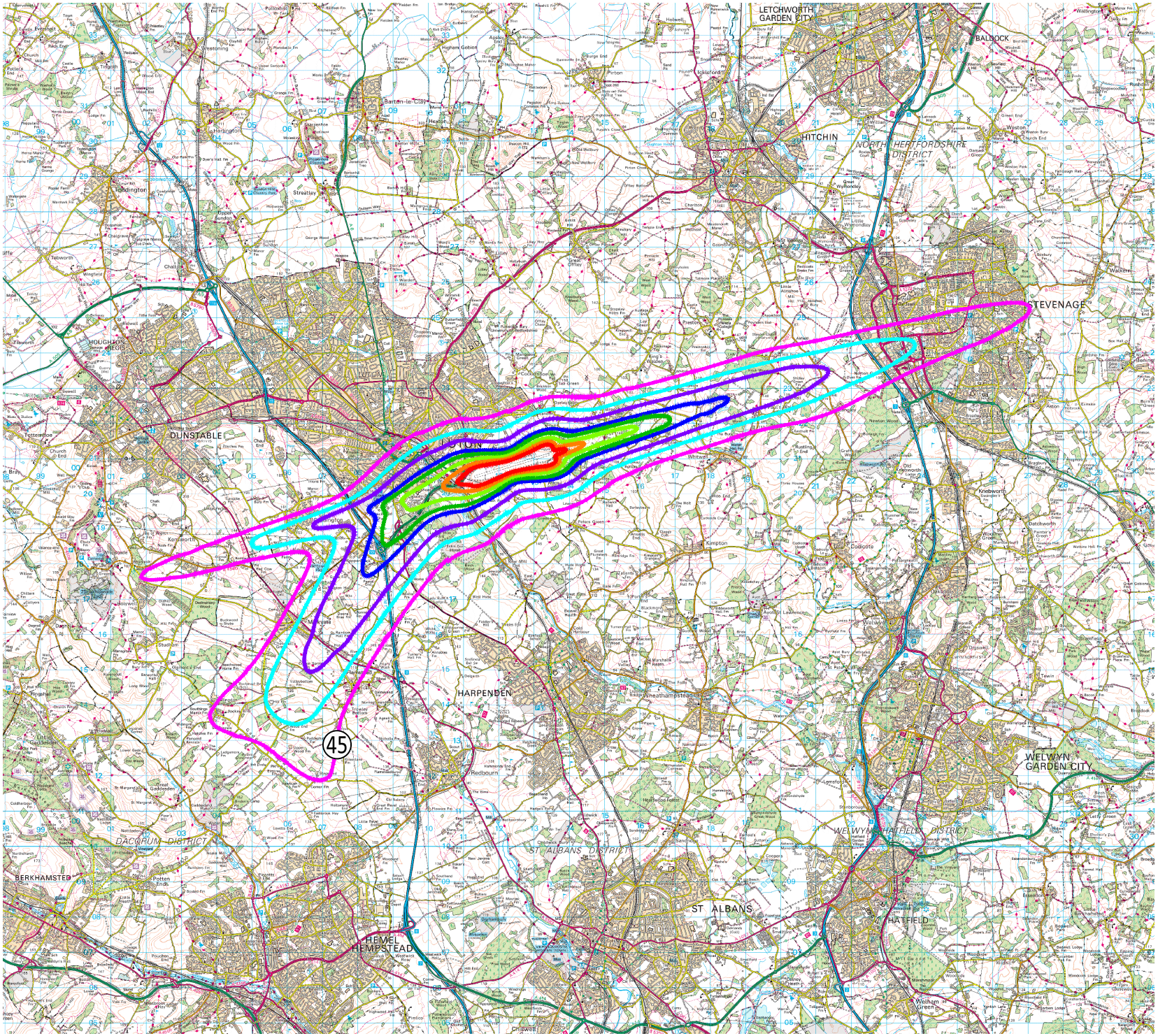
Figure 8.8

# 2021 18 mppa Night

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LEGEND:

$L_{Aeq,8h}$ Night-time Noise Contours,

- 45 dB LOAEL
- 48 dB
- 51 dB
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- 66 dB UAEL

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$L_{Aeq,8h}$ Night-time Noise Contours

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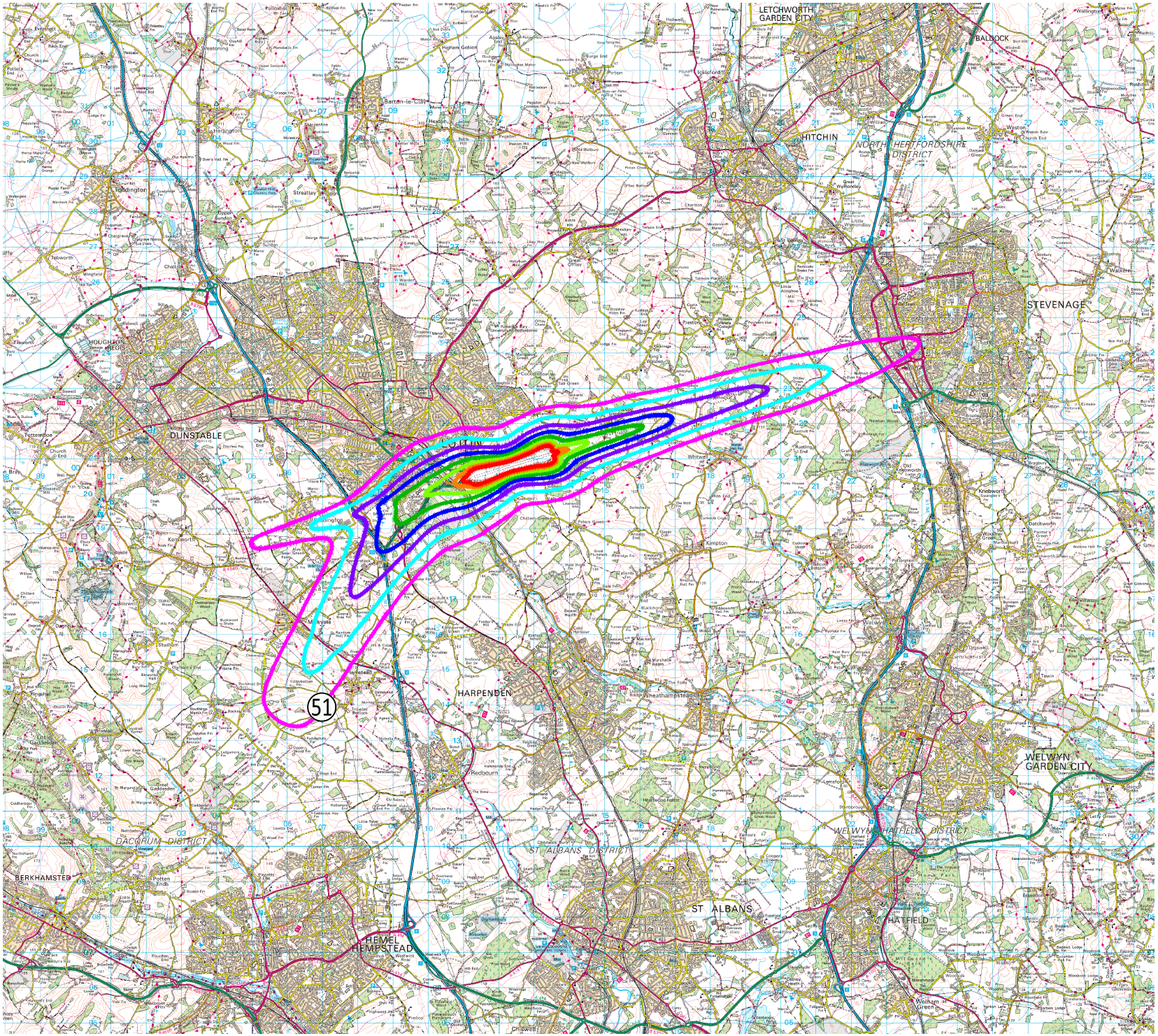
FIGURE No:

A11060-S73-42-1.0

Figure 8.9

# 2028 19 mppa Day

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LEGEND:

$L_{Aeq,16h}$ Daytime Noise Contours,

- 51 dB LOAEL
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- 57 dB
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- 66 dB
- 69 dB
- 71 dB UAEL

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2028 19 mppa

$L_{Aeq,16h}$ Daytime Noise Contours

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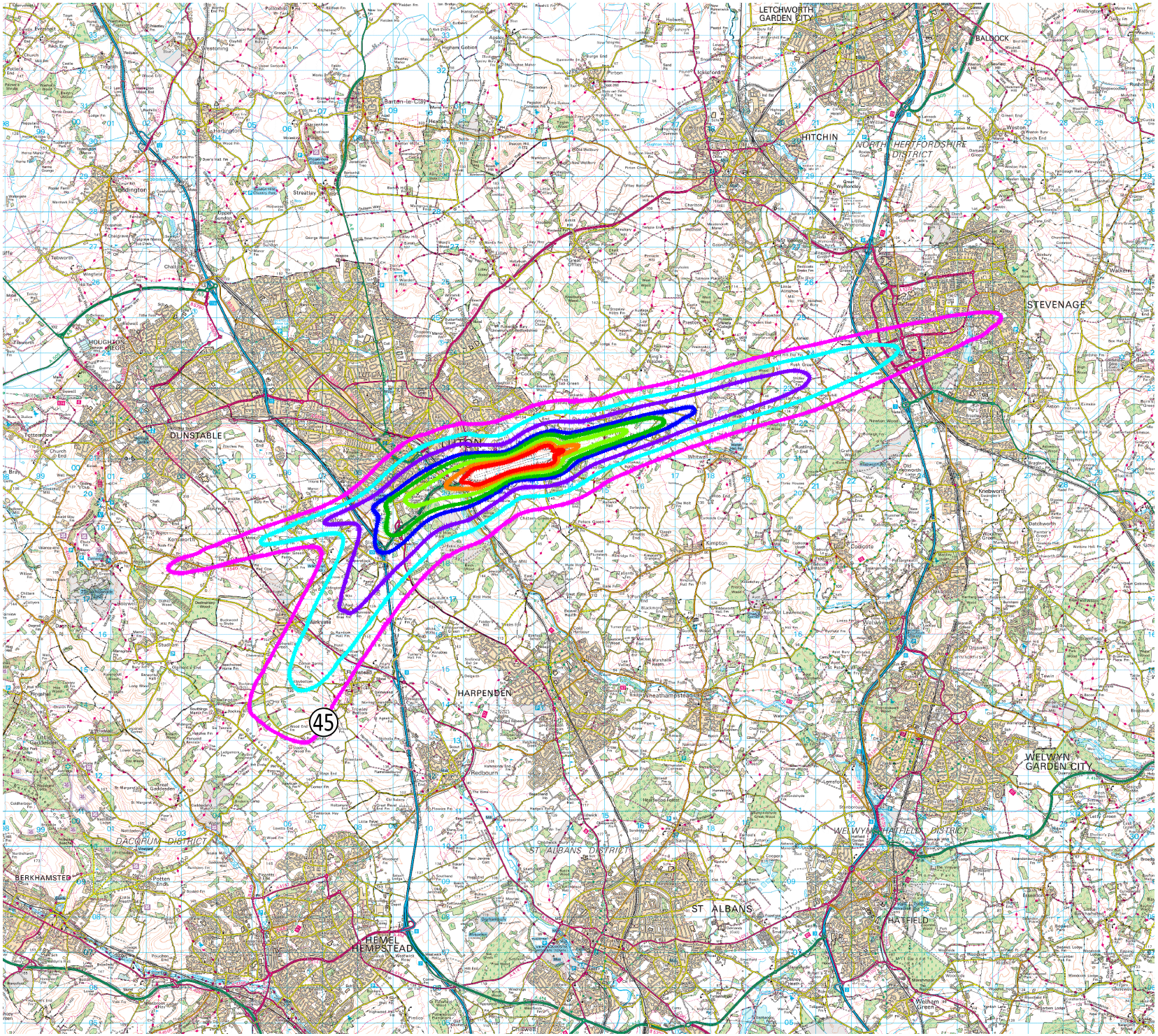
FIGURE No:

A11060-S73-43-1.0

Figure 8.10

# 2028 19 mppa Night

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LEGEND:

$L_{Aeq,8h}$ Night-time Noise Contours,

- 45 dB LOAEL
- 48 dB
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2028 19 mppa

$L_{Aeq,8h}$ Night-time Noise Contours

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DATE: November 2020 SCALE: 1:150000@A4

FIGURE No:

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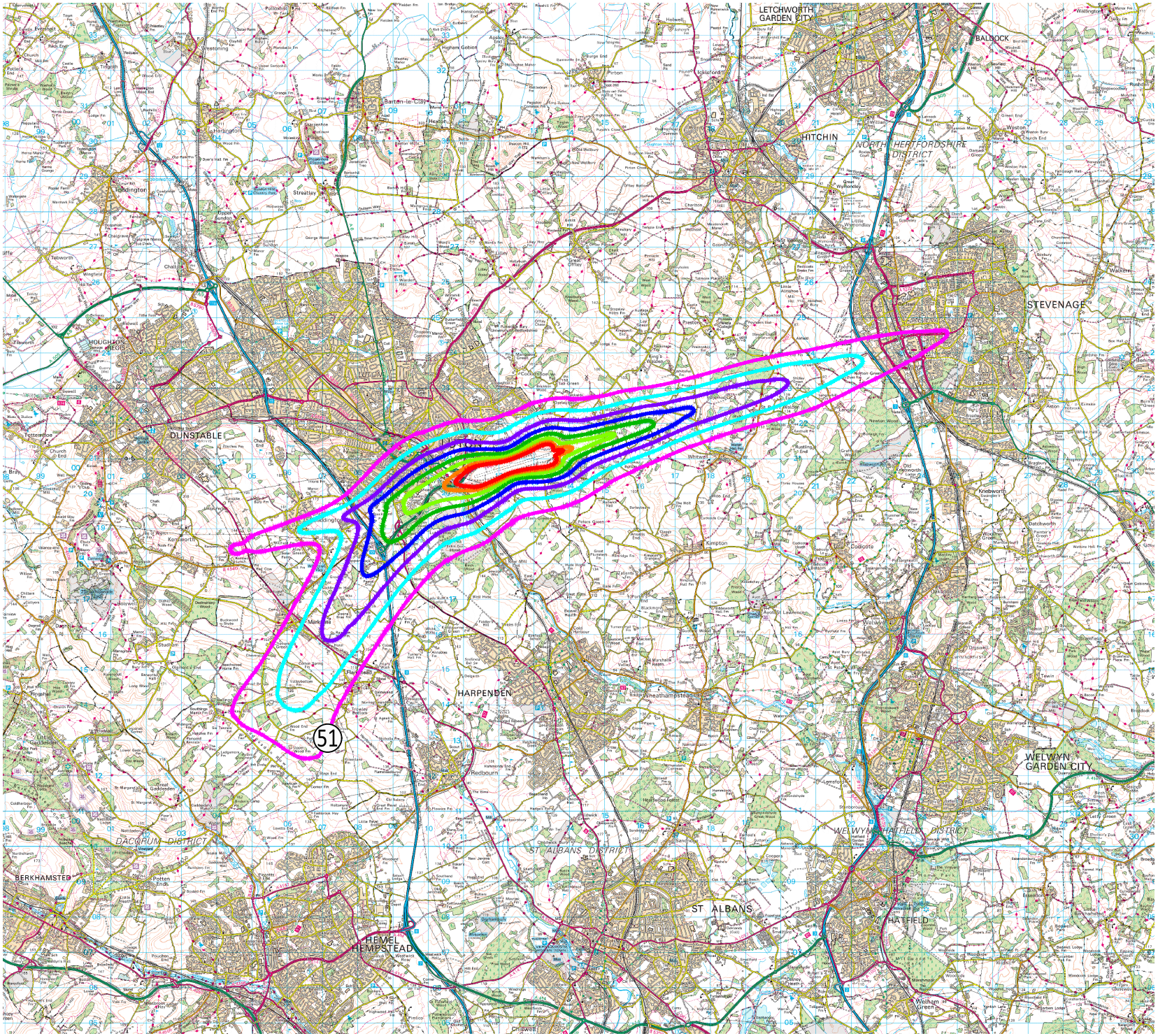
Figure 8.11

# 2022 18 mppa Day

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LEGEND:

$L_{Aeq,16h}$ Daytime Noise Contours,

- 51 dB LOAEL
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- 69 dB
- 71 dB UAEL

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$L_{Aeq,16h}$ Daytime Noise Contours

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FIGURE No:

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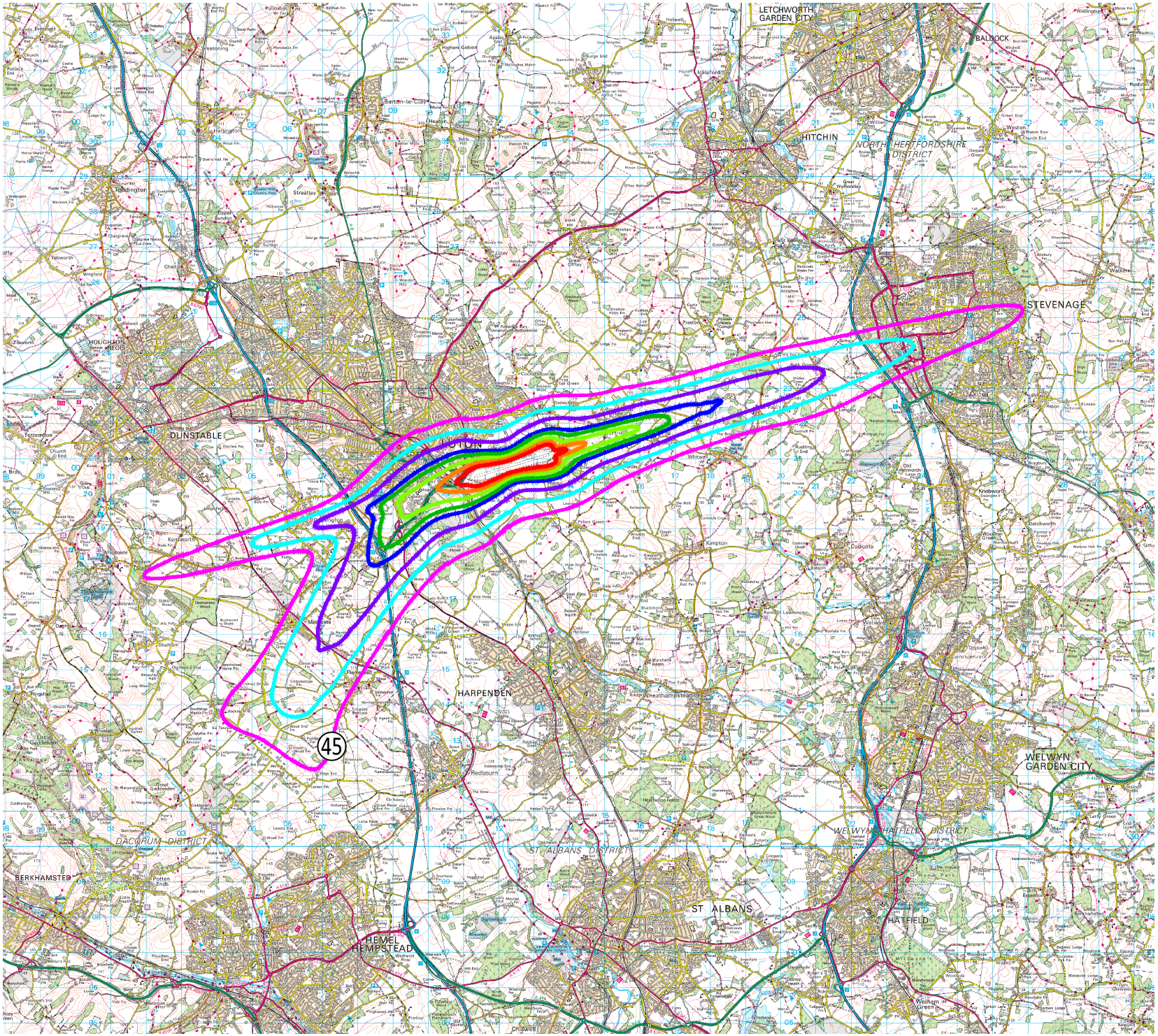
Figure 8.12

# 2022 18 mppa Night

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LEGEND:

$L_{Aeq,8h}$ Night-time Noise Contours,

- 45 dB LOAEL
- 48 dB
- 51 dB
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- 57 dB
- 60 dB
- 63 dB
- 66 dB UAEL

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$L_{Aeq,8h}$ Night-time Noise Contours

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DATE: November 2020 SCALE: 1:150000@A4

FIGURE No:

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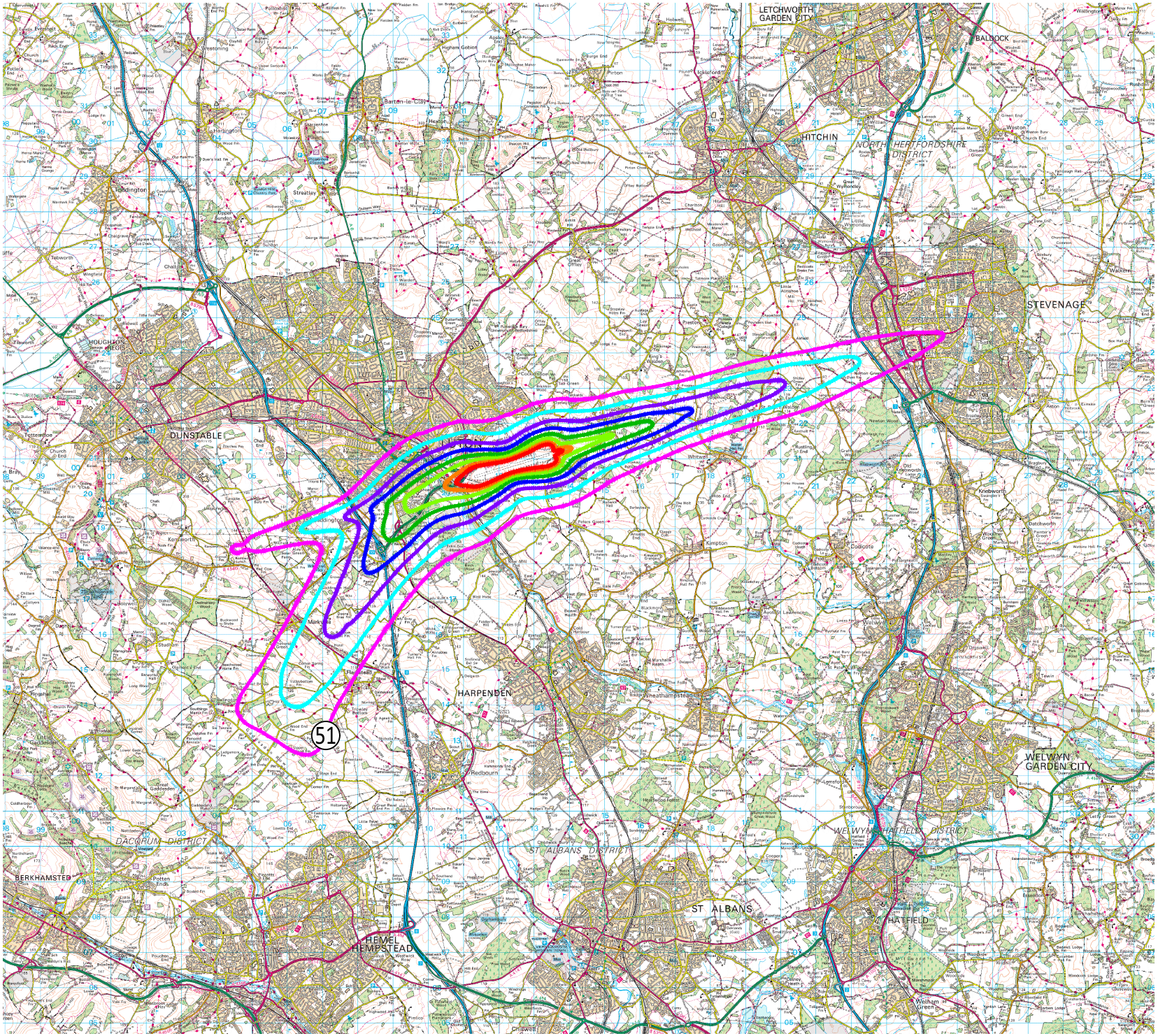
Figure 8.13

# 2023 18 mppa Day

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LEGEND:

$L_{Aeq,16h}$ Daytime Noise Contours,

- 51 dB LOAEL
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$L_{Aeq,16h}$ Daytime Noise Contours

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FIGURE No:

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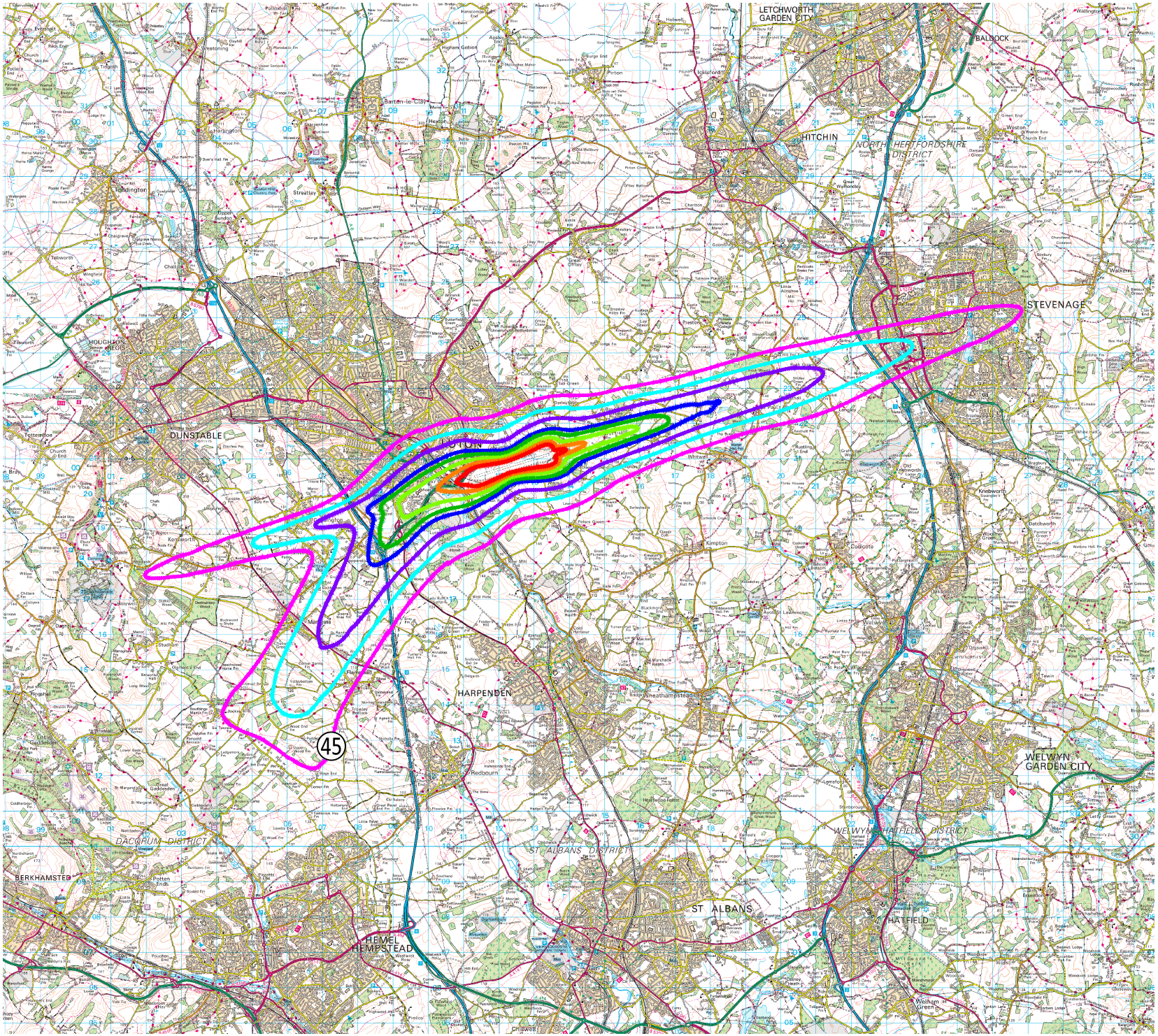
Figure 8.14

# 2023 18 mppa Night

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LEGEND:

$L_{Aeq,8h}$ Night-time Noise Contours,

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FIGURE No:

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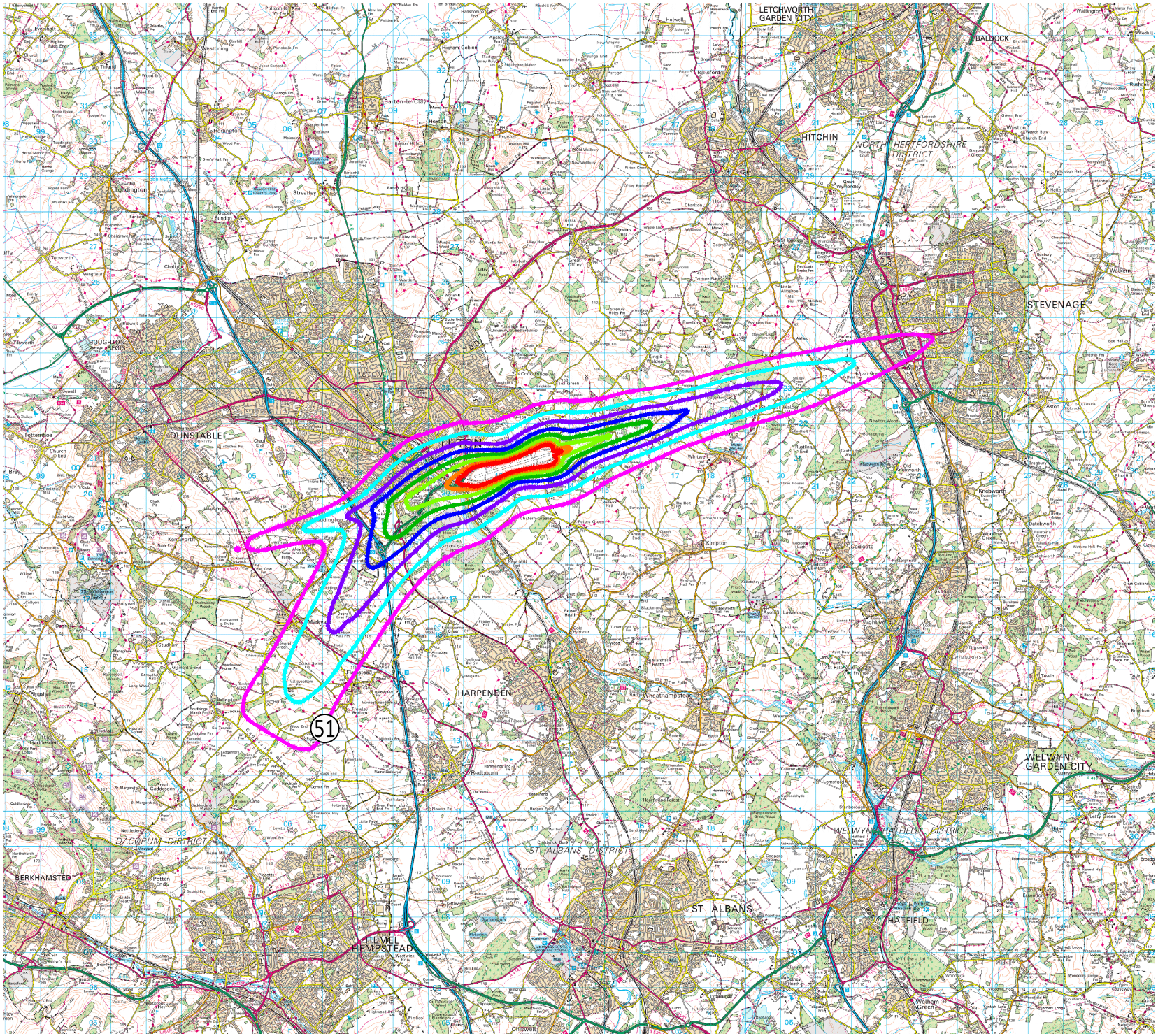
Figure 8.15

# 2024 19 mppa Day

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2024 19 mppa
$L_{Aeq,16h}$ Daytime Noise Contours

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FIGURE No:

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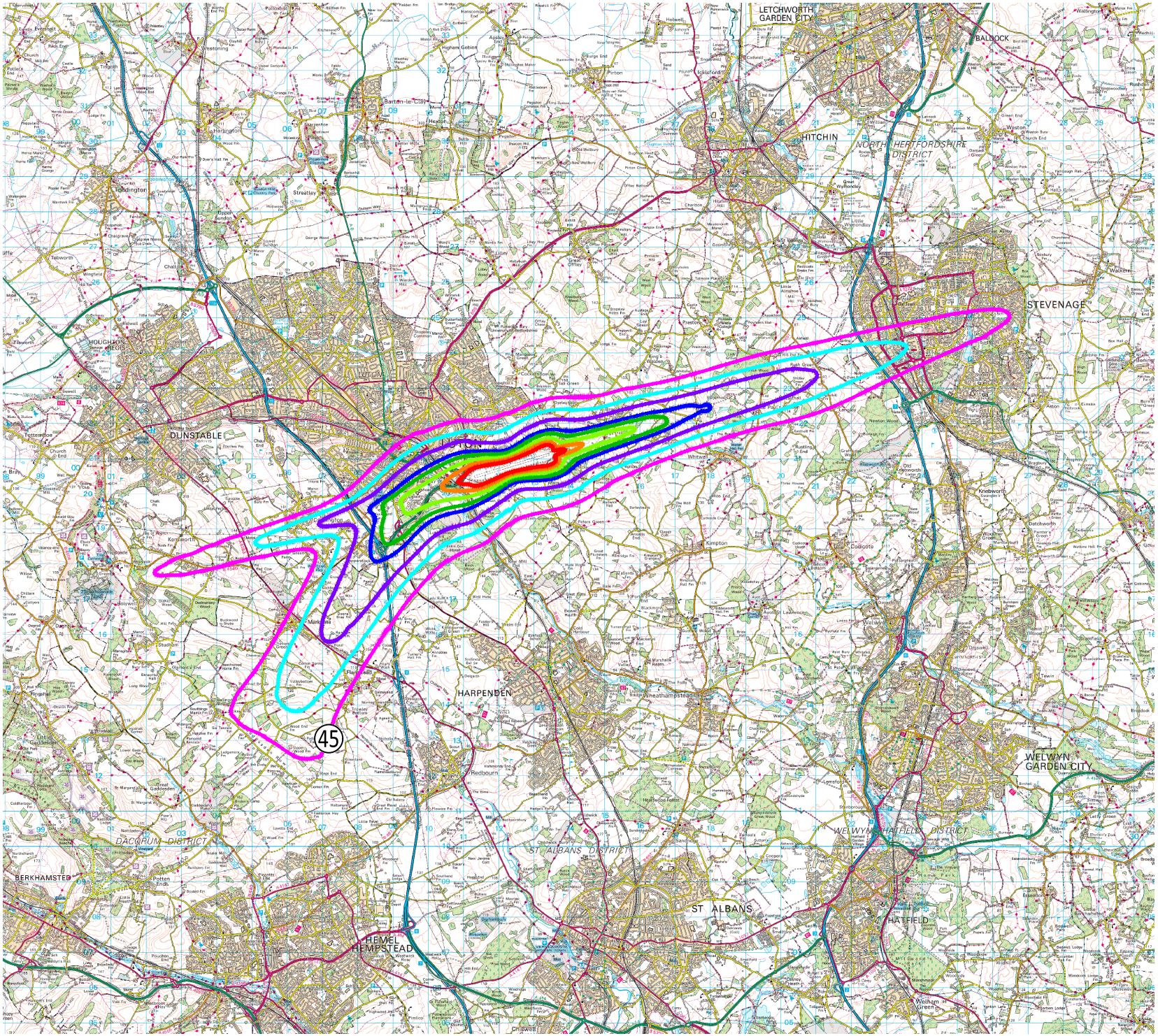
Figure 8.16

# 2024 19 mppa Night

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LEGEND:

$L_{Aeq,8h}$ Night-time Noise Contours,

- 45 dB LOAEL
- 48 dB
- 51 dB
- 55 dB SOAEL
- 57 dB
- 60 dB
- 63 dB
- 66 dB UAEL

REVISIONS

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London Luton Airport

2024 19 mppa

$L_{Aeq,8h}$ Night-time Noise Contours

DRAWN: MP CHECKED: DR

DATE: November 2020 SCALE: 1:150000@A4

FIGURE No:

A11060-S73-50-1.0

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# Appendix 1A
# **Screening report**

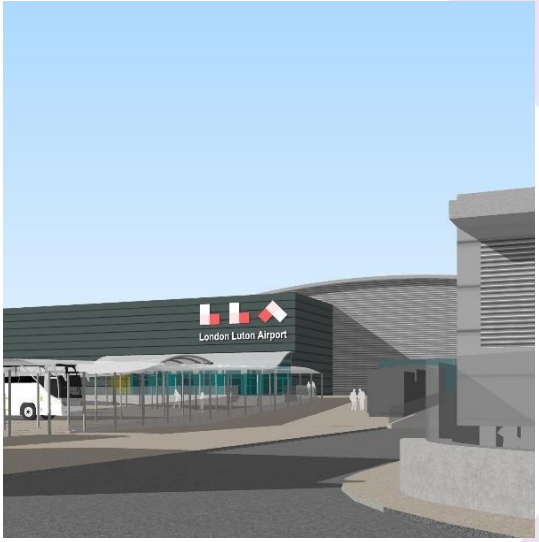
London Luton Airport

wood.

London Luton Airport Operations Limited

# Expansion to 19 million passengers per annum

Environmental Impact Assessment Screening Report



Wood Environment & Infrastructure Solutions UK Limited –July 2020

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## Document revisions

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# 1. Introduction

## 1.1 Overview

1.1.1 Wood Environment and Infrastructure Solutions UK Limited (hereafter referred to as 'Wood') has been commissioned by London Luton Airport Operations Limited (LLAOL) to prepare a Screening Report in support of a Section 73 application to vary Condition 8 and 10 (reference 15/00950/VARCON), granted permission in June 2014 (hereafter referred to as the '2012 consented scheme').

1.1.2 Planning permission is sought to increase the capacity of London Luton Airport (LLA) from 18 million passengers per annum (mppa) to 19 mppa (hereafter referred to as 'the Proposed Scheme'). The Proposed Scheme seeks to accommodate the additional passenger numbers through a variation of two conditions attached to planning permission 15/00950/VARCON; Condition 8 (relating to controls over operations) and Condition 10 (relating to noise).

1.1.3 The modification to Condition 8 would allow a rise to 19 mppa without necessitating the development of any additional on-site infrastructure. The additional passengers would be accommodated through a small increase in the number of air transport movements (ATMs). Consent is also sought for a variation to the wording of Condition 10 in order to provide a less restrictive day and night noise contour, on a temporary basis, up to the end of 2024.

1.1.4 The Proposed Scheme would allow LLA to continue to grow sustainably and deliver increased economic and social benefits for the local area, the wider sub region, and the national economy.

## 1.2 Purpose of this Report

1.2.1 This appraisal constitutes a formal request to Luton Borough Council (LBC) for a Screening Opinion under Regulation 5(2) of the *Town and Country Planning (Environmental Impact Assessment) Regulations 2017*[1] (hereafter referred to as 'the EIA Regulations'). This is in relation to a forthcoming planning application for the Proposed Scheme, as defined in **Section 2** of this report and the Site Location Plan (**Appendix A**, **Figure 1**). In accordance with Regulation 6(2) of the EIA Regulations, the following information is contained within this report:

- a plan sufficient to identify the land (**Appendix A**, **Figure 1**);
- an Environmental Constraints map (**Appendix A**, **Figure 2**)
- a description of the nature and purpose of the Proposed Scheme, including a description of the physical characteristics (**Section 2**);
- a description of the location of the Proposed Scheme, with particular regard to the environmental sensitivity of geographical areas likely to be affected (**Section 2**);
- consideration of the likely significant effects on the environment arising from the Proposed Scheme (**Section 3**); and
- a summary and conclusion as to whether the Proposed Scheme should be subject to an EIA (**Section 4**).

[1] Town and Country Planning (Environmental Impact Assessment) Regulations 2017 [online]. Available at: http://www.legislation.gov.uk/uksi/2017/571/pdfs/uksi_20170571_en.pdf [Accessed 11 May 2020].

1.2.2 All information has been collated from desk-based sources, accounting for the baseline conditions and the potential likely significant environmental effects of the Proposed Scheme.

## 1.3 Legal Obligations

1.3.1 In relation to the obligations on local planning authorities, the EIA Regulations state the following:

*"**6**.— (6) A relevant planning authority must adopt a screening opinion within—*

*(a) 3 weeks beginning with the date of receipt of a request made pursuant to paragraph (1); or*

(b) *such longer period, not exceeding 90 days from the date on which the person making the request submits the information required under paragraph (2) or (3) as may be agreed in writing with the person making the request."*

1.3.2 Accordingly, it is requested that LBC provide a Screening Opinion detailing their decision within three weeks of receiving this EIA Screening Report.

# 2. The Proposed Scheme

## 2.1 The Application Site and Surrounding Area

2.1.1 LLA is located approximately 45 km north of London and the redline boundary is wholly within the local authority administrative area of LBC. Outside of the redline boundary, LLA owns land in Central Bedfordshire and North Hertfordshire. As shown in **Appendix A**, **Figure 1**, LLA is situated to the south-east of Luton, directly adjacent to the A1081 to the west, and Percival Way to the north. To the south and east, LLA is bounded by agricultural land. The southern boundary of LLA closely follows the boundary between Luton and the district of Central Bedfordshire, while the easterly boundary follows the county boundaries between the counties of Hertfordshire and Bedfordshire.

2.1.2 LLA itself is approximately 245 ha and is predominantly level on a raised chalk plateau at the northern end of the Chiltern Hills; its highest point is approximately halfway along the runway. The local topography progresses to drop relatively steeply in proximity to the runway edges, with a gradient of 1:12.5 beyond the western extent and approximately 1:17 at the eastern extent. The general topography of the area to the south and east of Luton consists of a series of generally parallel ridges and valleys that run from north-west to south-east.

2.1.3 Elsewhere, the landscape is characterised by arable farmland and moderately sized villages or smaller clusters of residential properties. Arable farmland also contains pockets of priority habitat, namely deciduous woodland, ancient replanted woodland and semi-natural woodland located to the south and east of LLA. There are a number of listed buildings, two registered parks and gardens and one scheduled monument within 2 km of LLA. The nearest ecological designated site is Galley and Warden Hills Site of Special Scientific Interest (SSSI), 4.5 km north-west of LLA.

## 2.2 Description of the Proposed Scheme

2.2.1 A previous planning permission (15/00950/VARCON ), granted in 2014, provided consent to allow the capacity of LLA to increase to 18 mppa. According to London Luton Airport Vision for Sustainable Growth 2020-2050[2], the latest forecasts for LLA anticipated that the 18 mppa capacity was expected to be fully utilised by 2020. The 18 mppa cap on passenger numbers imposed by the 2012 consented scheme reflected the forecasts at that time, which anticipated that LLA would see a steady rise to around 18 mppa by around 2027. It is important to note, that within the decision notice, LBC acknowledged that the approved scheme provided LLA with a potential capacity of up to 20 mppa.

2.2.2 LLAOL wishes to vary Condition 8 and raise the passenger cap from 18 mppa to 19 mppa, as soon as possible. This would ensure that the number of passengers going through LLA could continue to grow over the next few years, and not be restricted by the existing cap.

2.2.3 The growth to 19 mppa could be accommodated without any new on-airport infrastructure, including that which is already permitted and not yet built, and that which could be built under permitted development rights. The growth to 19 mppa would, therefore, not require any new built development. However, a small increase in the number of ATMs is required to accommodate the additional passengers.

[2] London Luton Airport Ltd (n.d.). London Luton Airport Vision for Sustainable Growth 2020 – 2050, [online] Available at: https://www.llal.org.uk/Documents/vision2020-2050.pdf [Accessed 11 May 2020].

2.2.4 **Table 2.1** shows that to accommodate 19 mppa in 2021, the total peak day ATMs would marginally increase by 7 movements (1.45%) from those currently required to accommodate the 2019 18 mppa scenario (483). However, they would then reduce by 6 movements (-1.24%) from the 2019 18 mppa scenario by 2028 as larger planes are introduced. Only a marginal increase in flights would occur because additional passengers would be accommodated by higher levels of patronage on each individual aircraft.

Table 2.1 Peak Day Air Transport Movements 2019 to 2028*

| Peak day | 2019 18 mppa ATMs | 2021 19 mppa ATMs | 2028 19 mppa ATMs |
|---|---|---|---|
| **Daytime** | 417 | 423 | 413 |
| **Night-time** | 66 | 67 | 64 |
| **Daily total** | 483 | 490 | 477 |

*'Peak day' ATMs: the busiest day in terms of the number of ATMs.

2.2.5 **Table 2.2** shows that during the 92-day peak period, accommodating 19 mppa would result in an increase of 724 (2.12%) daytime ATMs over the 92-day period, with a reduction in the night-time ATMs of 395 (-7.32%) and an increase in the daily total of 329 (0.83%). There would, however, be a corresponding reduction in ATMs outside of the 92-day peak period.

Table 2.2 92-Day Peak Period Air Transport Movements 2019 to 2028*

| 92-day peak period | 2019 18 mppa ATMs | 2021 19 mppa ATMs | 2028 19 mppa ATMs |
|---|---|---|---|
| **Daytime** | 34, 124 | 34, 199 | 34,848 |
| **Night-time** | 5,398 | 5,413 | 5,003 |
| **Daily total** | 39,522 | 39,612 | 39,851 |

*'92-day peak period' ATMs: the 92-day period within which the highest number of ATMs occurs.

2.2.6 As shown in **Table 2.1** and **Table 2.2**, ATMs would increase to accommodate the additional passengers, but this would not be at the same rate of increase as the passenger numbers (5.56%). This can be achieved by increasing seat occupancy, and seat numbers by using larger aircraft.

2.2.7 In addition to the above, there will be no major change in the direction of flights. This is due to the short haul point-to-point nature of LLA and as such, the majority of flights will remain in the "East-North-East" to "South-South-West" sectors.

2.2.8 Consent is also sought for a variation to the wording of Condition 10 in order to provide a less restrictive day and night noise contour, on a temporary basis, up to the end of 2024. LLA has experienced unprecedented levels of growth in passenger numbers, which are considerably above those predicted, reflecting the success of LAA as a destination.

2.2.9 In addition to the above, the 2012 consented scheme took into account the fleet modernisation information that was available at that time. It was anticipated that the aircraft fleet using LLA would be modernised and therefore become quieter over time.

2.2.10 It is understood that Condition 10 was set on the basis of noise modelling carried out for the 2012 application. This modelling only took into account the effects of modernisation with respect to the assessment in 2028, by which time it was assumed that the resident airlines would have acquired all

of the ordered NEO and MAX aircraft. As such, little or no headroom was included for unforeseen circumstances outside of the control of the operator of LLA. There are a number of reasons why forecasting fleet modernisation is difficult to predict, including:

- the speed of manufacturing;
- whether an Operator chooses to base or use aircraft at LLA;
- whether an aircraft is permitted to fly;
- financial situation of an operator and whether they order as many as forecasted; and
- likelihood of manufacturers producing re-engined aircraft.

2.2.11 It is acknowledged that whilst the condition was considered realistic at the time, based on fleet forecasts, the original assumptions have proven to be optimistic, in terms of fleet modernisation, and pessimistic in terms of demand. As such, the expected reductions in noise levels have not been forthcoming to the extent envisaged, and it is taking longer to achieve the mandated noise levels resulting in breaches of Condition 10.

2.2.12 In addition to this, the delay in the manufacturing of Airbus Neo aircraft, due to the unavailability of Pratt and Whitney engines, and the grounding of Boeing 737Max aircraft due to safety concerns, has meant that there are lower numbers of new generation aircraft at LLA compared to the initial assumptions made as part of the 2028 forecast for 18 mppa.

2.2.13 The Applicant is seeking a variation to Condition 10. The proposed variation to Condition 10 seeks to temporarily (until 2024) increase the area enclosed by the contours for daytime and night-time noise. The proposed variation is driven by the occasional breaches during the summer 2017, 2018 and 2019 night-time contour. The daytime contour was exceeded in 2019 by 1.4 $km^2$ at 20.8 $km^2$.

2.2.14 The proposed variation will enable the area enclosed by the 57 dB(A) $L_{Aeq16hr}$ daytime (0700-2300) noise contour shall increase from 19.4 $km^2$ to 21.4 $km^2$; and the area enclosed by the 48 dB(A) $L_{Aeq8hr}$ (2300-0700) night-time noise contour to increase from 37.2 $km^2$ to 44.1 $km^2$for the period up to the end of 2024 (see **Appendix B**).

2.2.15 At the end of the temporary period, Condition 10 will revert back to its current wording.

# 3. EIA Screening Assessment

## 3.1 Introduction

3.1.1 This chapter presents analysis of the extent to which the Proposed Scheme is aligned with Schedules 1 and 2 of the EIA Regulations, and provides an overview of the potential environmental issues associated with the Proposed Scheme.

## 3.2 EIA Screening Methodology

### Schedule 1 or Schedule 2: Applicable Thresholds

3.2.1 The EIA Regulations contain two lists of different types of development projects. This EIA screening assessment seeks to determine whether the Proposed Scheme constitutes EIA development. Regulation 2 of the EIA Regulations defines EIA development as:

- "*Schedule 1 development*" for which an EIA is required in every case; or
- "*Schedule 2 development*" for which an EIA is required only if the particular project in question is *"likely to have significant effects on the environment by virtue of factors such as its nature, size or location*."

3.2.2 Where a development falls within the description of the developments listed within Schedule 2 and exceeds the applicable thresholds and criteria, it must be screened against Schedule 3 to determine whether it is likely to have significant environmental effects.

3.2.3 Additionally, where a development proposal falls within the description of the developments listed within Schedule 2 and falls below the applicable thresholds and criteria, but is located wholly or partly within a 'sensitive area', it must be screened against Schedule 3 to determine whether it is likely to have significant environmental effects.

3.2.4 Development proposals which do not fall under the description of developments within Schedule 2 are not EIA development and therefore EIA is not required.

### Schedule 3: Selection Criteria

3.2.5 Although significance is not defined in detail, Schedule 3 of the EIA Regulations asks Local Planning Authorities to consider the following factors:

- The **characteristics of development** having regard to size; cumulation with other developments, use of natural resources; production of waste; pollution and nuisances; risk of major accidents and/or disasters, including those caused by climate change; and risks to human health;
- The **location of development** having regard to environmentally sensitive geographical areas such as, existing and approved land use; the relative abundance, availability, quality and regenerative capacity of local natural resources; and the absorption capacity of the natural environment; and
- The **characteristics of the potential impact** the likely significant effects of the Proposed Scheme having regard to the magnitude and spatial extent, nature, transboundary nature, intensity and complexity, probability, onset, duration, frequency and reversibility of the impact;

cumulation of the impact with the impact of other existing and/or approved development; and the possibility of effectively reducing the impact.

3.2.6 The Proposed Scheme will be considered against the criteria and thresholds set out in Schedule 1 and 2 along with the selection criteria within Schedule 3, to determine whether likely significant effects are anticipated and as such, whether the Proposed Scheme should be considered EIA development.

## 3.3 EIA Screening Assessment

### Is the Proposed Scheme within Schedule 1 or Schedule 2 of the EIA Regulations?

3.3.1 Consideration of the EIA Regulations determines that the Proposed Scheme does not constitute development falling within Schedule 1 of the EIA Regulations. Schedule 1 developments are large scale projects for which significant effects would be expected and comprise proposals such as new airports and power stations.

3.3.2 The construction of airports with a basic runway length greater than or equal to 2,100m, such as LLA, falls under Schedule 1 (paragraph 7(1)) of the EIA Regulations, and is defined as development requiring EIA. Since the Proposed Scheme does not require any new built development, including the construction of a runway, **it does not fall under any of the categories of Schedule 1**.

3.3.3 The Proposed Scheme would be considered as Schedule 2 development if:

- any part of the Proposed Scheme is to be carried out in a sensitive area; or
- any applicable threshold or criterion in the corresponding part of column 2 of the table in Schedule 2 (see **Table 3.1**) is exceeded or met by the Proposed Scheme.

3.3.4 If deemed to be Schedule 2 development, an EIA is only required if the Proposed Scheme is likely to have significant environmental effects.

3.3.5 The Proposed Scheme does fall within the descriptions of development, and applicable thresholds and criteria, under Part 13(a)(i) and Part 13(b)(i) of Schedule 2. The applicable thresholds set out in Schedule 2, associated with the Proposed Scheme, are reproduced in **Table 3.1**.

Table 3.1 Schedule 2 thresholds and criteria

| Column 1: Description of development | Column 2: Applicable thresholds and criteria |
|---|---|
| **13. Changes and extensions** | |
| ***"(a) Any change to or extension of development of a description listed in Schedule 1 (other than a change or extension falling within paragraph 24 of that Schedule) where that development is already authorised, executed or in the process of being executed."*** | *"Either-*<br><br>*(i) The development as changes or extended may have significant adverse effects on the environment; or*<br><br>*(ii) in relation to development of a description mentioned in a paragraph in Schedule 1 the thresholds and criteria in column 2 of the paragraph of the table applied to the change or extension are met or exceeded."* |
| ***"(b) Any change to or extension of development of a description listed in paragraphs 1 to 12 of column 1 of this table, where that development is already authorised, executed or in the process of being executed."*** | *"Either-*<br><br>*(i) The development as changed or extended may have significant adverse effects on the environment; or* |

| Column 1: Description of development | Column 2: Applicable thresholds and criteria |
|---|---|
| | *(ii) in relation to a development of a description mentioned in column 1 of this table, the thresholds and criteria in the corresponding part of column 2 of this table applied to the change or extension are met or exceeded."* |

Source: Extract from the Town and Country Planning (Environmental Impact Assessment) Regulations 2017

3.3.6 However, the Proposed Scheme is neither wholly nor partially located within a 'Sensitive Area', defined in paragraph 2 of the EIA Regulations. 'sensitive areas' comprise: SSSIs; National Parks; the Broads; Areas of Outstanding Natural Beauty (AONB); World Heritage Sites; scheduled monuments; and European sites.

3.3.7 Notwithstanding the above appraisal, the Proposed Scheme has been considered against Schedule 3 of the EIA Regulations, namely whether it can be considered Schedule 2 development because it will be likely to give rise to significant effects on the environment "*by virtue of factors such as the development's nature, size or location*".

## Is the Proposed Scheme Likely to Result in Significant Adverse Environmental Effects?

3.3.8 The following sections of this Screening Report present further details in line with the criteria set out in Schedule 3 (see paragraph 3.2.5), as well as the environmental factors set out within the EIA Regulations, to help determine whether significant environmental effects are likely to result from the Proposed Scheme. **Table 3.2** lists the environmental factors which have been appraised within this Screening Report.

Table 3.2 Environmental factors appraised

| Factor | Where the factor is considered within this Screening Report (Section 3.3) |
|---|---|
| **Population** | **Human Health;** and<br>**Socio-Economic;** |
| **Human health** | **Human Health;**<br>**Air Quality;** and<br>**Noise and Vibration** |
| **Biodiversity** | **Biodiversity;**<br>**Air Quality;** and<br>**Noise and Vibration** |
| **Land** | **Ground Conditions** |
| **Soil** | **Ground Conditions** |
| **Water** | **Ground Conditions;** and<br>**Water Resources and Flood Risk** |
| **Air** | **Air Quality;** and<br>**Transport** |
| **Climate** | **Climate Change (including Greenhouse Gases and Climate Resilience)** |
| **Material assets** | **Climate Change (including Greenhouse Gases and Climate Resilience);** |

| Factor | Where the factor is considered within this Screening Report (Section 3.3) |
|---|---|
| | **Ground Conditions;**<br>**Historic Environment;**<br>**Transport;**<br>**Waste and Resource Use ;** and<br>**Water Resources and Flood Risk** |
| **Cultural heritage** | **Historic Environment** |
| **Landscape** | **Landscape and Visual** |
| **Major Accidents and Disasters** | **Major Accidents and Disasters** |
| **Waste and Resource Use** | **Waste and Resource Use** |
| **Interaction between the above factors** | **Cumulative Effects** |
| **Cumulation with other projects** | **Cumulative Effects** |

Source: Wood Plc, 2020

## Air Quality

### Baseline

*Human receptors*

3.3.1 There are residential properties north of LLA on Eaton Green Road, about 1.2 km from the runway but only a few hundred metres from aircraft aprons, and a few tens of metres from car parks. There are two schools further to the north, and isolated properties to the east and south of LLA.

3.3.2 There are four Air Quality Management Areas (AQMA) near LLA (see **Appendix A**, **Figure 3**), namely:

- a cluster of 24 Residential properties on either side of the M1, near Junction 11;
- a cluster of 431 Residential properties on either side of the M1, near Junction 11;
- from Dunstable Road by Kenilworth Road through to Stuart Street and Chapel Viaduct by Latimer Road, including Castle Street to Holly Street and Telford Way; and
- Dunstable Town Centre, the A505 from the town centre to the junction of Poynters Road/Dunstable Road, the A5 from Union St to Borough Road, and the B489 - West St from the town centre to St Marys Gate.

3.3.3 Monitoring data presented within the LBC 2019 Air Quality Annual Status Report[3], suggests that at residential properties near Eaton Green Road, annual mean $NO_2$ concentrations are typically in the range 20–30 µg $m^{-3}$. These properties are set back from the road, mostly at least 20 m from the kerb. Concentrations at LN23[3], next to the junction of Mistletoe Hill with Eaton Green Road, are in the 30s but adjusting for distance to relevant exposure the modelled concentrations are about 30 µg $m^{-3}$.

[3] Luton Borough Council (2019). Air Quality Annual Status Report, June 2019 [online]. Available at: https://www.luton.gov.uk/Environment/Environmental%20health/Air_pollution_2/Air%20Quality/Pages/Pollution%20control%20-%20air_2.aspx [Accessed 12 May 2020].

3.3.4 At properties in the Dunstable Road AQMA, monitored concentrations adjusted for distance to relevant exposure are up to 43 µg $m^{-3}$ at LN52[3] (next to the junction of Cardigan Street with Dunstable Road), with other concentrations in the 30s. At properties in the M1 AQMA, monitored concentrations adjusted for distance to relevant exposure are up to 42 µg $m^{-3}$ at LN86 (Bradley Road), with other concentrations in the 20s and 30s.

3.3.5 The 2012 consented scheme[4] modelled annual mean $NO_2$ concentrations at selected receptors in 2017 assuming no improvement in road vehicle emission factors. Although conservative, this was a reasonable assumption. This predicted an exceedance at the junction of Hitchin Road and Vauxhall Way, where levels were measured at 47.9 µg $m^{-3}$, and high concentrations at Eaton Green Road, where levels were measures at 39.6 µg $m^{-3}$; although the latter is several metres from relevant exposure.

*Ecological receptors*

3.3.6 Background concentrations of annual mean $NO_x$ are about 20 µg $m^{-3}$ or less outside the urban area of Luton.

3.3.7 There are no Special Areas of Conservation (SACs), Special Protection Areas (SPAs) or Ramsar sites within 10 km of LLA, and there are no SSSIs within 2 km of LLA, or within 200 m of any roads that are likely to experience a significant increase in road traffic. There are ancient woodland sites and non-designated biodiversity sites within 2 km of the Proposed Scheme (see **Section 3.3: Biodiversity**).

### Likely Significant Effects

3.3.8 The principal pollutants of concern are nitrogen dioxide ($NO_2$) for human receptors, and oxides of nitrogen ($NO_x$), nitrogen deposition and acid deposition for ecological receptors. Other pollutants such as $PM_{10}$, $PM_{2.5}$ and $SO_2$ will be emitted in small quantities but are much less unlikely to be significant.

3.3.9 There are no construction or demolition activities planned as part of the Proposed Scheme, so there will be no additional dust impacts. Additional odour impacts are not expected to be significant.

*Human receptors*

3.3.10 The percentage of increased aircraft and on-airport activity is likely to be minor, and given the background concentrations, the impact at the most exposed receptors is likely to be "slight" or at most "moderate" (as defined in guidance from the Institute of Air Quality Management (IAQM) and Environmental Protection UK (EPUK)[5]), and of low overall significance.

3.3.11 With the above considerations taken into account it is concluded that the Proposed Scheme would not result in a significant air quality effect at air quality sensitive receptors.

3.3.12 Guidance from IAQM/EPUK suggests that a detailed assessment is required where road traffic flows increase by more than 100 light-duty vehicles per day in or near an AQMA, or 500 per day elsewhere. The increase in traffic will exceed this criterion on some links.

3.3.13 Overall, it is considered that a detailed Air Quality Assessment will be required to accompany the Planning Application.

[4] Air Quality Consultants, Technical Appendix B: London Luton Airport – Air Quality Assessment Methodology, December 2012.
[5] IAQM/EPUK (2017). Land-Use Planning & Development Control: Planning for Air Quality, January 2017.

*Ecological receptors*

3.3.14 In view of the distance of important ecological sites from the Proposed Scheme (including road traffic), it is not considered that there will be likely significant effects on ecological receptors.

3.3.15 The potential for likely significant effects on ecological receptors was screened out from assessment in the 2012 consented scheme, and the reasons remain the same for the 19 mppa scenario.

## Biodiversity

### Baseline

3.3.16 LLA is dominated by buildings, other airport infrastructure, areas of hardstanding, such as carparks, the runway and taxiways, and grassland and small areas of scrub. Either side of the runway are areas of grassland. The southern and eastern edges of LLA are bordered by green fields and trees, some of which is deciduous woodland. There are some areas of ancient woodland within 2 km of LLA, mainly to the south with the closest (Winch Hill Wood) adjacent to the eastern boundary.

3.3.17 There are no designated sites of nature conservation interest such as, Local Nature Reserves (LNRs), National Nature Reserves (NNRs), SSSI, SPAs, SACs or Ramsar sites within 2 km of LLA (**Appendix A**, **Figure 2**). The closest designated site, Galley and Warden Hills SSSI, is located approximately 4.5 km north-west of LLA and the SSSI Impact Risk Zone[6], where there may be likely effects on the SSSI, extends into the northern section of LLA[7]. Planning proposals within this zone will include consultation with Natural England on likely risks, so as to safeguard the SSSI. The Galley and Warden Hills SSSI has been designated for calcareous grassland and plants, which are not considered to be sensitive to changes in noise.

3.3.18 Knebworth Woods SSSI is located approximately 8.3 km towards the east of LLA at its closest point, within the 19 mppa noise contour. The qualifying feature of Knebworth Woods is almost all ancient in origin and is ecologically diverse with rides, ponds and small areas of both acidic and neutral grassland.

3.3.19 There are a number of non-designated sites within 2 km of LLA, including eight County Wildlife Sites (CWS), the closest of these being Winch Hill Wood CWS. This is an area of secondary woodland that lies east of LLA.

### Likely Significant Effects

3.3.20 Whilst there are a number of ecological designations within close proximity to LLA, it is likely that aircraft will be at a sufficient height and distance at these locations whereby emitted noise is low enough to be considered as to not have a significant effect. As such, there is unlikely to be a change in adverse effects on the ecological environment that would require further consideration.

3.3.21 There are no material changes proposed, which seek to alter the overall quantum of built development. In addition, the increase in ATMs as a result of the increase in passengers would be minor and the direction of flights will remain the same, so there will be no change to the spatial pattern of ATMs (see **Section 2.2**).

[6] Natural England SSSI Impact Risk Zone, [online]. Available at: https://data.gov.uk/dataset/5ae2af0c-1363-4d40-9d1a-e5a1381449f8/sssi-impact-risk-zones [Accessed 11 May 2020].
[7] Defra (2018). Magic Map Application, [online]. Available at: https://magic.defra.gov.uk/MagicMap.aspx [Accessed 11 May 2020].

3.3.22 The results of the screening assessment for noise in **Section 3.3: Noise and Vibration** have shown that there would be a negligible impact from the increase to 19 mppa from 18 mppa from in-air and ground aircraft noise and road traffic noise. There will, therefore, only be a negligible change to the noise environment at designated and non-designated biodiversity sites.

3.3.23 The results from the screening assessment for air quality in **Section 3.3: Air Quality** have shown that it is considered that there will not be a significant impact on ecological receptors.

3.3.24 As such, the Proposed Scheme is not expected to result in any likely significant adverse effects requiring further assessment in relation to biodiversity. No further assessment is required.

## Climate Change (including Greenhouse Gases and Climate Resilience)

3.3.25 Climate change resilience, i.e. the effect of climate change on the Proposed Scheme and on receptors that may be affected by the Proposed Scheme, has been considered. Since the Proposed Scheme does not include any new infrastructure (buildings, roads etc.), there is considered to be no material change to the existing site. It is therefore assumed that there is no requirement for a standalone climate change resilience assessment, and it is therefore screened out and not considered further in the following sections of this chapter. The remainder of this section focuses on greenhouse gas (GHG) emissions i.e. the effect of the Proposed Scheme on climate change.

### Baseline

3.3.26 There are two sets of baseline conditions relevant to the GHG assessment:

- the GHG emissions associated with the Proposed Scheme itself; and
- the projected GHG emissions from the UK aviation sector, and within this, the extent of emissions from LLA as a whole.

3.3.27 Given the only receptor for GHG emissions is the global climate, the zone of influence of the emissions from the Proposed Scheme is effectively the Earth system.

3.3.28 The primary source of guidance for carbon and other GHGs is the IEMA *Environmental Impact Assessment Guide to Assessing Greenhouse Gas Emissions and Evaluating their Significance*[8]. This guidance states that all GHG emissions have the potential to be significant given the global effects of climate change.

3.3.29 The *Luton Local Plan*[9] sets out strategic objectives in a number of areas including climate change. Policy LLP6 relates specifically to LLA and sets out requirements for Airport Expansion. This includes:

*"Proposals for expansion of the airport and its operation will only be supported where.....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."*

[8] IEMA (2017). Environmental Impact Assessment Guide to: Assessing Greenhouse Gas Emissions and Evaluating their Significance. Available online: https://www.iaia.org/pdf/wab/EIA%20Guide_GHG%20Assessment%20and%20Significance_IEMA_16May17.pdf [Accessed 11 May 2020].

[9] Luton Borough Council (2011). The Luton Local Plan. Available online: https://www.luton.gov.uk/Environment/Planning/Regional%20and%20local%20planning/Pages/Local%20Plan%202011%20-%202031.aspx [Accessed 11 May 2020].

3.3.30 Policy LLP31 also sets out requirements for sustainable transport options for developments seeking planning permission. This policy specifically states:

*"Support for the continued economic success of London Luton Airport as a transport hub (policy LLP6) will be delivered through:*

- *...continued enhancement of sustainable modes of transport via the Airport Surface Access Strategy."*

3.3.31 LBC published a draft climate change action plan in January 2020.[10] This sets out a commitment to aim *"for net zero carbon in advance of the national target in 2050"* with a *"2040 target"* for the council operations including increasing carbon sequestration efforts. A borough-wide carbon reduction plan will be developed over the next year. As part of the climate change action plan, the Local Plan will be reviewed in the near future. It will consider exacting environmental standards for new developments by setting parameters for zero carbon development and providing significant improvements in air quality in the borough.

### Likely Significant Effects

3.3.32 In-line with IEMA guidance[8], all GHG emissions from the Proposed Scheme are considered potentially significant. Therefore, on the basis of the ANPS[11], which contains the most recent policy guidance for UK airports, despite its geographical limitations, the following emission sources are calculated:

- GHG emissions from non-aviation operations of the Proposed Scheme, including surface access; and
- GHG emissions from aviation operations associated with the Proposed Scheme.

3.3.33 It is assumed that emissions from constructing the Proposed Scheme, including embodied carbon are zero since there is no new infrastructure proposed.

3.3.34 Since the Proposed Scheme will result in a larger number of vehicle movements, ATMs and the potential for increased energy consumption of the existing buildings, a standalone Carbon and Other GHG Assessment will be undertaken. This will assess the increase in emissions and provide details of embedded mitigations to reduce emissions as a result of the Proposed Scheme.

3.3.35 Given the submission of the standalone Carbon and Other GHG assessment, a GHG assessment alone does not trigger the preparation of an EIA.

3.3.36 It should be noted that the IEMA guidance[8] states that *"Where an EIA is to be undertaken based on other factors. It is envisaged that the assessment would include greenhouse gas emissions at the scoping stage as a matter of good practice."* Therefore, if the preparation of an EIA is triggered from any other topic, it is good practise to also consider a GHG assessment at scoping.

[10] LBC (2020). Climate change, [online]. Available at: https://www.luton.gov.uk/Environment/Pages/Climate-change.aspx [Accessed 20 May 2020].
[11] Department for Transport (2018). Airports National Policy Statement, [online]. Available at: https://www.gov.uk/government/publications/airports-national-policy-statement [Accessed 11 May 2020]

## Ground Conditions

### Baseline

3.3.37 The British Geological Society[12] (BGS) characterises the bedrock geology of LLA as predominantly Lewes Nodular Chalk Formation and Seaford Chalk Formation formed between 93.9 and 83.6 million years ago during the Cretaceous period. The BGS characterises the superficial deposits as predominantly Clay-with-flints Formation – Clay, silt, sand and gravel that were formed between 23.03 million and 11.8 thousand years ago during the Neogene and Quaternary period.

3.3.38 LLA is designated as a Principal aquifer for bedrock and predominantly Unproductive aquifer for superficial drift. The groundwater vulnerability of LLA is classified as Major High to Intermediate. The soil scape is slightly acid loamy and clayey soils with impeded drainage.[7]

3.3.39 The northwest of LLA is located within a designated Zone 3 (total catchment) Source Protection Zone (SPZ). Within 2 km there are two areas that are groundwater Drinking Water Safeguard Zones; the Kings Walden Drinking Water Safeguard Zone is within the north-west airport boundary and Crescent Road is 0.4 km to the north-east of LLA. There is one surface water Drinking Water Safeguard Zone (Cookham Teddington and Wey) within 2 km, to the south-west of LLA. LLA is also located within a Surface Water Nitrate Vulnerable Zone.[7]

### Likely Significant Effects

3.3.40 Since there are no material changes proposed that seek to alter the overall quantum of built development and no construction activities likely to disturb ground conditions, it is not expected that there will be any adverse effects requiring further assessment in relation to ground conditions and the risk of hazardous substance during operation will remain as present.

## Historic Environment

### Baseline

3.3.41 There are three Grade I listed buildings within 2 km of LLA; the Parish Church of St Mary, which is located 1.4 km west of LLA, Luton Hoo 1.6 km south-west and the associated Garden Houses and Retaining Walls to Terraced Gardens. Additionally, there is one Grade II* listed building; the Old Homestead, 1.2 km east of LLA and there are 89 Grade II listed buildings within 2 km of LLA. The closest of these is the Wigmore Hall Farmhouse, approximately 0.4 km north-east of LLA (**Appendix A**, **Figure 2**).

3.3.42 LBC has declared three commercial use conservation areas all of which are within 2 km of LLA; High Town Road is 1.8 km west, Plaiters Lea is 1.7 km west and the Town Centre is 1.7 km west. There are an additional two, primarily residential conservation areas, one of which is within 2 km of LLA (Luton South is 1.6 km south-west)[13].

3.3.43 There is also one Scheduled Monument within 2 km of LLA; Someries Caste which is located on the southern boundary of LLA. The Luton Hoo Grade II* Registered Park and Garden is located

[12] British Geological Society (2019). Geology of Britain viewer. Available online: http://mapapps.bgs.ac.uk/geologyofbritain3d/index.html [Accessed 11 May 2020].
[13] Luton Borough Council (2018) Conservation Areas, [online] Available at: https://www.luton.gov.uk/Environment/Planning/Conservation,%20design%20and%20trees/pages/Conservation%20and%20urban%20design%20planning%20-%20conservation%20areas.aspx [Accessed 11 May 2020].

approximately 0.1 km southwest of LLA and the Putteridge Bury Grade II Registered Park and Garden is located 1.6 km north of LLA (**Appendix A**, **Figure 2**).

3.3.44 There are no designated heritage assets within the boundary of LLA and there are no other statutory or non-statutory historic environment designations within 2 km of LLA.

3.3.45 There are no World Heritage sites or registered battlefields within 10 km of LLA. The nearest World Heritage Sites are approximately 45 km south of LLA, sited along the banks of River Thames in central London.

3.3.46 LLA is a former World War II (WWII) military airfield which was operated by the Royal Air Force (RAF) and was home to the 264 Fighter Squadron.

### Likely Significant Effects

3.3.47 There are no material changes proposed, which seek to alter the overall quantum of built development. In addition, the increase in ATMs as a result of the increase in passengers would be minor and the direction of flights will remain the same, so there will be no change to the spatial pattern of ATMs (see **Section 2.2**).

3.3.48 The results of the screening assessment for noise in **Section 3.3: Noise and Vibration** have shown that there would be a negligible impact from the increase to 19 mppa from 18 mppa from in-air and ground aircraft noise and road traffic noise. There will, therefore, only be a negligible change to the noise environment at designated sites.

3.3.49 The nature of the Proposed Scheme will not directly affect a listed building or Schedule Monument setting. There are therefore no additional significant adverse effects that would require further consideration in relation to the historic environment. No further assessment is required.

## Human Health

### Baseline

3.3.50 The health of people in Luton is generally worse than the England average. Luton is one of the 20% most deprived districts / unitary authorities in England and about 19% (9,960) of children live in low-income families.[14]

3.3.51 Life expectancy for both men and women is significantly worse than the England average. Life expectancy is 9.7 years lower for men and 4.1 years lower for women in the most deprived areas of Luton compared to the least deprived areas.[14]

3.3.52 In Year 6 Primary Schools, 25.9% (811) of children are classified as obese, significantly worse than the average for England. Levels of GCSE attainment are worse than the England average.

3.3.53 The rate of alcohol-specific hospital stays among those under 18 is 12 per 100,000 population, better than the average for England. This represents seven stays per year.[14]

3.3.54 The rate of alcohol-related harm hospital stays for adults is 772 per 100,000 population, significantly worse than the average for England. This represents 1,392 stays per annum. The rate of self-harm hospital stays is 188 per 100,000 population. This represents 420 stays per annum. Estimated levels of adult physical activity are worse than the England average. Rates of people

[14] Public Health England (2019). Luton health profile 2019, [online]. Available at: https://fingertips.phe.org.uk/profile/health-profiles [Accessed 11 May 2020].

killed and seriously injured on roads are better than average. Mortality rates are significantly worse than the England average for all causes, cardiovascular disease and cancers.[14]

3.3.55 Strategic noise mapping using national calculation methods and using data supplied by local authorities to model the percentage of the population exposed to road, rail and air transport noise of 55 dB and 65 dB between 07:00 - 23:00, shows that Luton is lower than the national average and most neighbouring boroughs (percentage of residents affected by noise above 65 dB is lower in Luton than in Slough, Birmingham, Wolverhampton, Hillingdon and Redbridge; the percentage of residents affected by noise above 55 dB in Luton is also lower, except for Wolverhampton).[15]

3.3.56 The rate of complaints from Luton residents is below the England average (Slough and Birmingham have lower rate of complaints; Wolverhampton, Hillingdon and Redbridge have a higher rate compared to Luton).[15]

### Likely Significant Effects

3.3.57 Whilst passenger numbers are anticipated to grow, the increase in ATMs would be minor and the direction of flights will remain the same, so there will be no change to the spatial pattern of ATMs (see **Section 2.2**). The results of the screening assessment for noise in **Section 3.3: Noise and Vibration** have shown that there would be a negligible impact from the increase to 19 mppa from 18 mppa from in-air and ground aircraft noise, and road traffic noise.

3.3.58 As set out in **Section 3.3: Air Quality**, the Proposed Scheme would not result in a significant air quality effect at air quality sensitive receptors. But with exceedances of IAQM/EPUK traffic flow criterion on some links, it is considered that a detailed Air Quality Assessment will be required to accompany the Planning Application.

3.3.59 Aircraft air noise occurs principally from aircraft arriving and landing, and from aircraft departing and taking off. Noise is also produced by aircraft on the ground. This occurs when aircraft are on the runway for State of Readiness, after landing on the runway, and when using reverse thrust for breaking.

3.3.60 The proposed variation Condition 10 is expected to increase noise levels by 1 dB for people living and visiting areas affected by aircraft noise from LLA.

*Change in the number of dwellings affected between the current and the proposed variation to Condition 10*

3.3.61 For the current Condition 10 and the proposed variation to Condition 10, the noise assessment has reported an increase in the number of residents affected by daytime noise that is between 51-62 dB $L_{Aeq, 16hr}$ (considered the level of noise exposure above which adverse effects on health and quality of life can be detected), and night-time noise that is between 45-53 dB $L_{Aeq, 8hr}$ (considered the level of noise exposure above which significant adverse effects on health and quality of life occur).

3.3.62 It is estimated that 10,045 additional dwellings will be affected by daytime noise levels between 51 and 62 dB $L_{Aeq, 16hr}$, and an additional 24,807 dwellings affected by night-time noise levels between 45 and 53 dB $L_{Aeq, 8hr}$.

3.3.63 It is estimated that an additional 443 dwellings will be exposed to noise at or above 63 dB $L_{Aeq, 16hr}$, during the daytime, and an additional 2,887 dwellings exposed to noise at or above 54 dB $L_{Aeq, 8hr}$, during the night-time.

[15] Luton Borough Council (2015). Luton's joint strategic needs assessment 2015, [online]. Available at: https://www.luton.gov.uk/Council_government_and_democracy/Lists/LutonDocuments/PDF/CPC/7-Joint-Strategic-Needs-Assessment-2015.pdf [Accessed 11 May 2020].

*Change in the number of dwellings affected between 2011 (baseline year) and 2019 (worst-case year)*

3.3.64 For daytime noise exposure, in 2011 an estimated 61,056 dwellings were exposed to aircraft noise between 51-62 dB $L_{Aeq, 16hr}$. This is estimated to have increased to 75,092. Therefore, the local community exposed to aircraft noise between 51-62 dB $L_{Aeq, 16hr}$, is estimated to increase dwelling numbers by 14,036 compared to 2011.

3.3.65 In 2011, an estimated 940 dwellings were exposed to daytime aircraft noise between 63 - 68 dB $L_{Aeq, 16hr}$, which is estimated to increase by 797.

3.3.66 For night-time noise exposure, in 2011, an estimated 69,082 dwellings were exposed to aircraft noise between 45-53 dB $L_{Aeq, 8hr}$. This is estimated to have increased to 95,678. Therefore, the number of dwellings exposed to aircraft noise between 45-53 dB $L_{Aeq, 8hr}$, is estimated to increase by 26,596.

3.3.67 In 2011, an estimated 3,489 dwellings were exposed to aircraft noise at or above 54 dB $L_{Aeq, 8hr}$, which is estimated to increase by 4,575.

*Health effects due to the change in noise exposure across the affected residential population*

3.3.68 The increase in noise exposure at the population level is likely to lead to some additional cases of hypertension, stroke, ischaemic heart disease and dementia. These additional cases are likely to represent a small fraction of the existing baseline rates for these health outcomes. Furthermore, the increased noise exposure is also likely to lead to additional annoyance and sleep disturbance within the exposed population.

*Sensitivity of the affected residential population*

3.3.69 Taking account of the existing health status of communities affected by the increase in noise, residents are judged to have a sensitivity that varies between low and high during both daytime and night-time. The health baseline shows that residents in Luton experience a range of existing health burdens. This means they have a shorter life expectancy, higher levels of mortality and morbidity from non-communicable diseases, and slightly lower levels of good mental health and wellbeing. Sensitivity is therefore low for some residents, and medium or high for others.

*Significance of the health effects across the affected residential population: 51-62 dB $L_{Aeq,16hr}$ and 45-54 dB $L_{Aeq,8hr}$*

3.3.70 For those residents experiencing noise levels between 51-62 dB $L_{Aeq,16hr}$ (daytime) and 45 – 54 dB $L_{Aeq,8hr}$ (night-time), while at the individual level the change in exposure is small (<1 dB), across the whole affected population and considering the additional population that is affected, this results in a magnitude of change that is judged to be minor to moderate. This takes into account an increase in noise exposure indoors and associated health effects (including with windows open and closed) and outdoors (changing the amenity value of public spaces); a minor magnitude of change on children's learning and cognition outdoors (outdoor play is an important part of children's learning) and a minor magnitude of change on social capital through a small reduction in helpful behaviours.

3.3.71 Those residents experiencing changes at the lower level of the range e.g. 51-53 dB $L_{Aeq,16hr}$ may experience a lower magnitude of change. Therefore, for those residents experiencing daytime noise levels between 51-62 dB $L_{Aeq,16hr}$, and night-time noise levels between 45-54 dB $L_{Aeq,8hr}$, the significance of the effect is judged to be a minor-moderate impact given the higher number of people affected at these noise levels and the larger aggregate population health effect that is likely to be experienced.

*Significance of the health effects across the affected residential population at or above 63dB $L_{Aeq,16hr}$ daytime and at or above 55 dB $L_{Aeq,8hr}$ night-time*

3.3.72 For those residents experiencing daytime noise levels at or above 63 dB $L_{Aeq,16hr}$ and night-time noise levels at or above 55 dB $L_{Aeq,8hr}$, the change in noise exposure is above the Significant Observed Adverse Effect Level (SOAEL). The magnitude of change is therefore moderate. This takes account of the more disruptive effect of noise during sleep and consequent effects on work performance and learning because of lower quality sleep and the higher occurrence of health effects at these higher exposure levels. As such, it is considered that there is a likely significant adverse impact.

3.3.73 Therefore, for those residents experiencing daytime noise levels at or above 63 dB $L_{Aeq,16hr}$ and at or above and night-time noise levels at or above 55 dB $L_{Aeq,8hr}$ before mitigation, the significance of the heath effect is judged to be moderate-large. As such, it is considered that there is a likely significant adverse impact.

3.3.74 For residents experiencing this level of noise, LLAOL will provide mitigation (**Section 3.3: Noise and Vibration** ). This is likely to reduce the noise exposure indoors to a large extent and therefore noise levels would result in a moderate significant health effect upon the residential population. However, the increase in noise levels would continue to be experienced when windows are open and when residents are outdoors.

*Significance of the health effects across the affected worker and visitor population*

3.3.75 For those workers and visitors experiencing daytime noise levels between 51-62 dB $L_{Aeq,16hr}$ and night-time noise levels between 45-54 dB $L_{Aeq,8hr}$, the sensitivity of these two groups is low. This is because workers and visitors are affected for relatively short periods of time (usually 8 hours or less). Though there is no estimate of the numbers of workers or visitors affected, it is likely that the magnitude of change is minor for workers and visitors because they have a specific reason to be in the area with immediate short-term benefits (e.g. workers receive an income for the work they do, visitors come for a reason to visit a site or meet family or friends). This is likely to make it easier for them to adapt to or not discern small increases in noise. Therefore, for those workers and visitors experiencing daytime noise levels between 51-62 dB $L_{Aeq,16hr}$ night-time noise levels between and 45-53 dB $L_{Aeq,8hr}$, the significance of the heath effect is judged to be neutral-slight.

3.3.76 For those workers and visitors experiencing daytime noise levels at or above 63 dB $L_{Aeq,16hr}$ and night-time at or above at or above 55 dB $L_{Aeq,8hr}$, the higher level of noise experienced means that the sensitivity of these two groups is medium. This is because workers and visitors are affected for relatively short periods of time (usually 8 hours or less). Although there is no estimate of the numbers of workers or visitors affected, it is likely that the magnitude of change is minor for these groups.

3.3.77 Therefore, for those workers and visitors experiencing daytime noise levels at or above 63 dB $L_{Aeq,16hr}$, and night-time noise levels at or above at or above 55dB $L_{Aeq,8hr}$, the significance of the heath effect is judged to be slight.

*Significance of the health effects across the noise-sensitive facilities*

*3.3.78* Noise sensitive non-residential facilities such as schools, nursing homes and hospitals are judged to have high sensitivity. The change in noise is between +1 dB and therefore, the magnitude of change is judged to be minor. Hospitals and nursing homes are likely to experience a minor change in magnitude. Schools could experience a moderate magnitude of change when taking account of

children's activities outdoors in school playgrounds and playing fields. The significance of the effect on noise-sensitive non-residential facilities is judged to be slight-moderate.

*Summary*

3.3.79 Overall, provided that mitigation is implemented, the health effects related to a change in noise exposure as a result of the Proposed Scheme are likely to have a slight-moderate significant adverse effect at the population level.

## Landscape and Visual

### Baseline

3.3.80 LLA sits on a plateau, which falls steeply away to the east and west, leading to the narrow valleys of Whiteway Bottom and the Upper Lee Valley, where there is a relative change in ground levels of 35 m.

3.3.81 There are various open space types within the area surrounding LLA. Green Belt open space is adjacent to LLA with large areas of agricultural land and woodland. Wigmore Valley Park CWS is also adjacent to LLA, including open grassland and mature trees. There are multiple areas of ancient natural woodland within 2 km of LLA (**Appendix A, Figure 2**). The closest of these include, Winch Hill Wood, which is adjacent to the eastern boundary, Withstocks Wood, which is 0.6 km south, and George Wood, which is 0.9 km south of LLA.

3.3.82 Furthermore, Luton Hoo Registered Park and Garden is located approximately 0.1 km south-west and includes: large size open and closed species characterised by ancient woodland, scattered mature trees, lakes, walled garden and an 18-hole golf course, all of which sit within metropolitan green belt (**Appendix A, Figure 2**).

3.3.83 LLA is situated within the Chilterns National Character Area (NCA). This NCA is characterised by wooded and farmed landscaped underlain by chalk bedrock.[16] The Chilterns AONB is located approximately 3 km north and 4.7 km to the west of LLA. This AONB contains a number of important habitats, including grassland and beech woodland and a landscape of prehistoric traces, such as the great dyke of Grim's Ditch and the ancient Ridgeway.[17]

### Likely Significant Effects

3.3.84 There are no material changes proposed, which seek to alter the overall quantum of built development. In addition, the increase in ATMs as a result of the increase in passengers would be minor and the direction of flights will remain the same, so there will be no change to the spatial pattern of ATMs (see **Section 2.2**).

3.3.85 It should be acknowledged that there will be a slight increase in the extent of the 57 dB daytime noise contour over the Chilterns AONB for the 2021 19 mppa scenario, however there will be a decrease in the 2028 19 mppa scenario. Nonetheless, the results of the screening assessment for noise in **Section 3.3: Noise and Vibration** have shown that there would be a negligible impact from the increase to 19 mppa from 18 mppa from in-air and ground aircraft noise and road traffic

[16] Natural England (2013). NCA Profile: 110 Chilterns (NE406), [online]. Available at: http://publications.naturalengland.org.uk/publication/4977697?category=587130 [Accessed 11 May 2020].
[17] Landscapes for Life (2018). The Chilterns AONB, [online] Available at: https://landscapesforlife.org.uk/about-aonbs/aonbs/chilterns [Accessed 11 May 2020].

noise. There will, therefore, only be a negligible change to the noise environment at designated sites.

3.3.86 Consequently, in relation to landscape and visual effects, the Proposed Scheme is not expected to result in any likely significant adverse effects. No further assessment is required.

## Major Accidents and Disasters

### Baseline

*3.3.87* LLA is an operational international airport. As part of their health and safety policy, LLAOL "*actively encourage all employees and third parties to report all accidents, incidents, near misses, hazardous observations…"*[18].

3.3.88 The Civil Aviation Authority (CAA) are the UK's aviation regulator and ensure that the aviation industry meets the highest safety standards. Basic international regulations are set by the International Civil Aviation Organisation (ICAO) and within Europe much of the safety regulations are set by the European Aviation Safety Agency (EASA).

3.3.89 For every 287 million passengers carried by UK operators, there is an average of one fatality. This can be compared with a one in 19 million chance of being struck and killed by lightning in the UK or a one in 17,000 chance of being killed in a road accident. Despite the UK's excellent safety record, the CAA are still active in identifying potential causes of accidents and reducing their likelihood so that safety can be continuously improved.[19]

3.3.90 The airport is not located within an area known for extreme adverse weather and is in a Flood Zone 1 area, so is at low risk of flooding (i.e. less than 0.1% chanced of flooding in any year).

3.3.91 There is low to moderate risk of unexploded ordnance (UXO) within and surrounding LLA; the former RAF airport was a Luftwaffe target during WWII. Nonetheless, there are no UXO finds within the vicinity of LLA.[20]

3.3.92 The Preliminary Risk Assessment undertaken in 2017[21] identifies one current Control of Major Accident Hazards (COMAH) lower tier operatory site within the LLA boundary; this is a fuel storage / distribution establishment licensed to Shell UK Oil Products Ltd. Although substances used or stored by such establishments can be dangerous, they are strictly regulated by the COMAH Regulations so as to reduce risks to workers and the public, and thus are unlikely to be a source of major accident or disaster.

### Likely Significant Effects

3.3.93 Since there are no material changes proposed that seek to alter the overall quantum of built development, there will not be any adverse effects associated with construction and the risk of hazardous substance during operation will remain as present.

[18] LLAOL (2018). Health and Safety Policy. Available online: https://www.london-luton.co.uk/corporate/health-safety-matters [Accessed 11 May 2020].
[19] CAA (2020). Aviation safety, [online]. Available at: https://www.caa.co.uk/Consumers/Guide-to-aviation/Aviation-safety/ [Accessed 11 May 2020].
[20] Zetica UXO (2020). Risk Maps, [online]. Available at: https://zeticauxo.com/downloads-and-resources/risk-maps/ [Accessd 11 May 2020].
[21] Over Arup and Partners Ltd (2017). Luton Airport Mass Passenger Transit System Land Contamination Preliminary Risk Assessment.

3.3.94 The slight increase in ATMs is unlikely to impact the likelihood of major accidents and disasters as the risk of aircraft accidents is extremely low and the airport will continue to operate under the same licensing controls e.g. CAA, ICAO and EASA.

3.3.95 A Transport Assessment (TA) will accompany the planning application and will take into account the effect of traffic associated with the Proposed Scheme, and propose if necessary, any environmental measures to ensure safety of the network.

## Noise and Vibration

### Baseline

*Receptors*

3.3.96 The closest receptors are isolated residences to the south of the runway. The nearest densely populated areas to LLA are suburbs of Luton directly north of the airport carparking. There are several small villages within relatively close proximity. Breachwood Green, Bendish and Whitwell are located to the east and are affected by easterly departures and westerly arrivals. Residential areas to the west beyond Luton, such as Slip End, Caddington and Markyate are affected by easterly arrivals or westerly departures. Residences are affected by road traffic noise along the A1081 near the junction with London Road and the overpass of The Luton Drive, Vauxhall Way, Eaton Green Drive and there has been recent residential development on Kimpton Road.

3.3.97 Non-commercial receptors include educational and medical premises interspersed in Luton and nearby villages. There are no Special Areas of Conservation (SACs), Special Protection Areas (SPAs) or Ramsar sites within 10 km of LLA, and there are no SSSIs within 2 km of LLA (see **Section 3.3: Biodiversity**).

*Noise environment*

3.3.98 LLA regularly undertakes noise mapping assessments as part of their obligations under *The Environmental Noise (England) Regulations 2006 (as amended)*[22]. In addition to aircraft noise, the local noise environment is influenced by road traffic noise and isolated commercial activities.

### Likely Significant Effects

3.3.99 As existing or permitted infrastructure is able to accommodate the increase from 18 mppa to 19 mppa, there would be no new or additional development required at LLA. This means that there will be no construction noise or vibration effects, and nor will there be any impacts from new building services plant.

*Methodology for Assessing Significant Effects*

3.3.100 The determination of likely significant effects within this section relates to an identified magnitude of effect based on change of noise level in comparison with a baseline. The assessment of potential significance utilises the criteria identified in **Table 3.2** for short-term (differences in the same year) and long-term effects (comparisons within different years). The noise level changes are applied to both increases and decreases in noise. An increase in noise is considered 'adverse' and a decrease in noise is considered 'beneficial'.

[22] The Environmental Noise (England) Regulations (as amended) 2006 [online]. Available online: http://www.legislation.gov.uk/uksi/2006/2238/pdfs/uksi_20062238_en.pdf [Accessed 7 June 2019].

Table 3.2 Categorising the Magnitude of Change in Noise Exposure (Beneficial or Adverse)

| Noise change, dB(A) | Short-term Magnitude Descriptor | Long-term Magnitude Descriptor |
|---|---|---|
| **0** | No Change | No Change |
| **0.1 – 0.9** | Negligible | Negligible |
| **1 – 2.9** | Minor | |
| **3 – 4.9** | Moderate | Minor |
| **5-9.9** | Major | Moderate |
| **10+** | | Major |

3.3.101 For receptors (residential or non-residential), a potential significant effect is attributed to a noise change of ≥ 1 dB in the short-term (i.e. comparing 2021 with the current condition limit) and ≥ 3 dB in the long-term (i.e. comparisons between the baseline and 2021 19 mppa scenario and the 2028 comparison). A significant effect is not necessarily identified where noise change exceeds these criteria. Exceedances would however indicate that a significant effect may be possible and further assessment work would be required.

3.3.102 **Table 3.3** presents the different scenario comparisons for the various aspects of the noise assessment, and which are considered short-term (ST) or long-term (LT). This includes assessment against the original baseline in 2011 assessed in the 2012 consented scheme; a comparison of with and without development in the worst-case (highest development noise levels) year 2021; and a comparison of future years (both anticipated in the 2012 ES and current predictions).

Table 3.3 Comparisons for Assessment

| Scenarios | 2011 Baseline* | 18 mppa Noise Condition | 18 mppa 2021 | 2012 ES 2028 Prediction | 18 mppa 2028 |
|---|---|---|---|---|---|
| **19 mppa 2021** | Aviation (LT)<br>Ground Noise (LT)<br>Road Traffic (LT) | Aviation (ST) | Ground Noise (ST)<br>Road Traffic (ST) | | |
| **19 mppa 2028** | | | | Aviation (LT)<br>Ground Noise (LT) | Aviation (LT)<br>Ground Noise (LT) |

3.3.103 The reason a short-term comparison of the aviation noise difference between 18 mppa and 19 mppa in 2021 has not been considered, is because the 18 mppa scenario for 2021 has been predicted previously to exceed Condition 10 on the area limits of the 57 dB daytime contour and 48 dB night-time contour. Therefore, the allowable noise contour area, as specified within the existing condition, has been used for the short-term comparison. This does not affect the road traffic noise comparison. This is because the exceedances of Condition 10 were attributable to a slower than expected fleet modernisation and does not relate to vehicular traffic arising from utilisation of the full 18 mppa quota.

3.3.104 The screening of aviation noise has focused on the core assessment metrics within Aviation Noise Policy ($L_{Aeq, 16 hr}$ and $L_{Aeq, 8 hr}$) and has not considered additional metrics for which there are currently no standardised means of assessment.

3.3.105 Aviation noise for the 19 mppa scenario has been predicted using computer noise modelling software and based on up to date aircraft flows. Further information on the modelling can be found in **Appendix B**. Road traffic noise has been predicted using flow data provided by Arup, as described in **Section 3.3: Transport** (with traffic flows used in **Appendix C**), and the basic noise level calculation methodology within Calculation of Road Traffic Noise[23]. Changes in ground noise have been related to the changes in the number of flights (provided by LLA) to come by an indication of impact, which is described in more detail below.

*Operation – Aviation In-Air Noise*

3.3.106 The comparison tables are presented in **Appendix D**. The summary results of the aviation noise predictions are as follows:

- between the 2011 baseline and the 2021 19 mppa long-term scenario there is a predicted increase of up to 2.5 dB (highest increase being during the daytime) in aviation noise level at non-residential receptors. By comparing the 19 mppa contour area for a particular dB contour with the 2011 contour areas, a maximum increase of no more than 2 dB during the daytime and 1 dB during the night-time can be identified at residential receptors[24] between these scenarios. This result amounts to not more than a minor adverse impact at receptors;
- between the 18 mppa area condition limits and the 2021 19 mppa short-term scenario there is a predicted increase of up to 0.7 dB (daytime and night-time) at non-residential receptors. By comparing the 2021 19 mppa contour area for a particular dB contour with the 2021 condition limit areas, a maximum increase of no more than 1 dB during the daytime or night-time can be identified at residential receptors between these scenarios. This result amounts to not more than a minor adverse impact at receptors;
- between 2028 future baseline (predicted for the 2012 consented scheme) and the 2028 19 mppa scenario there is a predicted increase of up to 1.1 dB (highest increase during the night-time) at a small number of non-residential receptors. Most non-residential receptors are predicted to have a lower noise level in the 2028 19 mppa scenario when compared with the future baseline predicted in 2012. By comparing the 2028 19 mppa contour area for a particular dB contour with the future baseline contour areas in 2028 there are only decreases in noise level during the daytime or night-time identified at residential receptors between these scenarios (up to 1 dB decrease during the day and night-time). This result amounts to not more than a minor adverse impact at some non-residential receptors, with a minor benefit at residential receptors;
- between 2028 18 mppa and 2028 19 mppa scenario there is a predicted increase of 0.2 dB at one non-residential receptor. Most non-residential receptors are predicted to have a lower noise level in the 19 mppa 2028 scenario when compared with the 2028 18 mppa scenario. By comparing the 19 mppa 2028 contour area for a particular dB contour with the 2028 18 mppa scenario noise levels are predicted to either be the same or decrease during the daytime or night-time identified at residential receptors between these scenarios. This result amounts to not more than a minor impact as one non-residential receptor and a negligible impact at other non-residential receptors and residential receptors; and

[23] Department of Transport Welsh Office (1988). Calculation of Road Traffic Noise.

[24] For example, the predicted size of area within the daytime 69 dB contour for the 19 mppa scenario is 1.9 km. This number matches the area in the baseline scenario for the 67 dB contour. Therefore, it can be concluded that the difference in noise from the 19 mppa at this decibel level is 2 dB. This difference lowers with distance from the airport; the difference for the 19 mppa 49 dB noise contour is somewhere between 1 and 2 dB.

- in summary, at most there would be a minor adverse impact at receptors, with beneficial impacts identified for 2028 in comparison with the future baseline predicted in the 2012 ES. Therefore, no significant effects would be predicted from aviation noise.

*Operation – Aviation Ground Noise*

3.3.107 It is anticipated that the change in fleet mix will result in quieter aircraft both during flight and on the ground. However, the details of how much quieter the modernised fleet mix would be are not currently known. A conservative approach to screening ground noise for significance has therefore been taken by considering just the changes in aircraft numbers. **Tables 3.4** to **3.7** show the differences in aircraft movements between a number of scenarios, past and future. In this case the 18 mppa 2021 scenario is considered as this does not breach any conditions from a ground noise perspective.

Table 3.4 Comparison of 2011 Baseline and 2021 19 mppa scenarios

| 2011 Baseline Daytime | 2011 Baseline Night-time | 2021 19 mppa Daytime | 2021 19 mppa Night-time | Daytime Difference | Night-time Difference |
|---|---|---|---|---|---|
| **23,762** | 4,464 | 34,469 | 5,143 | + 45% | + 15% |

Table 3.5 Comparison of 2021 18 mppa and 2021 19 mppa scenarios

| 2021 18 mppa Daytime | 2021 18 mppa Night-time | 2021 19 mppa Daytime | 2021 19 mppa Night-time | Daytime Difference | Night-time Difference |
|---|---|---|---|---|---|
| **34,391** | 5,131 | 34,469 | 5,143 | 0% | 0% |

Table 3.6 Comparison of ES Future Baseline 2028 and 2028 19 mppa scenarios

| 2028 Future Baseline Daytime | 2028 Future Baseline Night-time | 2028 19 mppa Daytime | 2028 19 mppa Night-time | Daytime Difference | Night-time Difference |
|---|---|---|---|---|---|
| **33,505** | 5,457 | 34,849 | 5,002 | + 4% | - 8% |

Table 3.7 Comparison of 2028 18 mppa and 2028 19 mppa scenarios

| 2028 18 mppa Daytime | 2028 18 mppa Night-time | 2028 19 mppa Daytime | 2028 19 mppa Night-time | Daytime Difference | Night-time Difference |
|---|---|---|---|---|---|
| **34,574** | 4,863 | 34,849 | 5,002 | + 1% | + 3% |

3.3.108 Consideration of the differences between the various scenarios is based on:

- a doubling of aviation would result in a 3 dB change which might indicate a significant effect in the long-term; and
- an increase of 25% would result in a 1 dB change would be the difference which might indicate a significant effect in the short-term.

3.3.109 Based on the differences in aviation movements between the scenarios, the short-term assessment (i.e. 2021 18 mppa against the 19 mppa scenario) would indicate a change less than 1 dB and

would not be significant. The longer-term assessments (baseline 2011 against 19 mppa 2021, 2028 future baseline against 19 mppa 2028, 2028 18 mppa and 19 mppa scenarios) would indicate a change less than 3 dB and would not be significant.

3.3.110 Individual events from aircraft movements representing $L_{Amax}$ events, which could result in awakenings, are higher with the 19 mppa 2021 scenario than the baseline but show only a slight increase on the 18 mppa scenario. Therefore, there would not be a noticeable increase in $L_{Amax}$ events in in the short-term. In the long-term, comparison with the 18 mppa 2028 scenario, there would be an increase of only 139 aviation $L_{Amax}$ events in a summer period, averaging less than two additional events per night. Given that it is likely that $L_{Amax}$ events from aircraft manoeuvring are anticipated to be lower due to modernisation of aircraft, this increase in events is not considered significant.

3.3.111 It is assumed for the purposes of this screening that the engine testing would be commensurate with that previously considered in the 2012 ES and therefore no change in noise would be predicted.

*Operation – Road Traffic Noise*

3.3.112 Noise levels from road traffic flows for the 2021 scenarios of both 18 mppa and 19 mppa have been predicted at 10 metres from the roadside using CRTN calculation methodology. The traffic flows used for predictions and full results are presented in **Appendix C**.

3.3.113 The results show that for 2021, the traffic noise level difference between 18 mppa and 19 mppa traffic is negligible. The largest difference in noise level between 2021 19 mppa and the 2011 baseline is an increase of 2 dB on the A1081 New Airport Way, which is a negligible impact in the long-term and not significant.

*Summary*

*3.3.114* The results have shown that there would be a negligible impact from the increase to 19 mppa from 18 mppa from in-air and ground aircraft noise and road traffic noise.

3.3.115 Notwithstanding the conclusions presented above, a standalone Noise Assessment will accompany the planning application. The standalone assessment will consist of an evaluation of significant adverse effects with regards to the Noise Policy Statement for England and an assessment of $L_{Amax}$ noise from aviation.

3.3.116 Additionally, LLAOL will continue to implement noise mitigation measures. LLAOL will contribute to the Noise Insulation Fund with a budget of £150,000 in 2020 and £600,000 in 2021, with dwellings with highest noise levels being a priority. One-off grants between £12,000 and £15,000 will be given to local councils exposed to noise levels between Lowest Observed Adverse Effect Level (LOAEL) and SOAEL based on the forecasted 2020 noise contours, with grants to be used to provide community improvements.

3.3.117 Furthermore, to ensure that noise levels decrease year on year LLAOL has committed to:

- for Summer 2020 and all subsequent seasons, no night-time (23:30 to 07:00) slots will be allocated to aircraft with a value greater than QC1;
- no further day time slots will be allocated to aircraft greater than QC1 (06:00-21:59 GMT 01 June – 30 September);
- no "non-emergency" Diverted Flights will be accepted;
- new airline / aircraft slots at night not to exceed QC 0.5; and

- differential charging has been implemented to incentivise the rapid modernisation of fleet.

## Socio-Economic

### Baseline

3.3.118 In the last 12 months, LLA has handled some 17.2 million passengers[25], making it one of the ten largest UK airports by passenger numbers. Historic data shows that passenger numbers have been increasing and this trend is expected to continue long-term.

3.3.119 LLA contributed £1.3 billion to UK Gross Domestic Product in 2013 and made up 10% of all employment in LBC.[26] As of 2018, LLA employs approximately 9,400 individuals and indirectly supports 17,700 jobs[27], making it a major economic contributor for the UK and local region.

3.3.120 In mid-2019, the population of Luton was estimated to be 213,052[28] of which approximately 63.2% were aged 16-64. This is slightly higher than both the regional proportion of people aged 16-64 for the east (61.0%) and Great Britain (62.7%)[29].

3.3.121 There are a number of community facilities within close proximity to LLA. The nearest school, Wigmore Primary School, is located approximately 0.4 km north of LLA and the nearest healthcare facility, Larkside Practice/Churchfield Medical Centre, is located approximately 0.6 km north of LLA. For places of worship, the closest facility is Wigmore Church, approximately 0.6 km north of LLA and the nearest community centre is Raynham Way Community Centre <0.1 km north-east of LLA.

3.3.122 Within 2 km of LLA, LBC[30] have Housing Allocation sites, which form part of Policy LLP15 for the provision of 8,500 dwellings, alongside Policy LLP24 allocations for Community and Education Facilities. Central Bedfordshire[31] have no sites allocated for housing, or community and education facilities. There are four allocated Strategic Housing Sites within North Herts that are within 2 km of LLA: EL1, EL2 and EL3 – East of Luton allocation for 2,100 homes; and KW1 – Land west of The Heath, Breachwood Green allocation for 16 homes.[32]

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[25] Luton Airport (2020). Monthly Passenger and Statistics Report – March 2020. Available online: https://www.london-luton.co.uk/LondonLuton/files/43/43aeef7a-06d3-42eb-b8d7-446ec0f91162.pdf [Accessed 11 May 2020].
[26] Oxford Economics (2015). The economic impact of London Luton Airport. Available online: https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=3&ved=2ahUKEwiUgYWxvPbdAhWmL8AKHTSjBLwQFjACegQIBxAC&url=https%3A%2F%2Fwww.llal.org.uk%2FDocuments%2FOE-The-economic-impact-of-London-Luton-Airport.pdf&usg=AOvVaw3zpSjS-My-2WafK7IImZKT [Accessed 11 May 2020].
[27] Think Luton (2018). London Luton Airport. Available online: https://www.thinkluton.co.uk/key-developments/london-luton-airport [Accessed 11 May 2020].
[28] Office for National Statistics (2020). Population Estimates for the UK, England and Wales, Scotland and Northern Ireland: Mid-2019, [online]. Available at: https://www.ons.gov.uk/peoplepopulationandcommunity/populationandmigration/populationestimates/datasets/populationestimatesforukenglandandwalesscotlandandnorthernireland [Accessed 11 May 2020].
[29] Nomis (2018). Labour Market Profile – Luton. Available online: https://www.nomisweb.co.uk/reports/lmp/la/1946157201/report.aspx [Accessed 11 May 2020].
[30] Luton Borough Council (2017). Policies Map 2011-31. [online] Available at: https://www.luton.gov.uk/Environment/Lists/LutonDocuments/PDF/Local%20Plan/adoption/Luton-Local-Plan-2011-2031-policies-map.pdf [Accessed 20 May 2020].
[31] South Bedfordshire (2004). South Bedfordshire Local Plan Review. [online] Available at: https://apps.centralbedfordshire.gov.uk/apps/stat/sbdc-localplan/DATA/PMap/mapfr098.html [Accessed 20 May 2020].
[32] North Herts (2016). North Herts Local Plan. [online] Available at: https://www.north-herts.gov.uk/sites/northherts-cms/files/North%20Herts%20Sheet%201%20Side%20B.pdf [Accessed 20 May 2020].

### Likely Significant Effects

3.3.123 Since there are no material changes proposed that seek to alter the overall quantum of built development, it is not expected that there will be any adverse effects requiring further assessment.

3.3.124 There could be potential for beneficial effects upon employment and the local economy associated with the increase in passenger numbers. An economics assessment will accompany any supporting planning application.

3.3.125 Potential environmental effects on community facilities surrounding the Proposed Scheme have been considered within the relevant parts of **Section 3.3**, including effects such as air quality and noise; no significant effects are considered likely.

3.3.126 The Proposed Scheme will not increase demand for such facilities due to the limited nature of the proposals, so no significant effects on community facilities are likely.

## Transport

### Baseline

3.3.127 Access into LLA by road can be gained via Airport Way and Airport Approach Road. These roads pass by the Short-Term Car Park, Mid-Term Car Parks, Holiday Inn, the Ibis, and directly into the Central Terminal Area which has associated public transport facilities, drop-off / pick-up zones, taxi bays and priority parking.

3.3.128 The airport lies approximately 1.5 km from Luton Airport Parkway Rail Station to the south-west, with frequent shuttle services providing a connection for passengers between the station and the Central Terminal Area.

3.3.129 According to data from a 2019 CAA survey[33], the passenger mode share for buses was 16.9%, whilst rail mode share was 20.7%. Passenger mode share for private cars (which includes passengers travelling as a passenger and rental cars) was 44.3%.

### Likely Significant Effects

3.3.130 The 19 mppa traffic flows generated by LLA were forecasted by ARUP using actual 18 mppa ATMs and forecast 19 mppa ATMs provided by York Aviation. The resulting flows show an increase of 2% in two-way trips in the AM Peak (63 trips) and an increase of 3% in two-way trips in the PM Peak (108 trips) between the 18 mppa and 19 mppa scenarios. Therefore, it has been concluded that the forecast increase in traffic flows in the network in the 19 mppa scenario is very minor and is unlikely to have a significant impact on the operation of the network in the study area. Following discussions with LBC and Highways England it was agreed that such minor increase in traffic would not require any further impact analysis.

3.3.131 A Travel Plan with sufficient measures to reduce car travel to and from LLA, as well as providing robust public transport services via bus, rail and the DART (operational from 2021) would mean the existing drop-off area would be able to successfully manage with increased passenger numbers. However, if the targets and measures are not achieved, fast-acting interventions would be required in order to ensure the facility is not in danger of operating over-capacity.

3.3.132 Current bus patronage data was obtained from LLAOL for July 2019, based on flight data and available surveys. Based on forecasted passenger trip mode shares, trips using bus / coach were

[33] CAA (2019). Airport data 2019, [online]. Available at: https://www.caa.co.uk/Data-and-analysis/UK-aviation-market/Airports/Datasets/UK-Airport-data/Airport-data-2019/ [Accessed 12 May 2020].

estimated for the 18 mppa and 19 mppa scenarios. The results indicated that all services will be able to operate within capacity even with the increase in demand in the 19 mppa scenario.

3.3.133 It has been estimated that car parking demand will increase from 4,764 spaces in 2017 for a 15.9 mppa scenario to 8,516 spaces for an 18 mppa scenario. This increase of 3,752 spaces is addressed in the Car Parking Management Strategy for an 18 mppa scenario, by proposing an increase in parking provision through a multi-storey car park and an extension of existing car parks; this has been deemed appropriate by LBC.

3.3.134 For a 19 mppa car parking demand scenario, a minor increase of 413 spaces, to a total demand of 8,929 has been estimated. It has been concluded that the existing 18 mppa Car Parking Management Strategy is still deemed appropriate to manage this increase. This will be achieved by controlling parking capacity and pricing at each car park accordingly and will be monitored through the Airport Surface Access Strategy, as well as the 2019 Luton Airport Travel Plan which focuses on reducing private vehicle travel and promoting sustainable travel alternatives to LLA.

3.3.135 Based on the mitigation measures outlined above, the Proposed Scheme is not anticipated to have likely significant effects on transport.

## Waste and Resource Use

### Baseline

3.3.136 LLA work closely with their business partners to ensure as much waste as possible that is produced on site is recycled[34].

3.3.137 There is one former landfill situated approximately <0.1 km north-east of LLA.

### Likely Significant Effects

3.3.138 Since there are no material changes proposed that seek to alter the overall quantum of built development there will not be any generation of construction waste so it is not expected that there will be any adverse effects requiring further assessment.

3.3.139 An increase in passenger numbers will result in a minor increase in operational waste, which is within the routine capacity of LLA's waste management infrastructure and facilities operated by their waste management contractors. The management of waste will continue as existing and there are unlikely to be significant effects associated with the operational waste. Nonetheless, a Site Waste Management Plan will accompany the planning application.

## Water Resources and Flood Risk

### Baseline

3.3.140 LLA comprises large impermeable areas associated with the runway, taxiways and apron and as well as buildings and large car parking areas. The rest of LLA, including the land between and around the runway and taxiways is currently set to grass.

3.3.141 With regards to the area to which surface water run off could drain, LLA is set within an urban landscape to the north and a largely agricultural landscape to the south, comprising primarily

[34] London Luton Airport Operations Limited (2019). Minimising waste. Available online: https://www.london-luton.co.uk/corporate/lla-and-the-environment/minimising-waste [Checked 28 May 2019].

pasture. To the north lies Luton, with the area adjacent to LLA being predominantly residential in nature.

3.3.142 LLA is within the Lee Upper drainage catchment, which has a total of 23 rivers or canals within it[35]. No surface water bodies are present on-site.

3.3.143 The Environment Agency Flood Map for Planning[36] identifies LLA to be located within Flood Zone 1, so has a low probability of flooding. The River Lea, one of the tributaries to the River Thames, is located approximately 0.5 km to the south-west of LLA; land on either side of the River is designated as Flood Zone 3 (so at a high probability of flooding).

### Likely Significant Effects

3.3.144 Since there are no material changes proposed that seek to alter the overall quantum of built development or increase impermeable areas, it is not expected that there will be any adverse effects requiring further assessment in relation to water resources and flood risk.

## Cumulative Effects

### Baseline

3.3.145 There is a requirement under the EIA Regulations to consider the cumulative effects of a Proposed Scheme, in this instance a cumulative effect associated with the proposed variation to Condition 8 and 10. This element of the assessment will identify whether any of the individual effects of the proposed variation to Condition 8 and 10 would combine to create a cumulative effect greater than the sum of the individual effects.

3.3.146 All other cumulative effects as assessed within the 2012 ES remain valid, since there are no material changes to the application, which would alter the conclusions of the previous assessment.

3.3.147 The cumulative effects assessment process considers two types of effect:

- **Intra-project effects:** Typically, these effects occur when different activities associated with a project act upon the same environmental receptor. In determining such effects, consideration would be given to the sensitivity of the receptor and the magnitude of environmental change. Consideration is given to both the interaction of significant effects and the interaction of different impacts from project activities even if individually they are not significant.
- **Inter-project effects:** Typically, consideration will be given to whether there is the potential for the effects of a scheme and effects of other 'major' developments to combine and result in a significant environmental effect.

### Likely Significant Effects

3.3.148 In the context of the proposed variation to Condition 8, cumulative effects are limited to those associated with passenger movements to and from the airport and within the airport.

[35] Environment Agency (2020). Catchment Data Explorer, [online]. Available at: https://environment.data.gov.uk/catchment- planning/OperationalCatchment/3493/Summary [Accessed 11 May 2020].
[36] Environment Agency (2020). Flood map for planning. Available online: https://flood-map-for-planning.service.gov.uk/confirm-location?easting=512592&northing=221106&placeOrPostcode=luton%20airport [Accessed 11 May 2020].

3.3.149 In the context of the proposed variation to Condition 10, cumulative effects are limited to those developments located within the noise contour limits, which have been granted consent since the baseline assessment year assessed within the 2012 ES (i.e. 2011) up to 2019.

*Intra-project effects*

3.3.150 Since there are no material changes proposed that seek to alter the overall quantum of built development (see **Section 2.2**), intra-project cumulative effects are limited to changes to noise and traffic volumes within the study area.

3.3.151 The noise and transport modelling used within the assessment has assumed a population increase since 2011 (the baseline assessment year) consistent with the area. No likely significant effects have been identified as part of this cumulative effects assessment and as such, intra-project effects can be screened out for further assessment.

*Inter-project effects*

3.3.152 Since the Proposed Scheme only intends to increase passenger numbers with only a minor increase in ATMs and noise contours (see **Section 2.2**), and no associated change to the building infrastructure, it is appropriate to only consider cumulative effects where a likely significant effect may be a factor. No likely significant effects have been identified as part of this cumulative effects assessment and as such, inter-project effects can be screened out for further assessment.

## Transboundary Effects

3.3.153 There will relatively small increase in ATMs associated with the proposed variation to Condition 8, which is not considered likely to have a significant transboundary effect.

3.3.154 There is a small temporary increase in the noise contour associated with the proposed variation to Condition 10, which does not extent outside of the jurisdiction of the UK. As such, there is not considered to be any significant transboundary effects.

# 4. Summary and Conclusion

## 4.1 Summary

1.1.1.1 The appraisal presented in **Section 3** demonstrates that the Proposed Scheme is unlikely to have a significant effect on the environment. **Table 4.1** summarises the key considerations as assessed against Schedule 3 of the EIA Regulations and in line with the Screening Matrix[37].

Table 4.1 EIA Regulations 2017 Screening Matrix

| Consideration | The Proposed Scheme |
|---|---|
| **EIA Regulations** | |
| Is the Proposed Scheme Schedule 1 development according to Schedule 1 of the EIA Regulations? If YES, which description of development? | No (see **Section 3.2**) |
| Is the Proposed Scheme Schedule 2 development under the EIA Regulations? If YES, under which description of development in Column 1 and Column 2? | Yes<br><br>The Proposed Scheme falls within the descriptions of development under Part 13(a) and Part 13(b) of Schedule 2 (see **Section 3.2**). |
| Is the Proposed Scheme within, partly within, or near a 'sensitive area' as defined by Regulation 2 of the EIA Regulations? If YES, which area? | No (see **Section 3.2**) |
| Are the applicable thresholds/criteria in Column 2 exceeded/met? If yes, which applicable threshold/criteria? | Yes<br><br>The Proposed Scheme falls under the applicable threshold and criteria for Schedule 2, Part 13(a)(i) and Part 13(b)(i)(see **Section 3.2**). |
| **Natural Resources** | |
| Will construction, operation or decommissioning of the Proposed Scheme involve actions which will cause physical changes in the topography of the area? | There are no material changes proposed, which seek to alter the overall quantum of built development (see **Section 2.2**).<br><br>No significant effects are likely. |
| Will construction or operation of the Proposed Scheme use natural resources above or below ground such as land, soil, water, materials/minerals or energy which are non-renewable or in short supply? | There are no material changes proposed, which seek to alter the overall quantum of built development, so there will be no additional construction use of natural resources (see **Section 2.2**).<br><br>Since the Proposed Scheme will result in a larger number of vehicle movements, ATMs and the potential for increased energy consumption of the existing buildings, a standalone Carbon and Other GHG Assessment will be undertaken. This will assess the increase in emissions and provide details of embedded mitigations to reduce emissions as a result of the Proposed Scheme. Given the submission of the standalone assessment, a GHG assessment alone does not trigger the preparation of an EIA (see **Section 3.3: Climate Change (including Greenhouse Gases and Climate Resilience)**). |

[37] The Town and Country Planning (EIA) Regulations 2017 Screening Matrix [online]. Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/643241/TCPA_EIA_Screening_Matrix_2017_Regs.pdf [Accessed 11 May 2020].

| Consideration | The Proposed Scheme |
|---|---|
| Are there any areas on/around the location which contain important, high quality or scarce resources which could be affected by the Proposed Scheme, e.g. forestry, agriculture, water/coastal, fisheries, minerals? | The surrounding landscape is characterised by arable farmland, with pockets of priority habitat, namely deciduous woodland, ancient replanted woodland and semi-natural woodland located to the south and east of LLA. The Chilterns AONB is located approximately 3 km north and 4.7 km to the west of LLA. There are a number of listed buildings, two registered parks and gardens and one scheduled monument within 2 km of LLA. The nearest ecological designated site is Galley and Warden Hills SSSI, 4.5 km north-west of LLA. There are a number of non-designated sites within 2 km of LLA, including eight CWS, the closest of these being Winch Hill Wood CWS (see **Section 3.3: Landscape and Visual**, **Historic Environment** and **Biodiversity**).<br><br>LLA is designated as a Principal aquifer for bedrock and predominantly Unproductive aquifer for superficial drift. The groundwater vulnerability is classified as Major High to Intermediate. The north-west of LLA is located within a designated Zone 3 (total catchment) SPZ. Within 2 km there are two areas that are groundwater Drinking Water Safeguard Zones and there is one surface water Drinking Water Safeguard Zone. LLA is also located within a Surface Water Nitrate Vulnerable Zone (see **Section 3.3: Ground Conditions**). |
| **Waste** | |
| Will the Proposed Scheme produce solid wastes during construction or operation or decommissioning? | There are no material changes proposed, which seek to alter the overall quantum of built development, so there will be no additional construction waste (see **Section 2.2**).<br><br>An increase in passenger numbers will result in a minor increase in operational waste, which is within the routine capacity of LLA's waste management infrastructure (see **Section 3.3: Waste and Resource Use**).<br><br>No significant effects are likely. |
| **Pollution and Nuisances** | |
| Will the Proposed Scheme release pollutants or any hazardous, toxic or noxious substances to air? | There are no material changes proposed, which seek to alter the overall quantum of built development, so there will be no release of pollutants during construction (see **Section 2.2**).<br><br>The percentage of increased aircraft and on-airport activity is likely to be minor, and given the background concentrations, the impact at the most exposed human receptors is likely to be "slight" or at most "moderate", and of low overall significance. In view of the distance of important ecological sites from the Proposed Scheme (including road traffic), it is not considered that there will be likely significant effects on ecological receptors (see **Section 3.3: Air Quality**).<br><br>No significant effects are likely. |
| Will the Proposed Scheme cause noise and vibration or release of light, heat, energy or electromagnetic radiation? | There are no material changes proposed, which seek to alter the overall quantum of built development, so there will be no nuisances during construction (see **Section 2.2**).<br><br>Whilst passenger numbers are anticipated to grow, the increase in ATMs would be minor and the direction of flights will remain the same, so there will be no change to the spatial pattern of ATMs. The results of the screening assessment for noise have shown that there would be a negligible impact from the increase to 19 mppa from 18 mppa from in-air and ground aircraft noise and road traffic noise. Notwithstanding the conclusions presented above, a standalone Noise Assessment will |

| Consideration | The Proposed Scheme |
|---|---|
| | accompany the planning application (see **Section 3.3: Noise and Vibration**).<br><br>No significant effects are likely. |
| Will the Proposed Scheme lead to risks of contamination of land or water from releases of pollutants onto the ground or into surface waters, groundwater, coastal waters or the sea? | There are no material changes proposed, which seek to alter the overall quantum of built development, so there will be no contamination risks during construction and the risk of hazardous substance during operation will remain as present (see **Section 3.3: Ground Conditions**).<br><br>No significant effects are likely. |
| Are there any areas on or around the location which are already subject to pollution or environmental damage, e.g. where existing legal environmental standards are exceeded, which could be affected by the Proposed Scheme? | There are four AQMAs near LLA. Nonetheless, no significant effects are expected upon air quality as a result of the Proposed Scheme (see **Section 3.3: Air Quality**).<br><br>No significant effects are likely. |
| **Population and Human Health** | |
| Will there be any risk of major accidents (including those caused by climate change, in accordance with scientific knowledge) during construction, operation or decommissioning? | There are no material changes proposed, which seek to alter the overall quantum of built development, so there will be no risk of major accidents or disasters during construction and the risk of hazardous substance during operation will remain as present (see **Section 2.2**).<br><br>The airport is not located within an area known for extreme adverse weather and is in a Flood Zone 1 area, so is at low risk of flooding.<br><br>The slight increase in ATMs is unlikely to impact the likelihood of major accidents and disasters as the risk of aircraft accidents is extremely low and the airport will continue to operate under the same licensing controls e.g. CAA, ICAO and EASA (see **Section 3.3: Major Accidents and Disasters**).<br><br>No significant effects are likely. |
| Will the Proposed Scheme present a risk to the population (having regard to population density) and their human health during construction, operation or decommissioning? (for example due to water contamination or air pollution) | There are no material changes proposed, which seek to alter the overall quantum of built development, so there will be no human health impacts during construction (see **Section 2.2**).<br><br>Whilst passenger numbers are anticipated to grow, the increase in ATMs would be minor and the direction of flights will remain the same, so there will be no change to the spatial pattern of ATMs. The results of the screening assessment for noise have shown that there would be a negligible impact from the increase to 19 mppa from 18 mppa from in-air and ground aircraft noise and road traffic noise. Provided that mitigation is implemented, the health effects related to a change in noise exposure as a result of the Proposed Scheme are likely to have a slight-moderate significant adverse effect at the population level. Additionally, the Proposed Scheme would not result in a significant air quality effect at air quality sensitive receptors (see **Section 3.3: Human Health**).<br><br>No significant effects are likely. |
| **Water Resources** | |
| Are there any water resources including surface waters, e.g. rivers, lakes/ponds, coastal or underground waters on or around the location which could be affected by the Proposed Scheme, particularly in terms of their volume and flood risk? | Since there are no material changes proposed that seek to alter the overall quantum of built development or increase impermeable areas, it is not expected that there will be any adverse effects requiring further assessment in relation to water resources and flood risk (see **Section 3.3: Water Resources and Flood Risk**). |

| Consideration | The Proposed Scheme |
|---|---|
| | No significant effects are likely. |
| **Biodiversity (Species and Habitats)** | |
| Are there any protected areas which are designated or classified for their terrestrial, avian and marine ecological value, or any non-designated / non-classified areas which are important or sensitive for reasons of their terrestrial, avian and marine ecological value, located on or around the location and which could be affected by the Proposed Scheme? (e.g. wetlands, watercourses or other water-bodies, the coastal zone, mountains, forests or woodlands, undesignated nature reserves or parks. (Where designated indicate level of designation (international, national, regional or local))).<br><br>Could any protected, important or sensitive species of flora or fauna which use areas on or around the Site, e.g. for breeding, nesting, foraging, resting, over-wintering, or migration, be affected by the Proposed Scheme? | There are no material changes proposed, which seek to alter the overall quantum of built development, so there will be no biodiversity impacts during construction (see **Section 2.2**).<br><br>Whilst passenger numbers are anticipated to grow, the increase in ATMs would be minor and the direction of flights will remain the same, so there will be no change to the spatial pattern of ATMs. Although there are a number of ecological designations within close proximity to LLA, it is likely that aircraft will be at a sufficient height and distance at these locations whereby emitted noise is low enough to be considered as to not have a significant effect. The results of the screening assessment for noise have shown that there would be a negligible impact from the increase to 19 mppa from 18 mppa from in-air and ground aircraft noise and road traffic noise. As such, there is unlikely to be a change in adverse effects on the ecological environment that would require further consideration (see **Section 3.3: Biodiversity**).<br><br>No significant effects are likely. |
| **Landscape and Visual** | |
| Are there any areas or features on or around the location which are protected for their landscape and scenic value, and/or any non-designated / non-classified areas or features of high landscape or scenic value on or around the location which could be affected by the Proposed Scheme? Where designated indicate level of designation (international, national, regional or local).<br><br>Is the Proposed Scheme in a location where it is likely to be highly visible to many people? (If so, from where, what direction, and what distance?) | There are no material changes proposed, which seek to alter the overall quantum of built development, so there will be no landscape and visual impacts during construction (see **Section 2.2**).<br><br>The increase in ATMs as a result of the increase in passengers would be minor and the direction of flights will remain the same, so there will be no change to the spatial pattern of ATMs. Although there are a number of designations within close proximity to LLA, the results of the screening assessment for noise have shown that there would be a negligible impact from the increase to 19 mppa from 18 mppa from in-air and ground aircraft noise and road traffic noise. There will, therefore, only be a negligible change to the noise environment at designated sites (see **Section 3.3: Landscape and Visual**).<br><br>No significant effects are likely. |
| **Cultural Heritage/Archaeology** | |
| Are there any areas or features which are protected for their cultural heritage or archaeological value, or any non-designated / classified areas and/or features of cultural heritage or archaeological importance on or around the location which could be affected by the Proposed Scheme (including potential impacts on setting, and views to, from and within)? Where designated indicate level of designation (international, national, regional or local). | There are no material changes proposed, which seek to alter the overall quantum of built development, so there will be no cultural heritage/archaeology impacts during construction (see **Section 2.2**).<br><br>The increase in ATMs as a result of the increase in passengers would be minor and the direction of flights will remain the same, so there will be no change to the spatial pattern of ATMs (see **Section 2.2**). Although there are a number of designations within close proximity to LLA, the results of the screening assessment for noise have shown that there would be a negligible impact from the increase to 19 mppa from 18 mppa from in-air and ground aircraft noise and road traffic noise. There will, therefore, only be a negligible change to the noise environment at designated heritage sites (see **Section 3.3: Historic Environment**).<br><br>No significant effects are likely. |
| **Transport and Access** | |

| Consideration | The Proposed Scheme |
|---|---|
| Are there any routes on or around the location which are used by the public for access to recreation or other facilities, which could be affected by the Proposed Scheme? | There are no material changes proposed, which seek to alter the overall quantum of built development, so there will be no transport impacts during construction (see **Section 2.2**). |
| Are there any transport routes on or around the location which are susceptible to congestion or which cause environmental problems, which could be affected by the Proposed Scheme? | Forecast increase in traffic flows in the network in the 19 mppa scenario is very minor and is unlikely to have a significant impact on the operation of the network in the study area. Following discussions with LBC and Highways England it was agreed that such minor increase in traffic would not require any further impact analysis (see **Section 3.3: Transport**).<br><br>No significant effects are likely. |
| **Land Use** | |
| Are there existing land uses or community facilities on or around the location which could be affected by the Proposed Scheme? E.g. housing, densely populated areas, industry / commerce, farm/agricultural holdings, forestry, tourism, mining, quarrying, facilities relating to health, education, places of worship, leisure /sports / recreation. | Since there are no material changes proposed that seek to alter the overall quantum of built development, there will be no land use impacts during construction (see **Section 2.2**).<br><br>The increase in ATMs as a result of the increase in passengers would be minor and the direction of flights will remain the same, so there will be no change to the spatial pattern of ATMs. Although there are existing land uses and community facilities within close proximity to LLA, the results of the screening assessment for noise have shown that there would be a negligible impact from the increase to 19 mppa from 18 mppa from in-air and ground aircraft noise and road traffic noise. There will, therefore, only be a negligible change to the noise environment at these sites. Additionally, the Proposed Scheme would not result in a significant air quality effect at air quality sensitive receptors (see **Section 3.3: Human Health**).<br><br>No significant effects are likely. |
| Are there any plans for future land uses on or around the location which could be affected by the Proposed Scheme? | There are a number of community facilities within close proximity to LLA, alongside local plan allocations for housing and community/education facilities (see **Section 3.3: Socio-Economic**).<br><br>Potential environmental effects on community facilities surrounding the Proposed Scheme have been considered within the relevant parts of **Section 3.3**, including effects such as air quality and noise; no significant effects are considered likely. Additionally, the Proposed Scheme will not increase demand for such facilities due to the limited nature of the proposals, so no significant effects on community facilities are likely.<br><br>No significant effects are likely. |
| **Land Stability and Climate** | |
| Is the location susceptible to earthquakes, subsidence, landslides, erosion, or extreme /adverse climatic conditions, e.g. temperature inversions, fogs, severe winds, which could cause the Proposed Scheme to present environmental problems? | The airport is not located within an area known for extreme adverse weather and is in a Flood Zone 1 area, so is at low risk of flooding (see **Section 3.3: Major Accidents and Disasters**).<br><br>No significant effects are likely. |
| **Cumulative Effects** | |
| Could this Proposed Scheme together with existing and/or approved development result in cumulation of | Since the Proposed Scheme only intends to increase passenger numbers with only a minor increase in ATMs and noise contours (see **Section 2.2**) and no associated change to the building infrastructure, it is appropriate |

| Consideration | The Proposed Scheme |
|---|---|
| impacts together during the construction/operation phase? | to only consider cumulative effects where a likely significant effect may be a factor. No likely significant effects have been identified as part of the cumulative effects assessment and as such, inter-project effects can be screened out for further assessment (see **Section 3.3: Cumulative Effects**).<br><br>No significant effects are likely. |
| **Transboundary effects** | |
| Is the Proposed Scheme likely to lead to transboundary effects? | No significant transboundary effects are anticipated as a result of the Proposed Scheme (see **Section 3.3: Transboundary Effects**). |
| **Summary** | |
| Is the Proposed Scheme likely to have significant effects on the environment? | As set out above and within the Screening Assessment (**Section 3.3**), the Proposed Scheme is not likely to give rise to significant adverse effects on the environment. |
| Does the Proposed Scheme require an EIA? | As the Proposed Scheme is not likely to give rise to significant adverse effects, it is considered that the Proposed Scheme **does not require EIA** under the provisions of the EIA Regulations (see **Section 3.2**). |

Source: Adapted from the Town and Country Planning (EIA) Regulations 2017 Screening Matrix[37]

## 4.2 Conclusion

4.2.1 This Screening Report has systematically considered whether the Proposed Scheme to increase passenger numbers of 19 mppa is likely to give rise to significant adverse effects on the environment.

4.2.2 In conclusion, it is considered that the proposal is not 'EIA development' because, although it is Schedule 2 development, it is not likely to have significant effects on the environment "*by virtue of factors such as its nature, size or location*". Furthermore, the site is not located within a sensitive area. Therefore, it is considered that the Proposed Scheme **does not require EIA** under the provisions of the EIA Regulations.

4.2.3 The following technical documents will be submitted in support of the planning application alongside a Planning Statement:

- Air Quality Assessment;
- Carbon and Other GHG Assessment;
- Noise Assessment;
- Economics Assessment;
- Transport Assessment and Framework Travel Plan; and
- Site Waste Management Plan.

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# Appendix A Figures

Key

Airport boundary

0 100 200 300 400 500 600 m

Scale at A3: 1:10,000

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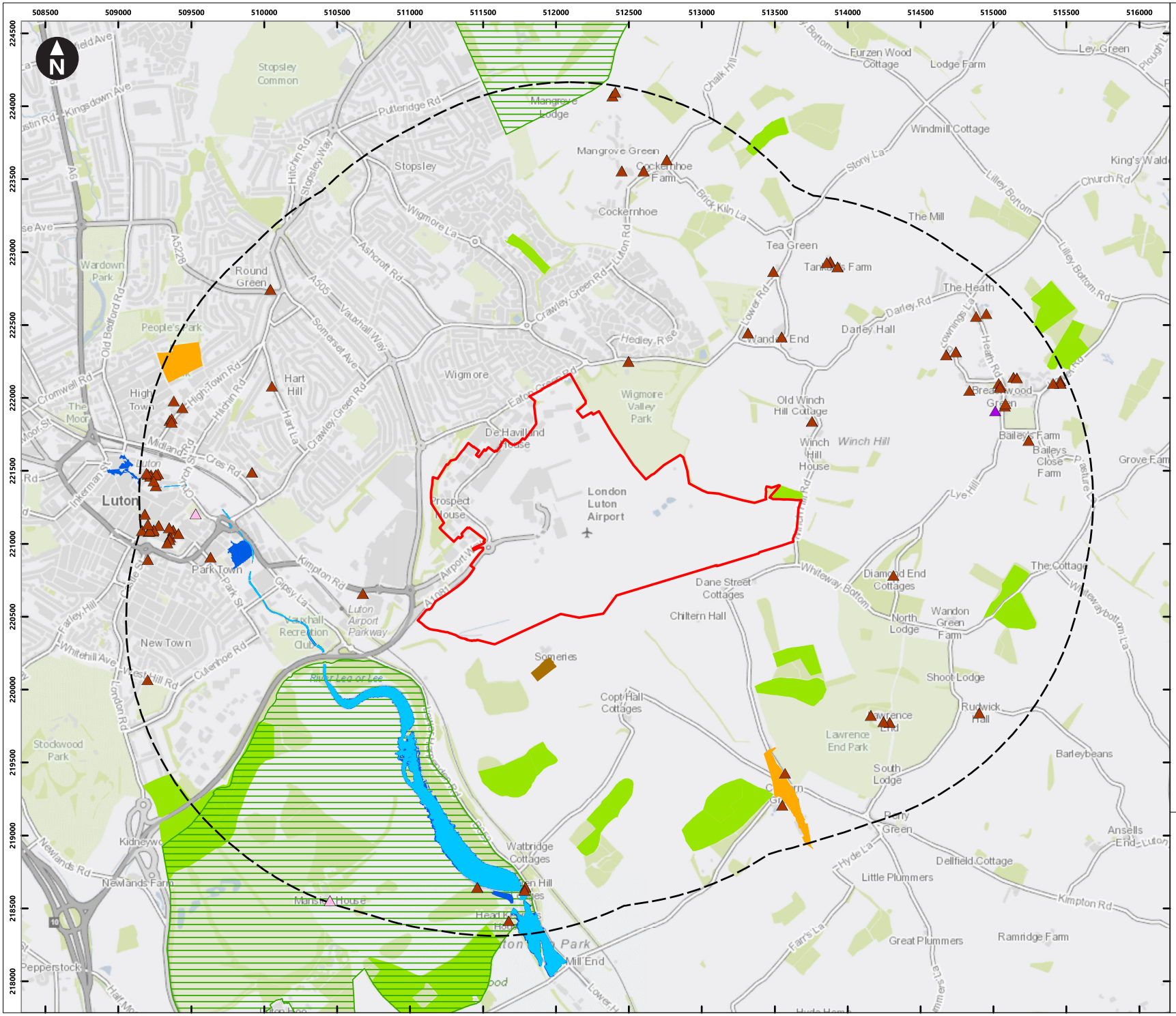
**Figure 1: Site location plan**

June 2020

wood.

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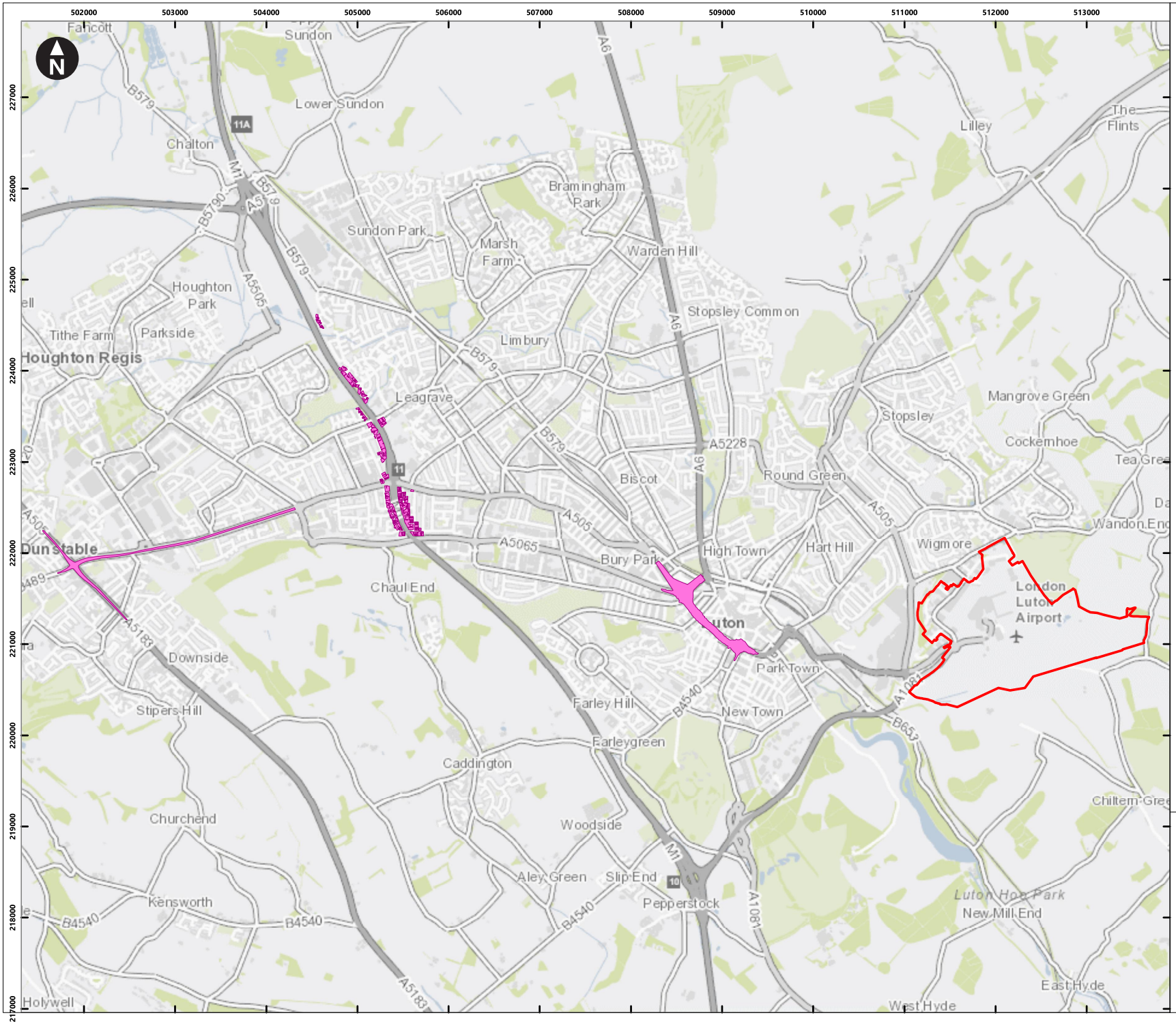
London Luton Airport Planning Consultancy Support

**Figure 2: Environmental and heritage constraints**

June 2020

wood.




Key

Airport boundary

Air Quality Management Areas

0 500 1,000 1,500 2,000 m

Scale at A3: 1:40,000

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**Figure 3: Air Quality Management Areas**

June 2020

wood.

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# Appendix B Aviation Noise Modelling Report

**LONDON LUTON AIRPORT**

A11060-N49-DR

13 December 2019

**2024 & 2028 19mppa Forecast Contours**

## 1.0 INTRODUCTION

London Luton Airport Operations Limited (LLAOL) have provided a forecast for 2024 and 2028 based on 19 million passengers per annum (mppa). Bickerdike Allen Partners LLP (BAP) have produced average summer day and night airborne aircraft noise contours on the basis of these forecasts and this note reports the results.

## 2.0 CONTOUR METHODOLOGY

The contours have been produced using the Integrated Noise Model (INM) version 7.0d with a validation for currently common types based on measured results from the airport's NMTs in 2018. For two of the aircraft types in the forecasts no or limited measured results are available as they didn't operate at Luton in significant numbers in 2018. Therefore their modelled noise levels have been based on their certification noise levels when compared to the current aircraft types they are replacing as shown in Table 1 below.

| Replacement Aircraft Type | Current Aircraft Type | Noise Level Adjustment (dB) | |
|---|---|---|---|
| | | Arrival | Departure |
| Airbus A321neo | Airbus A321 | -1.8 | -6.3 |
| Boeing 737 MAX8 | Boeing 737-800 | -2.2 | -3.0 |

**Table 1: Modelled Noise Levels**

## 3.0 AIRCRAFT MOVEMENTS

The 2024 and 2028 19mppa forecasts are based on the actual movements in summer 2019, with some of the aircraft types changed to allow for expected fleet modernisation and a number of changes and additional movements, particularly an increase in general aviation flights. As the forecasts are based on actual movements they allow for the effect of delays.

In summer 2019 there were a significant number of delays resulting in an increase in night time movements. BAP understand LLAOL discussed the issues of delays with airlines prior to the 15th August and changes were subsequently made, which reduced the number of delays.

Based on this reduction in delays being maintained in future years BAP have factored up the forecast movements in the period 15th August to 15th September to produce 92 day forecasts. The resulting daytime and night time forecast movements are summarised in Table 2 below, and compared with the actual movements in summer 2019 and the latest forecast movements in 2024 and 2028 with 18mppa.

| Scenario | Summer Fixed Wing Movements | | |
|---|---|---|---|
| | Daytime | Night Time | Total |
| 2019 Actual | 34,124 | 5,398 | 39,522 |
| 2024 18mppa | 34,391 | 5,131 | 39,522 |
| 2028 18mppa | 34,574 | 4,863 | 39,437 |
| 2024 19mppa | 35,331 | 5,007 | 40,338 |
| 2028 19mppa | 34,849 | 5,002 | 39,851 |

**Table 2: Daytime and Night time Summer Movements**

Reviewing the movement numbers, the 19mppa forecasts have slightly more total movements. This is due to an increase in the number of general aviation movements in the 19mppa forecasts compared to the 18mppa forecasts. The number of passenger flights is actually slightly lower in the 19mppa forecasts. This, and the reduction in forecast movements with 19 mppa from 2024 to 2028, is due to the increased use of larger modernised aircraft types. As these types have more seats their use requires a reduction in the number of flights in order to remain at 19mppa.

Table 3 shows the proportions of movements by modernised aircraft in the forecasts and compares them with the proportions in the 18mppa forecasts. The 18mppa and 19mppa 2024 daytime forecasts have the same proportion of movements by modernised aircraft. The corresponding 2024 night time forecasts have a greater proportion of movements by modernised aircraft at 19mppa. The proportion of movements by modernised aircraft in 2028 are higher than in 2024, and are higher at 19mppa than at 18mppa.

| Scenario | % of Forecast Movements by Modernised Aircraft | |
|---|---|---|
| | Daytime | Night Time |
| 2024 18mppa | 39% | 36% |
| 2028 18mppa | 55% | 71% |
| 2024 19mppa | 39% | 49% |
| 2028 19mppa | 68% | 80% |

**Table 3: Percentage of Forecast Movements by Modernised Aircraft**

## 4.0 NOISE CONTOURS

The areas of the resulting 57 dB $L_{Aeq,16h}$ daytime and 48 dB $L_{Aeq,8h}$ night time noise contours are shown in Table 4 below, and compared with the latest 2024 and 2028 18mppa forecast contours and the current and proposed short term contour area limits and the current long term contour area limits.

| Scenario | Noise Contour Area, km$^2$ | |
|---|---|---|
| | 57 dB $L_{Aeq,16h}$ Daytime | 48 dB $L_{Aeq,8h}$ Night Time |
| 2024 18mppa | 16.7 | 37.2 |
| 2028 18mppa | 13.6 | 31.6 |
| 2024 19mppa | 17.5 | 34.9 |
| 2028 19mppa | 12.8 | 29.9 |
| Current Short Term Limit | 19.4 | 37.2 |
| Proposed Short Term Limit | 21.4 | 44.1 |
| Current Long Term Limit | 15.2 | 31.6 |

**Table 4: 57 dB Daytime and 48 dB Night time Noise Contour Areas**

The 2024 19mppa daytime contours are larger than those for 18mppa, while the night time contours are smaller than those for 18mppa. The increase in the 19mppa daytime contours is due to the increase in forecast movements whilst having a the same proportion of modernised aircraft to the 18mppa forecast. The night time contours are smaller due to the slight reduction in movements and the greater proportion of modernised aircraft in the 19mppa forecast. The areas of the 2024 19mppa 57 dB daytime and 48 dB night time contours are below the current short term limits.

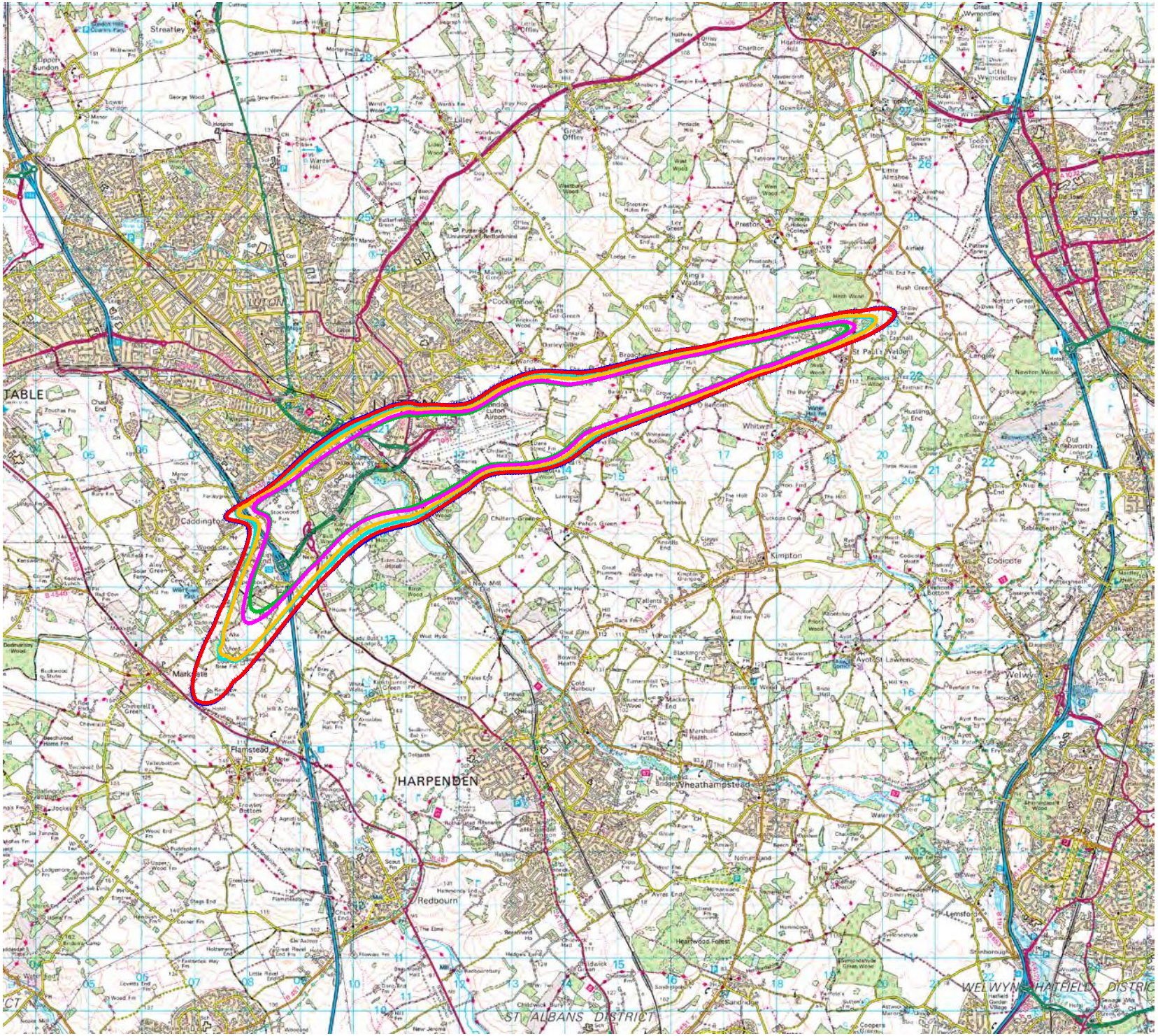
The 2028 19mppa daytime and night time contours are smaller than those for 18mppa. This is largely due to the greater proportion of modernised aircraft in the 19mppa forecasts. The areas of the 2028 19mppa 57 dB daytime and 48 dB night time contours are below the current long term limits.

**Duncan Rogers**
**for Bickerdike Allen Partners**

**David Charles**
**Partner**

N.B the forecasts have been taken from the following files provided by LLAOL:

19mppa Forecasts: S19 92day 19m Consolidated v3.xlsx (provided by email on 11/12/19)

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LEGEND:

57 dB $L_{Aeq,16h}$ Noise Contours,

- 2021 18mppa Forecast
- 2021 19mppa Forecast
- 2024 18mppa Forecast
- 2024 19mppa Forecast
- 2028 18mppa Forecast
- 2028 19mppa Forecast

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London Luton Airport

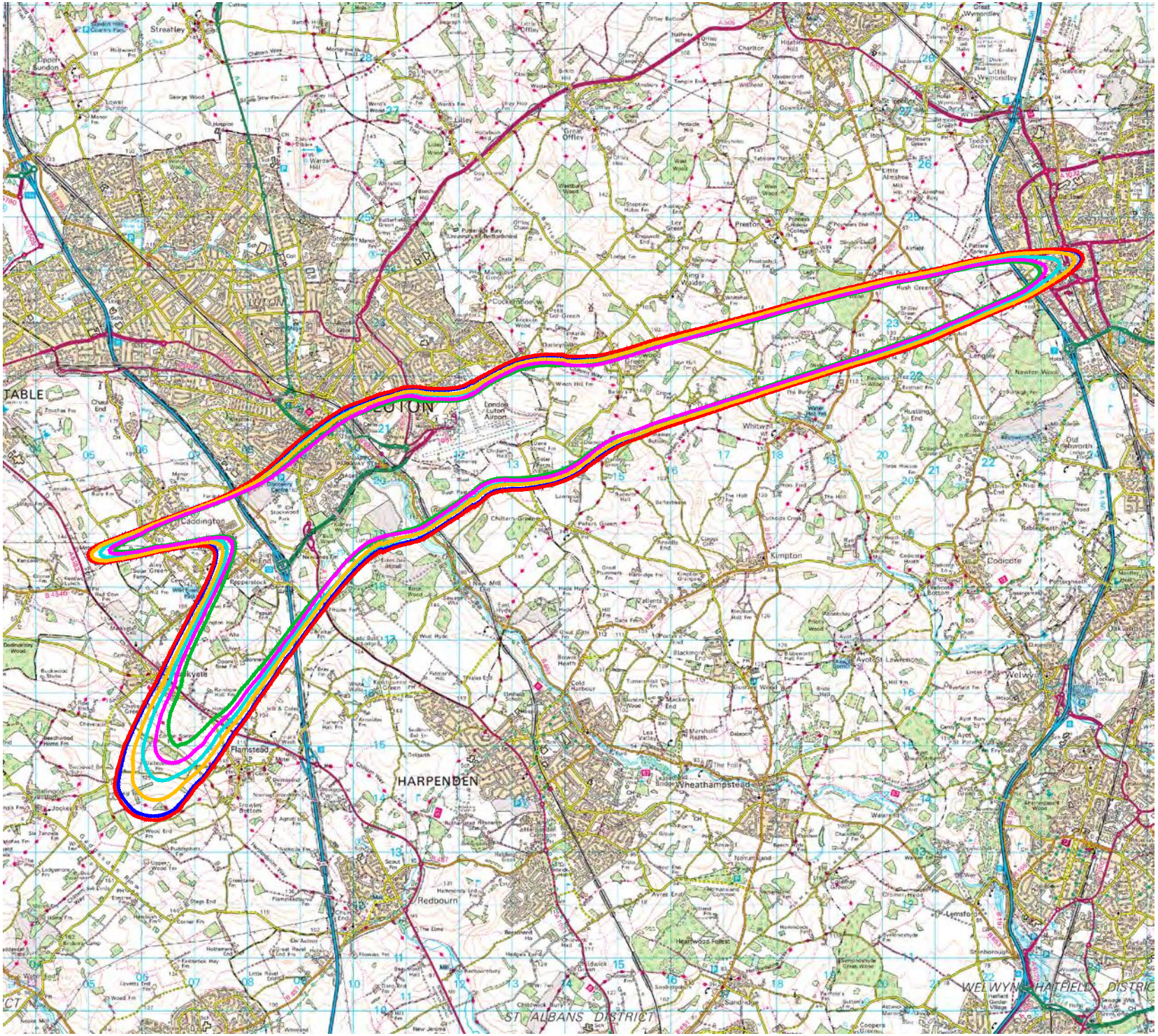
57 dB $L_{Aeq,16h}$ Summer Daytime Noise Contours
Comparison of 18mppa and 19mppa
2021, 2024 and 2028

DRAWN: DR CHECKED: DC

DATE: December 2019 SCALE: 1:100000@A4

FIGURE No:

A11060_06_DR001_1.0

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LEGEND:

48 dB $L_{Aeq,8h}$ Noise Contours,

- 2021 18mppa Forecast
- 2021 19mppa Forecast
- 2024 18mppa Forecast
- 2024 19mppa Forecast
- 2028 18mppa Forecast
- 2028 19mppa Forecast

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London Luton Airport

48 dB $L_{Aeq,8h}$ Summer Night Time Noise Contours
Comparison of 18mppa and 19mppa
2021, 2024 and 2028

DRAWN: DR CHECKED: DC

DATE: December 2019 SCALE: 1:100000@A4

FIGURE No:

A11060_06_DR002_1.0

# Appendix C Road Traffic Noise Data and Results

Road traffic noise has been predicted using flow data provided by Arup, as set out within **Table C1.1**, and the basic noise level calculation methodology within Calculation of Road Traffic Noise. The results are shown within **Table C1.2**.

Table C1.1 Road Traffic Data

| ID | Road | 2021, 18 mppa | | 2021, 19 mppa | | Speed (kmph)* |
|---|---|---|---|---|---|---|
| | | Total Flows | HGV% | Total Flows | HGV% | |
| 1 | M1 north of junction 10 | 30845 | 2.2 | 31039 | 2.2 | 108 |
| 2 | M1 south of junction 10 | 41634 | 2.6 | 42028 | 2.6 | 108 |
| 3 | A1081 New Airport Way, east of M1 Junction 10 | 72051 | 2.3 | 72638 | 2.3 | 80 |
| 4 | A1081 New Airport Way south of junction with London Road S/London Road N junction | 17035 | 1.5 | 17035 | 1.5 | 60 |
| 5 | London Road S, west of junction with A1081 New Airport Way/London Road N | 18664 | 1.5 | 18664 | 1.5 | 50 |
| 6 | London Road N, north of junction with London Road S and A1081 New Airport Way | 19391 | 1.4 | 19391 | 1.4 | 50 |
| 7 | A1081 New Airport Way north of junction with London Road/A1081 London Road | 15998 | 1.1 | 16012 | 1.1 | 60 |
| 8 | A1081 London Road south of London Road/A1081 New Airport Way | 24015 | 1.4 | 24030 | 1.4 | 50 |
| 9 | London Road West of junction with A1081 London Road/A1081 New Airport Way | 20572 | 1.5 | 20572 | 1.5 | 50 |
| 10 | A1081 New Airport Way west of B653 | 63232 | 2.3 | 64151 | 2.2 | 50 |

| ID | Road | 2021, 18 mppa | | 2021, 19 mppa | | Speed (kmph)* |
|---|---|---|---|---|---|---|
| | | Total Flows | HGV% | Total Flows | HGV% | |
| **11** | B365 north of A1081 New Airport Way | 18869 | 2.4 | 18869 | 2.4 | 50 |
| **12** | A1081 New Airport Way east of B653 | 51833 | 2.1 | 52753 | 2.1 | 50 |
| **13** | A505 Kimpton Road west of junction with A505 Vauxhall Way/A1081 New Airport Way | 11187 | 4.4 | 11221 | 4.4 | 50 |
| **14** | A505 Vauxhall Way north of the juncton with A1081 New Airport Way/A505 Airport Way | 28614 | 1.6 | 28614 | 1.6 | 50 |
| **15** | A505 Airport Way east of junction with A505 Vauxhall Way /A1081 New Airport Way | 14214 | 1.6 | 14248 | 1.6 | 50 |
| **16** | A1081 New Airport Way south of junction with A505 Airport Way/A505 Vauxhall Road | 29179 | 3.4 | 29179 | 3.4 | 50 |
| **17** | Harrowden Road west of jucntion with A505 Vauxhall Way and Eaton Green Road | 1896 | 0.0 | 1896 | 0.0 | 50 |
| **18** | A505 Vauxhall Road north of junction with Harrowden Road/Eaton green Road | 23331 | 2.1 | 23427 | 2.1 | 50 |
| **19** | Eaton Green Road east of junction with A505 Vauxhalll Road/Harrowden road | 24090 | 0.9 | 24186 | 0.9 | 50 |
| **20** | A505 Vauxhall Road south of the junction with Harrowden Road/Eaton Green Road | 28428 | 1.2 | 28428 | 1.2 | 50 |
| **21** | Eaton Green Road West of junction with Frank lester Way | 21970 | 1.4 | 22063 | 1.4 | 50 |
| **22** | Frank Lester Way south of the junction with Eaton Green Road | 22934 | 1.0 | 23027 | 1.0 | 50 |
| **23** | Eaton Green Road East of junction with Frank Lester Way | 19497 | 0.9 | 19497 | 0.9 | 50 |
| **24** | Frank Lester Way north of junction with president way and Airport Approach Road | 22909 | 1.0 | 23002 | 1.0 | 50 |

| ID | Road | 2021, 18 mppa | | 2021, 19 mppa | | Speed (kmph)* |
|---|---|---|---|---|---|---|
| | | Total Flows | HGV% | Total Flows | HGV% | |
| 25 | President Way east of junction with Frank Lester Way/Airport Approach Road | 11858 | 2.1 | 11858 | 2.1 | 50 |
| 26 | Airport approach road south of jucntion with President Way/Frank Lester Way | 907 | 3.8 | 957 | 3.8 | 50 |
| 27 | Percival Way west of jucntion with Frank lesterWay/President Way | 17775 | 1.6 | 17818 | 1.6 | 50 |
| 28 | A505 Airport Way west of junction with Percival Way/A1081 New Airport Way | 13698 | 0.9 | 13728 | 0.9 | 50 |
| 29 | Percival Way north of junction with A505 Airport Way/A1080 New Airport Way | 17073 | 1.2 | 17165 | 1.2 | 50 |
| 30 | A505 Airport Way east of junction with Percival way/A1081 NewAirport Road | 22523 | 0.6 | 23564 | 0.5 | 50 |
| 31 | A1081 New Airport Road south of junction with A505 Airport Way/Percvial Way | 23126 | 0.8 | 24045 | 0.8 | 50 |
| 32 | Airport Way west of junction with car park/Airport Approach Road | 22554 | 0.5 | 23605 | 0.5 | 50 |
| 33 | Airport Approach Road east of junction with Airport Way/Car park | 21796 | 0.2 | 22847 | 0.2 | 50 |

* Taken from CRTN speed classification using road speed limits

## Table C1.2 Road Traffic Noise Results and Comparison – Noise Levels Provided for 10 metres from the kerbside

| ID | Road | 2011 Baseline Noise Levels (dB) | | 2021, 18 mppa Noise Levels (dB) | 2021, 19 mppa Noise Levels (dB) | 2021 19mppa Minus Base 2011 Noise Levels (dB) | 2021 19mppa Minus 2021 18mppa Noise Levels (dB) |
|---|---|---|---|---|---|---|---|
| | | $L_{Aeq, 16hr}$ | $L_{A10,18hr}$ | $L_{A10,18hr}$ | $L_{Aeq, 16hr}$ | $L_{Aeq, 16hr}$ | $L_{A10,18hr}$ |
| 1 | M1 north of junction 10 | - | 77.7 | 77.7 | 75.5 | - | 0.0 |
| 2 | M1 south of junction 10 | - | 79.0 | 79.1 | 76.9 | - | 0.0 |

| ID | Road | 2011 Baseline Noise Levels (dB) | 2021, 18 mppa Noise Levels (dB) | 2021, 19 mppa Noise Levels (dB) | 2021 19mppa Minus Base 2011 Noise Levels (dB) | 2021 19mppa Minus 2021 18mppa Noise Levels (dB) |
|---|---|---|---|---|---|---|
| | | $L_{Aeq, 16hr}$ | $L_{A10,18hr}$ | $L_{A10,18hr}$ | $L_{Aeq, 16hr}$ | $L_{Aeq, 16hr}$ | $L_{A10,18hr}$ |
| **3** | A1081 New Airport Way, east of M1 Junction 10 | - | 78.8 | 78.8 | 76.6 | - | 0.0 |
| **4** | A1081 New Airport Way south of junction with London Road S/London Road N junction | - | 70.3 | 70.3 | 68.1 | - | 0.0 |
| **5** | London Road S, west of junction with A1081 New Airport Way/London Road N | - | 69.6 | 69.6 | 67.4 | - | 0.0 |
| **6** | London Road N, north of junction with London Road S and A1081 New Airport Way | - | 69.7 | 69.7 | 67.5 | - | 0.0 |
| **7** | A1081 New Airport Way north of junction with London Road/A1081 London Road | - | 69.9 | 69.9 | 67.7 | - | 0.0 |
| **8** | A1081 London Road south of London Road/A1081 New Airport Way | - | 70.7 | 70.7 | 68.5 | - | 0.0 |
| **9** | London Road West of junction with A1081 London Road/A1081 New Airport Way | - | 70.0 | 70.0 | 67.8 | - | 0.0 |
| **10** | A1081 New Airport Way west of B653 | - | 75.2 | 75.3 | 73.1 | - | 0.1 |
| **11** | B365 north of A1081 New Airport Way | - | 70.0 | 70.0 | 67.8 | - | 0.0 |
| **12** | A1081 New Airport Way east of B653 | - | 74.3 | 74.3 | 72.1 | - | 0.1 |
| **13** | A505 Kimpton Road west of junction with A505 Vauxhall Way/A1081 New Airport Way | 67.0 | 68.4 | 68.4 | 66.2 | -0.8 | 0.0 |
| **14** | A505 Vauxhall Way north of the juncton with A1081 New Airport Way/A505 Airport Way | 69.0 | 71.5 | 71.5 | 69.3 | 0.3 | 0.0 |
| **15** | A505 Airport Way east of junction with A505 Vauxhall Way /A1081 New Airport Way | - | 68.5 | 68.5 | 66.3 | - | 0.0 |

| ID | Road | 2011 Baseline Noise Levels (dB) | 2021, 18 mppa Noise Levels (dB) | 2021, 19 mppa Noise Levels (dB) | 2021 19mppa Minus Base 2011 Noise Levels (dB) | 2021 19mppa Minus 2021 18mppa Noise Levels (dB) |
|---|---|---|---|---|---|---|
| | | $L_{Aeq, 16hr}$ | $L_{A10,18hr}$ | $L_{A10,18hr}$ | $L_{Aeq, 16hr}$ | $L_{Aeq, 16hr}$ | $L_{A10,18hr}$ |
| **16** | A1081 New Airport Way south of junction with A505 Airport Way/A505 Vauxhall Road | 68.0 | 72.2 | 72.2 | 70.0 | 2.0 | 0.0 |
| **17** | Harrowden Road west of Junction with A505 Vauxhall Way and Eaton Green Road | - | 59.9 | 60.0 | 57.8 | - | 0.1 |
| **18** | A505 Vauxhall Road north of junction with Harrowden Road/Eaton green Road | 69.0 | 70.8 | 70.8 | 68.6 | -0.4 | 0.0 |
| **19** | Eaton Green Road east of junction with A505 Vauxhalll Road/Harrowden road | 67.0 | 70.5 | 70.5 | 68.3 | 1.3 | 0.0 |
| **20** | A505 Vauxhall Road south of the junction with Harrowden Road/Eaton Green Road | - | 71.3 | 71.3 | 69.1 | - | 0.0 |
| **21** | Eaton Green Road West of junction with Frank Lester Way | 67.0 | 70.3 | 70.3 | 68.1 | 1.1 | 0.0 |
| **22** | Frank Lester Way south of the junction with Eaton Green Road | 66.0 | 70.3 | 70.3 | 68.1 | 2.1 | 0.0 |
| **23** | Eaton Green Road East of junction with Frank Lester Way | 68.0 | 69.6 | 69.6 | 67.4 | -0.6 | 0.0 |
| **24** | Frank Lester Way north of junction with president way and Airport Approach Road | - | 70.3 | 70.3 | 68.1 | - | 0.0 |
| **25** | President Way east of junction with Frank Lester Way/Airport Approach Road | - | 67.9 | 67.9 | 65.7 | - | 0.0 |
| **26** | Airport approach road south of junction with President Way/Frank Lester Way | - | 57.7 | 58.0 | 55.8 | - | 0.3 |
| **27** | Percival Way west of junction with Frank lesterWay/President Way | - | 69.4 | 69.5 | 67.3 | - | 0.0 |
| **28** | A505 Airport Way west of junction with Percival Way/A1081 New Airport Way | - | 68.0 | 68.0 | 65.8 | - | 0.0 |
| **29** | Percival Way north of junction with A505 Airport Way/A1080 New Airport Way | - | 69.1 | 69.2 | 67.0 | - | 0.0 |

| ID | Road | 2011 Baseline Noise Levels (dB) | | 2021, 18 mppa Noise Levels (dB) | 2021, 19 mppa Noise Levels (dB) | 2021 19mppa Minus Base 2011 Noise Levels (dB) | 2021 19mppa Minus 2021 18mppa Noise Levels (dB) |
|---|---|---|---|---|---|---|---|
| | | $L_{Aeq, 16hr}$ | $L_{A10,18hr}$ | $L_{A10,18hr}$ | $L_{Aeq, 16hr}$ | $L_{Aeq, 16hr}$ | $L_{A10,18hr}$ |
| **30** | A505 Airport Way east of junction with Percival way/A1081 New Airport Road | - | 70.1 | 70.3 | 68.1 | - | 0.2 |
| **31** | A1081 New Airport Road south of junction with A505 Airport Way/Percival Way | - | 70.3 | 70.4 | 68.2 | - | 0.2 |
| **32** | Airport Way west of junction with car park/Airport Approach Road | - | 70.1 | 70.3 | 68.1 | - | 0.2 |
| **33** | Airport Approach Road east of junction with Airport Way/Car park | - | 69.8 | 70.0 | 67.8 | - | 0.2 |

# Appendix D Aviation Noise Results

Within **Table D1.1** and **D1.2**, to identify the maximum difference in noise levels between the 2021 scenarios and the baseline scenarios, the baseline area (whether 2011, Condition 10, etc.) for a specific noise level is compared with the areas in the relevant 19 mppa scenario for a closest match (this will normally be between two areas rather than an exact match). The baseline area is then rounded up or down (whichever is more conservative against the 19 mppa scenario) to match the closest 19 mppa area, The relevant noise level associated with the matched area is then the maximum noise level increase from the baseline for that particular noise contour. For example, in **Table D1.1**, the baseline 2011 contour for 66 dB encompasses 2.4 km$^2$. In the 2021 19 mppa scenario, the noise level associated with 2.4 km$^2$ outside is somewhere between 67 and 68 dB. As a worst-case, the level is rounded up to 68 dB (though this would represent more than 2.4 km$^2$), allowing a conclusion to be made that the increase from the 2011 baseline as a result of the 19 mppa application for 2021 would be not more than 2 dB.

Table D1.1 Aviation Noise Area Within Noise Contours Comparison - Daytime

| $L_{Aeq, 16hr}$ (dB) | Area 2021 19 mppa Contours (km$^2$) | Area 2011 Contours (km$^2$) | Rounded Up Closest Integer 2021 19 mppa Noise Level ($L_{Aeq, 16hr}$ dB) from 2011 | Condition 10 Area Contours (km$^2$) | Rounded Up Closest Integer 2021 19 mppa Noise Level ($L_{Aeq, 16hr}$ dB) from Condition 10 | Area 2028 19 mppa Contours (km$^2$) | 2012 Future Baseline (FB) 2028 Contours (km$^2$) | Rounded Down Closest Integer 2028 19 mppa Noise Level ($L_{Aeq, 16hr}$ dB) from FB 2028 | Area 2028 18 mppa Contours (km$^2$) | Rounded Down Closest Integer 2028 19 mppa Noise Level ($L_{Aeq, 16hr}$ dB) from FB 2028 |
|---|---|---|---|---|---|---|---|---|---|---|
| **48** | 95.7 | 71.9 | 50 | 89.5 | 49 | 64.9 | 73.9 | N/A | 68.3 | 48 |
| **49** | 81.0 | 60.7 | 51 | 75.6 | 50 | 54.9 | 62.6 | 48 | 57.8 | 49 |
| **50** | 68.1 | 51.6 | 52 | 63.7 | 51 | 46.5 | 53.4 | 49 | 48.9 | 50 |
| **51** | 57.7 | 44.0 | 53 | 54.1 | 52 | 39.5 | 45.6 | 50 | 41.6 | 51 |
| **52** | 49.3 | 37.2 | 54 | 46.4 | 53 | 33.3 | 38.8 | 51 | 35.2 | 52 |
| **53** | 42.3 | 30.9 | 55 | 39.6 | 54 | 27.8 | 32.5 | 52 | 29.5 | 53 |

| $L_{Aeq, 16hr}$ (dB) | Area 2021 19 mppa Contours ($km^2$) | Area 2011 Contours ($km^2$) | Rounded Up Closest Integer 2021 19 mppa Noise Level ($L_{Aeq, 16hr}$ dB) from 2011 | Condition 10 Area Contours ($km^2$) | Rounded Up Closest Integer 2021 19 mppa Noise Level ($L_{Aeq, 16hr}$ dB) from Condition 10 | Area 2028 19 mppa Contours ($km^2$) | 2012 Future Baseline (FB) 2028 Contours ($km^2$) | Rounded Down Closest Integer 2028 19 mppa Noise Level ($L_{Aeq, 16hr}$ dB) from FB 2028 | Area 2028 18 mppa Contours ($km^2$) | Rounded Down Closest Integer 2028 19 mppa Noise Level ($L_{Aeq, 16hr}$ dB) from FB 2028 |
|---|---|---|---|---|---|---|---|---|---|---|
| **54** | 35.9 | 25.4 | 56 | 33.5 | 55 | 22.9 | 26.7 | 53 | 24.3 | 54 |
| **55** | 30.2 | 20.9 | 57 | 28.1 | 56 | 19.0 | 22.0 | 54 | 20.2 | 55 |
| **56** | 25.3 | 17.4 | 58 | 23.4 | 57 | 15.6 | 18.3 | 55 | 16.6 | 56 |
| **57** | 21.0 | 14.4 | 59 | 19.4 | 58 | 12.8 | 15.2 | 56 | 13.6 | 57 |
| **58** | 17.3 | 11.9 | 60 | 15.9 | 59 | 10.4 | 12.6 | 57 | 11.0 | 58 |
| **59** | 14.2 | 10.0 | 61 | 13.0 | 60 | 8.5 | 10.6 | 58 | 8.9 | 59 |
| **60** | 11.7 | 8.5 | 62 | 10.8 | 61 | 7.1 | 8.9 | 59 | 7.4 | 60 |
| **61** | 9.8 | 7.2 | 63 | 9.0 | 62 | 5.9 | 7.6 | 60 | 6.2 | 61 |
| **62** | 8.3 | 6.0 | 64 | 7.6 | 63 | 4.8 | 6.4 | 61 | 5.0 | 62 |
| **63** | 6.9 | 5.0 | 65 | 6.3 | 64 | 3.9 | 5.3 | 62 | 4.1 | 63 |
| **64** | 5.7 | 4.0 | 66 | 5.1 | 65 | 3.1 | 4.3 | 63 | 3.2 | 64 |
| **65** | 4.7 | 3.1 | 67 | 4.1 | 66 | 2.4 | 3.4 | 64 | 2.5 | 65 |
| **66** | 3.7 | 2.4 | 68 | 3.2 | 67 | 2.0 | 2.7 | 65 | 2.1 | 66 |
| **67** | 2.9 | 1.9 | 69 | 2.5 | 68 | 1.6 | 2.1 | 66 | 1.7 | 67 |
| **68** | 2.3 | 1.6 | N/A | 2.1 | 69 | 1.4 | 1.7 | 67 | 1.5 | 68 |

| $L_{Aeq, 16hr}$ (dB) | Area 2021 19 mppa Contours ($km^2$) | Area 2011 Contours ($km^2$) | Rounded Up Closest Integer 2021 19 mppa Noise Level ($L_{Aeq, 16hr}$ dB) from 2011 | Condition 10 Area Contours ($km^2$) | Rounded Up Closest Integer 2021 19 mppa Noise Level ($L_{Aeq, 16hr}$ dB) from Condition 10 | Area 2028 19 mppa Contours ($km^2$) | 2012 Future Baseline (FB) 2028 Contours ($km^2$) | Rounded Down Closest Integer 2028 19 mppa Noise Level ($L_{Aeq, 16hr}$ dB) from FB 2028 | Area 2028 18 mppa Contours ($km^2$) | Rounded Down Closest Integer 2028 19 mppa Noise Level ($L_{Aeq, 16hr}$ dB) from FB 2028 |
|---|---|---|---|---|---|---|---|---|---|---|
| **69** | 1.9 | 1.3 | N/A | 1.7 | N/A | 1.2 | 1.4 | 68 | 1.3 | 69 |

Table D1.2 Aviation Noise Area Within Noise Contours Comparison – Night-time

| $L_{Aeq, 16hr}$ | Area 2021 19 mppa Contours ($km^2$) | Area 2011 Contours ($km^2$) | Rounded Up Closest Integer 2021 19 mppa Noise Level LAeq, 16hr dB) from 2011 | Condition 10 Area Contours ($km^2$) | Rounded Up Closest Integer 2021 19 mppa Noise Level ($L_{Aeq, 16hr}$ dB) from Condition 10 | Area 2028 19 mppa Contours ($km^2$) | 2012 Future Baseline (FB) 2028 Contours ($km^2$) | Rounded Down Closest Integer 2028 19 mppa Noise Level ($L_{Aeq, 16hr}$ dB) from FB 2028 | Area 2028 18 mppa Contours ($km^2$) | Rounded Down Closest Integer 2028 19 mppa Noise Level ($L_{Aeq, 16hr}$ dB) from FB 2028 |
|---|---|---|---|---|---|---|---|---|---|---|
| **45** | 67.0 | 60.4 | 46 | 60.9 | 46 | 50.7 | 53.3 | N/A | 53.5 | 45 |
| **46** | 56.7 | 50.9 | 47 | 51.5 | 47 | 42.6 | 45.4 | 45 | 44.9 | 46 |
| **47** | 47.9 | 42.8 | 48 | 43.8 | 48 | 35.8 | 38.6 | 46 | 37.7 | 47 |
| **48** | 40.6 | 35.8 | 49 | 37.2 | 49 | 29.9 | 32.3 | 47 | 31.6 | 48 |
| **49** | 34.3 | 29.5 | 50 | 31.2 | 50 | 24.7 | 26.4 | 48 | 26.1 | 49 |
| **50** | 28.7 | 24.1 | 51 | 25.9 | 51 | 20.2 | 21.9 | 49 | 21.4 | 50 |
| **51** | 23.6 | 19.9 | 52 | 21.5 | 52 | 16.8 | 18.4 | 50 | 17.5 | 51 |
| **52** | 19.6 | 16.6 | 53 | 17.7 | 53 | 13.9 | 15.4 | 51 | 14.4 | 52 |

| $L_{Aeq, 16hr}$ | Area 2021 19 mppa Contours ($km^2$) | Area 2011 Contours ($km^2$) | Rounded Up Closest Integer 2021 19 mppa Noise Level LAeq, 16hr dB) from 2011 | Condition 10 Area Contours ($km^2$) | Rounded Up Closest Integer 2021 19 mppa Noise Level ($L_{Aeq, 16hr}$ dB) from Condition 10 | Area 2028 19 mppa Contours ($km^2$) | 2012 Future Baseline (FB) 2028 Contours ($km^2$) | Rounded Down Closest Integer 2028 19 mppa Noise Level ($L_{Aeq, 16hr}$ dB) from FB 2028 | Area 2028 18 mppa Contours ($km^2$) | Rounded Down Closest Integer 2028 19 mppa Noise Level ($L_{Aeq, 16hr}$ dB) from FB 2028 |
|---|---|---|---|---|---|---|---|---|---|---|
| **53** | 16.0 | 13.8 | 54 | 14.6 | 54 | 11.4 | 12.8 | 52 | 11.6 | 53 |
| **54** | 13.1 | 11.4 | 55 | 11.8 | 55 | 9.2 | 10.7 | 53 | 9.2 | 54 |
| **55** | 10.5 | 9.4 | 56 | 9.6 | 56 | 7.5 | 9.0 | 54 | 7.5 | 55 |
| **56** | 8.6 | 7.9 | 57 | 8.0 | 57 | 6.2 | 7.7 | 55 | 6.2 | 56 |
| **57** | 7.1 | 6.6 | 58 | 6.6 | 58 | 5.1 | 6.5 | 56 | 5.1 | 57 |
| **58** | 5.8 | 5.5 | 59 | 5.4 | 59 | 4.2 | 5.4 | 57 | 4.2 | 58 |
| **59** | 4.8 | 4.5 | 60 | 4.4 | 60 | 3.3 | 4.4 | 58 | 3.3 | 59 |
| **60** | 3.8 | 3.6 | 61 | 3.5 | 61 | 2.6 | 3.5 | 59 | 2.7 | 60 |
| **61** | 3.0 | 2.8 | 62 | 2.7 | 62 | 2.1 | 2.7 | 60 | 2.1 | 61 |
| **62** | 2.4 | 2.1 | 63 | 2.2 | 63 | 1.7 | 2.1 | 61 | 1.8 | 62 |
| **63** | 2.0 | 1.7 | 64 | 1.8 | 64 | 1.4 | 1.7 | 62 | 1.5 | 63 |
| **64** | 1.6 | 1.4 | 65 | 1.5 | 65 | 1.2 | 1.4 | 63 | 1.3 | 64 |
| **65** | 1.4 | 1.2 | 66 | 1.3 | 66 | 1.0 | 1.2 | 64 | 1.1 | 65 |
| **66** | 1.2 | 1.0 | N/A | 1.1 | N/A | 0.9 | 1.0 | 65 | 0.9 | 66 |

For **Table D1.3** and **D1.4**, showing the results of the non-residential receptor assessment, as levels are taken from specific receptors within the model, a direct comparison can be made between scenarios.

Table D1.3 Non-residential Aviation Noise Results - Daytime

| Location | 2021 19 mppa Noise Levels ($L_{Aeq, 16hr}$ dB) | 2011 Noise Levels ($L_{Aeq, 16hr}$ dB) | Difference: 2021 19 mppa – 2011 (dB) | Condition 10 Noise Levels ($L_{Aeq, 16hr}$ dB) | Difference: 2021 19 mppa – Condition 10 (dB) | 2028 19 mppa Noise Levels ($L_{Aeq, 16hr}$ dB) | 2012 Future Baseline (FB) 2028 Noise Levels ($L_{Aeq, 16hr}$ dB) | Difference: 2028 19 mppa – FB 2028 Noise Levels (dB) | 2028 18 mppa Noise Levels ($L_{Aeq, 16hr}$ dB) | Difference: 2028 19 mppa – 2028 18 mppa Noise Levels (dB) |
|---|---|---|---|---|---|---|---|---|---|---|
| **Old Knebworth Lodge Farm** | 44.4 | 42.2 | 2.2 | 44.3 | 0.1 | 41.5 | 41.6 | -0.1 | 42 | -0.4 |
| **Grove Farm Noise Terminal** | 57.7 | 54.9 | 2.8 | 57.4 | 0.3 | 54.9 | 55.0 | -0.1 | 55 | -0.4 |
| **Caddington** | 54.5 | 52.7 | 1.8 | 54.1 | 0.4 | 53.3 | 53.0 | 0.3 | 54 | -0.2 |
| **Park Town, Luton** | 60.8 | 58.8 | 2.0 | 60.2 | 0.6 | 57.4 | 59.0 | -1.6 | 58 | -0.2 |
| **Whitwell** | 47.5 | 45.7 | 1.8 | 47.1 | 0.4 | 45.4 | 45.8 | -0.4 | 46 | -0.3 |
| **Frogmore Noise Terminal** | 59.5 | 57.7 | 1.8 | 59.1 | 0.4 | 58.0 | 58.3 | -0.3 | 58 | -0.2 |
| **Breachwood Green** | 54.5 | 52.5 | 2.0 | 54.2 | 0.3 | 52.7 | 52.9 | -0.2 | 53 | -0.3 |
| **St Pauls Walden** | 53.8 | 51.7 | 2.1 | 53.4 | 0.4 | 52.0 | 52.1 | -0.1 | 52 | -0.2 |
| **Peter's Green** | 47.0 | 44.8 | 2.2 | 46.5 | 0.5 | 44.0 | 45.0 | -1.0 | 45 | -0.5 |

| Location | 2021 19 mppa Noise Levels ($L_{Aeq, 16hr}$ dB) | 2011 Noise Levels ($L_{Aeq, 16hr}$ dB) | Difference: 2021 19 mppa – 2011 (dB) | Condition 10 Noise Levels ($L_{Aeq, 16hr}$ dB) | Difference: 2021 19 mppa – Condition 10 (dB) | 2028 19 mppa Noise Levels ($L_{Aeq, 16hr}$ dB) | 2012 Future Baseline (FB) 2028 Noise Levels ($L_{Aeq, 16hr}$ dB) | Difference: 2028 19 mppa – FB 2028 Noise Levels (dB) | 2028 18 mppa Noise Levels ($L_{Aeq, 16hr}$ dB) | Difference: 2028 19 mppa – 2028 18 mppa Noise Levels (dB) |
|---|---|---|---|---|---|---|---|---|---|---|
| **Kinsbourne Green** | 44.0 | 43.7 | 0.3 | 43.5 | 0.5 | 41.3 | 43.9 | -2.6 | 42 | -0.4 |
| **Farley Hill School Luton** | 49.5 | 47.6 | 1.9 | 48.9 | 0.6 | 46.7 | 47.9 | -1.2 | 47 | -0.3 |
| **Slip End** | 60.4 | 57.9 | 2.5 | 60.0 | 0.4 | 57.5 | 58.0 | -0.5 | 58 | -0.3 |
| **Winch Hill Farm** | 61.3 | 59.0 | 2.3 | 60.8 | 0.5 | 58.3 | 59.2 | -0.9 | 59 | -0.4 |
| **Harpenden Children's Home** | 39.7 | 38.4 | 1.3 | 39.0 | 0.7 | 36.9 | 38.7 | -1.8 | 37 | -0.3 |
| **Walkern** | 46.4 | 44.9 | 1.5 | 46.0 | 0.4 | 45.5 | 45.8 | -0.3 | 46 | -0.2 |
| **Stevenage (Eastern Perimeter)** | 49.1 | 47.4 | 1.7 | 48.6 | 0.5 | 48.1 | 48.3 | -0.2 | 48 | -0.2 |
| **Stevenage Station** | 52.6 | 50.9 | 1.7 | 52.2 | 0.4 | 51.4 | 51.8 | -0.4 | 52 | -0.1 |
| **Rush Green** | 54.8 | 53.0 | 1.8 | 54.5 | 0.3 | 53.5 | 53.8 | -0.3 | 54 | -0.2 |
| **Luton (Wondon End)** | 54.0 | 51.7 | 2.3 | 53.5 | 0.5 | 51.0 | 51.9 | -0.9 | 52 | -0.5 |
| **Luton (South East)** | 66.7 | 64.9 | 1.8 | 66.1 | 0.6 | 63.7 | 65.0 | -1.3 | 64 | -0.1 |

| Location | 2021 19 mppa Noise Levels ($L_{Aeq, 16hr}$ dB) | 2011 Noise Levels ($L_{Aeq, 16hr}$ dB) | Difference: 2021 19 mppa – 2011 (dB) | Condition 10 Noise Levels ($L_{Aeq, 16hr}$ dB) | Difference: 2021 19 mppa – Condition 10 (dB) | 2028 19 mppa Noise Levels ($L_{Aeq, 16hr}$ dB) | 2012 Future Baseline (FB) 2028 Noise Levels ($L_{Aeq, 16hr}$ dB) | Difference: 2028 19 mppa – FB 2028 Noise Levels (dB) | 2028 18 mppa Noise Levels ($L_{Aeq, 16hr}$ dB) | Difference: 2028 19 mppa – 2028 18 mppa Noise Levels (dB) |
|---|---|---|---|---|---|---|---|---|---|---|
| **Kensworth** | 49.9 | 47.9 | 2.0 | 49.5 | 0.4 | 48.8 | 48.2 | 0.6 | 49 | -0.2 |
| **Hudnall Corner** | 47.6 | 46.1 | 1.5 | 46.4 | 1.2 | 44.8 | 45.5 | -0.7 | 45 | -0.3 |
| **Flamstead** | 50.8 | 50.6 | 0.2 | 50.5 | 0.3 | 48.0 | 50.8 | -2.8 | 48 | -0.4 |
| **Markyate** | 53.2 | 50.5 | 2.7 | 52.8 | 0.4 | 50.3 | 50.5 | -0.2 | 51 | -0.4 |

Table D1.4 Non-residential Aviation Noise Results – Night-time

| Location | 2021 19 mppa Noise Levels ($L_{Aeq, 16hr}$ dB) | 2011 Noise Levels ($L_{Aeq, 16hr}$ dB) | Difference: 2021 19 mppa – 2011 (dB) | Condition 10 Noise Levels ($L_{Aeq, 16hr}$ dB) | Difference: 2021 19 mppa – Condition 10 (dB) | 2028 19 mppa Noise Levels ($L_{Aeq, 16hr}$ dB) | 2012 Future Baseline (FB) 2028 Noise Levels ($L_{Aeq, 16hr}$ dB) | Difference: 2028 19 mppa – FB 2028 Noise Levels (dB) | 2028 18 mppa Noise Levels ($L_{Aeq, 16hr}$ dB) | Difference: 2028 19 mppa – 2028 18 mppa Noise Levels (dB) |
|---|---|---|---|---|---|---|---|---|---|---|
| **Old Knebworth Lodge Farm** | 38.8 | 37.6 | 1.2 | 38.4 | 0.4 | 36.6 | 36.5 | 0.1 | 37 | -0.5 |
| **Grove Farm Noise Terminal** | 52.1 | 50.0 | 2.1 | 51.6 | 0.5 | 49.8 | 49.9 | -0.1 | 50 | -0.5 |
| **Caddington** | 50.5 | 49.8 | 0.7 | 49.9 | 0.6 | 49.4 | 48.3 | 1.1 | 50 | -0.2 |
| **Park Town, Luton** | 54.3 | 53.9 | 0.4 | 54.0 | 0.3 | 52.6 | 54.2 | -1.6 | 52 | 0.2 |

| Location | 2021 19 mppa Noise Levels ($L_{Aeq, 16hr}$ dB) | 2011 Noise Levels ($L_{Aeq, 16hr}$ dB) | Difference: 2021 19 mppa – 2011 (dB) | Condition 10 Noise Levels ($L_{Aeq, 16hr}$ dB) | Difference: 2021 19 mppa – Condition 10 (dB) | 2028 19 mppa Noise Levels ($L_{Aeq, 16hr}$ dB) | 2012 Future Baseline (FB) 2028 Noise Levels ($L_{Aeq, 16hr}$ dB) | Difference: 2028 19 mppa – FB 2028 Noise Levels (dB) | 2028 18 mppa Noise Levels ($L_{Aeq, 16hr}$ dB) | Difference: 2028 19 mppa – 2028 18 mppa Noise Levels (dB) |
|---|---|---|---|---|---|---|---|---|---|---|
| **Whitwell** | 42.6 | 41.9 | 0.7 | 41.9 | 0.7 | 41.0 | 40.8 | 0.2 | 41 | -0.4 |
| **Frogmore Noise Terminal** | 55.2 | 54.7 | 0.5 | 54.6 | 0.6 | 54.0 | 53.6 | 0.4 | 54 | -0.2 |
| **Breachwood Green** | 50.0 | 49.1 | 0.9 | 49.4 | 0.6 | 48.5 | 47.9 | 0.6 | 49 | -0.3 |
| **St Pauls Walden** | 49.2 | 48.4 | 0.8 | 48.6 | 0.6 | 47.8 | 47.2 | 0.6 | 48 | -0.3 |
| **Peter's Green** | 41.2 | 40.0 | 1.2 | 40.6 | 0.6 | 39.3 | 39.9 | -0.6 | 40 | -0.6 |
| **Kinsbourne Green** | 38.5 | 38.9 | -0.4 | 37.8 | 0.7 | 36.5 | 38.9 | -2.4 | 37 | -0.6 |
| **Farley Hill School Luton** | 43.7 | 43.3 | 0.4 | 43.3 | 0.4 | 42.2 | 43.0 | -0.8 | 42 | 0.0 |
| **Slip End** | 54.7 | 52.8 | 1.9 | 54.2 | 0.5 | 52.4 | 53.0 | -0.6 | 53 | -0.2 |
| **Winch Hill Farm** | 55.4 | 54.3 | 1.1 | 54.9 | 0.5 | 53.5 | 54.1 | -0.6 | 54 | -0.5 |
| **Harpenden Children's Home** | 34.2 | 33.6 | 0.6 | 33.5 | 0.7 | 32.1 | 34.1 | -2.0 | 33 | -0.6 |
| **Walkern** | 42.6 | 42.4 | 0.2 | 42.0 | 0.6 | 41.7 | 40.8 | 0.9 | 42 | -0.2 |

| Location | 2021 19 mppa Noise Levels ($L_{Aeq, 16hr}$ dB) | 2011 Noise Levels ($L_{Aeq, 16hr}$ dB) | Difference: 2021 19 mppa – 2011 (dB) | Condition 10 Noise Levels ($L_{Aeq, 16hr}$ dB) | Difference: 2021 19 mppa – Condition 10 (dB) | 2028 19 mppa Noise Levels ($L_{Aeq, 16hr}$ dB) | 2012 Future Baseline (FB) 2028 Noise Levels ($L_{Aeq, 16hr}$ dB) | Difference: 2028 19 mppa – FB 2028 Noise Levels (dB) | 2028 18 mppa Noise Levels ($L_{Aeq, 16hr}$ dB) | Difference: 2028 19 mppa – 2028 18 mppa Noise Levels (dB) |
|---|---|---|---|---|---|---|---|---|---|---|
| **Stevenage (Eastern Perimeter)** | 45.2 | 44.9 | 0.3 | 44.5 | 0.7 | 44.1 | 43.4 | 0.7 | 44 | -0.3 |
| **Stevenage Station** | 48.5 | 48.2 | 0.3 | 47.9 | 0.6 | 47.4 | 46.9 | 0.5 | 48 | -0.2 |
| **Rush Green** | 50.8 | 50.2 | 0.6 | 50.2 | 0.6 | 49.6 | 49.0 | 0.6 | 50 | -0.2 |
| **Luton (Wondon End)** | 48.2 | 46.9 | 1.3 | 47.6 | 0.6 | 46.2 | 46.8 | -0.6 | 47 | -0.6 |
| **Luton (South East)** | 60.6 | 60.4 | 0.2 | 60.3 | 0.3 | 59.1 | 60.3 | -1.2 | 59 | 0.4 |
| **Kensworth** | 46.1 | 45.2 | 0.9 | 45.5 | 0.6 | 45.1 | 43.4 | 1.7 | 45 | -0.1 |
| **Hudnall Corner** | 42.0 | 41.8 | 0.2 | 41.1 | 0.9 | 39.7 | 41.4 | -1.7 | 40 | -0.6 |
| **Flamstead** | 45.2 | 45.7 | -0.5 | 44.7 | 0.5 | 43.0 | 45.5 | -2.5 | 44 | -0.6 |
| **Markyate** | 47.6 | 45.7 | 1.9 | 47.0 | 0.6 | 45.3 | 45.5 | -0.2 | 46 | -0.5 |

wood.

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# Appendix 1B
# **Screening opinion**

**Luton Borough Council**
**Development Management**
Town Hall,
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Luton,
Bedfordshire
LU1 2BQ

Gemma Davies

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Wood Environment & Infrastructure
Solutions UK Limited
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Canary Wharf
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E14 5LB
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katie.lidington@woodplc.com

30th July 2020
Reference: 20/00826/EIASCR

Dear Ms Lidlington,

**20/00826/EIASCR– Request for screening pursuant to Regulation 6 of the Town and Country Planning (Environmental Impact Assessment) Regulations 2017. - To increase the passenger cap from 18 mppa to 19 mppa at London Luton Airport.**

Thank you for your letter of the 10th July 2020 requesting a screening opinion from this Authority.

**Description of Development**

As set out in the Screening Request, the proposed development increases the passenger cap from 18 mppa to 19 mppa at London Luton Airport and temporarily increases the area enclosed by the daytime and night time noise contours.

**EIA Development**

Having considered the proposals as detailed in the Screening Request, Luton Council is of the opinion that the application does not fall within Schedule 1 development of the Environmental Impact Assessment (EIA) Regulations 2017, but could be categorised as Schedule 2 development falling within Part 13(a) or (b), being either an alteration to a development that would fall within Schedule 1(7) or Schedule 2(10)(e).

The relevant threshold for EIA for this form of development is where the works would be in excess of 1ha. Whilst the airport covers an area of 245ha there are no proposed physical works associated with this application.

Luton

There are no national designations relating to the area over which the development is proposed, and it is therefore not defined as a 'sensitive' location in terms of the EIA Regulations.

The principle test for a screening request is to determine whether or not the impacts of the development are likely to be significant. The significant effects could be through negative or positive impacts upon the environment, and factors such as the nature of development, its location and size can influence this.

Schedule 3 of the EIA Regulations sets out the selection criteria for screening Schedule 2 development, covering:

1. The characteristics of the development, including: size; cumulative impacts; use of natural resources; production of waste; pollution and nuisances; and risk.
2. The location of development, including: environmental sensitivity of the area; existing and proposed land use; the relative abundance of natural resources; and the absorption capacity of the environment.
3. The type and characteristics of the potential impact, including consideration of its magnitude; spatial extent; nature; complexity; probability; duration and frequency.

Luton Borough Council has given consideration to the characteristics of the development, its location and potential impact as set out in Schedule 3 of the Environmental Impact Regulations 2017 and National Planning Practice Guidance.

Whilst the submitted Environmental Impact Assessment Screening Request concluded that resultant noise impact of the development would be negligible and the effect of human health, a slight-moderate significant adverse effect, taking into account the proposed increase to the daytime and night time noise contour areas and the increase in the number of dwellings that will be exposed to noise levels above the Significant Observed Adverse Effect Level (SOAEL), it is considered that the proposed development is likely to have a significant environmental effect which has the potential to harm human health. The Council therefore considers that the proposed development is classed as Environmental Impact Assessment development and as such an Environmental Statement is required so that the environmental impacts of the proposal can be properly assessed.

**Planning Application**

The Screening Request indicates that a planning application will be submitted for this development to vary two conditions attached to the existing consent (ref: 15/00950/VARCON), namely conditions 8 (passenger cap) and 10 (noise contours). The application would be a 'major' development and consequently certain documents will be required in order to comply with the national and local requirements for planning applications.

The Council's validation checklist sets out the documents that need to accompany a major planning application this can be accessed via the link below:

https://www.luton.gov.uk/Environment/Lists/LutonDocuments/PDF/Planning/Development%20Control/New-PAR-2020.pdf

The list below sets out the information that you should provide with the application:

**National Requirements:**

- Completed planning application forms and certificates.
- The correct fee.
- Site location plan at 1:1250.
- Block plan at a scale of 1:500.
- In order to demonstrate that the capacity can be accommodated within the existing infrastructure you will need to provide existing and proposed floor plans (including roof plan) at a scale of 1:100.
- Existing and proposed elevations (if there are physical alterations) at a scale of 1:100.
- Existing and proposed site sections and finished floor and site levels (if there are physical alterations) at a scale of 1:100.
- There may be a requirement for a design and access statement to show how the growth can be accommodated, even if there are no physical changes to existing infrastructure.
- Environmental Statement set out in the form proscribed in Schedule 4 of the Town and Country Planning (Environmental Impact Assessment) Regulations 2017.

**Local Requirements:**

Note that some of the reports listed below are likely to be included in the Environmental Statement and so will not need to be submitted as separate reports under the local requirements.

- Planning statement – it may be that this statement can pick up some of the other reports that are listed on the validation checklist, but may not necessarily be required (for instance references to heritage, archaeology, possibly ecology/biodiversity and land contamination could be wrapped up in this statement).
- Air quality assessment – you indicated in the Screening Report (paragraph 3.3.13) that one would be provided.
- Carbon and greenhouse gas assessment – you indicated in the Screening Report (paragraph 3.3.34) that one would be provided.
- Transport statement – you indicated in the Screening Report (paragraph 3.3.95) that one would be provided. This should also include information about parking provision and also a travel plan.
- Noise assessment – you indicated in the Screening Report (paragraph 3.3.115) that one would be provided and given the potential increase in air transport movements, the change in numbers of flights in the summer period and potential use of a greater number of larger aircraft in the fleet, this will be needed as there may be knock on effects to other existing planning conditions.

- Economic statement – you indicated in the Screening Report Paragraph 3.3.124) that one would be provided.
- Planning obligations – please refer to the Council's SPG.
- Site waste management plan – you indicated in the Screening Report that a Site Waste Management Plan would accompany the planning application (paragraph 3.3.139), this should update the waste/recycling information for the original permission to consider the impact of an additional 1mppa
- Water resources and flood risk – whilst the Screening Report indicated that there would be no increase in the overall quantum of development and therefore no further assessment was required, it will be necessary to consider the implications for water usage and the impact of additional flows to the foul sewer (discussions should take place with Thames Water Utilities).

In terms of the planning application it is assumed that you will submit this via the Planning Portal. If this is the case could you also submit one hard copy and one copy on a CD.

I trust that this response is of assistance.

Yours sincerely

Sunil Sahadevan
Head of Development Management

Luton

**CMI CASE OFFICER RECOMMENDATION**

***28.07.20. Recommend refuse – GD***

| | |
|---|---|
| APPLICATION NO. | 20/00826/EIASCR |
| LOCATION | London Luton Airport, Airport Way |
| DESCRIPTION OF DEVELOPMENT | Request for screening pursuant to Regulation 6 of the Town and Country Planning (Environmental Impact Assessment) Regulations 2017. - To increase the passenger cap from 18 mppa to 19 mppa at london Luton Airport. |
| CLEARED BY PLANNING OFFICER<br><br>CLEARED BY TEAM LEADER | INITIALS/SIGNATURE DATE<br>GD 28.07.20 |
| PASSED BY DCM | Sunny Sahadevan 30th July 2020 |

**Consultations:**

No consultations necessary.

**Assessment:**

**Relevant Planning History:**

Planning permission was granted in 2014 for alterations to the terminal, an additional pier, alterations to the taxiways, dualling of airport way, etc (LBC ref: 12/01400/FUL). Conditions were imposed that restricted the passenger capacity to 18mppa and placed restrictions on the areas enclosed by the day time and night time contours.

A section 73 application to vary one of the noise conditions (11[i]) was approved in 2017, with a new decision notice being issued (LBC ref: 17/00950/VARCON). The carried forward many of the conditions imposed under the former application.

Currently there is another section 73 application to vary condition 10 of the 2017 permission in order to enlarge the day and night time noise contours – this application was considered to be EIA development and an environmental statement was submitted with it. The application is yet to be determined, with further information pursuant to a number of Reg 25 requests having been supplied - the most recent in November 2019 (LBC ref: 19/00428/EIA).

A screening response to increase the passenger cap from 18 mppa to 19 mppa was requested at the end of 2019 where is was considered that an EIA was not required (19/01006/EIASCR), however whilst this response was negative, it was based on the assumption that the s73 application to change the noise contours as stated above would have been determined and therefore there would be no additional increase in the noise contours and as such no significant environmental impact in terms of noise. However, as the aforementioned application has still not been determined the noise effects of the development must still be assessed.

**Proposal:** The proposed development would increase the passenger cap from 18 mppa to 19 mppa at London Luton Airport and temporarily increase the area enclosed by the daytime and night time noise contours.

| | |
|---|---|
| **GENERAL INTRODUCTION** | The Airport occupies a 245 hectare site on the south eastern edge of Luton approximately 3km east of junction 10 of the M1 motorway. The Airport is located on an elevated plateau approximately 150/160m above ordnance datum (AOD). To the east and north east of the site the land uses are predominantly rural in character, comprising a mix of farmland with villages and small settlements. To the north of the Airport the land use is predominantly residential. Immediately to the west is an area of commercial and industrial land uses and beyond are the Park Town area and the Town Centre of Luton. To the south the land is predominantly rural in character and includes the scheduled ancient monument Someries Castle and The Luton Hoo Estate. |
| **THE PROPOSAL** | The proposal in the screening report refers to a proposed section 73 application to vary conditions 8 and 10 of the 2017 permission to allow the airport to operate at 19mppa (an increase of 1mppa) and to temporarily increase the area enclosed by the contours for daytime and night-time noise contours. |
| **LOCAL PLAN PROPOSALS MAP ALLOCATION:** | The site is allocated as London Luton Airport Strategic Allocation. |
| **EIA CRITERIA** | The project is indicated as falling under Schedule 2 Part 13(a) or (b) of the EIA Regs, being either an alteration to a development that would fall within Schedule 1(7) or Schedule 2(10)(e). Since the original permission was EIA development under Schedule 2(10)(e), than it is necessary to consider whether the current proposal meets the thresholds associated with that class and also whether the proposal would have any significant environmental impacts. |

The relevant threshold for EIA for this form of development is where the works would be in excess of 1ha. Note whilst the airport covers an area of 245ha there are no proposed physical works associated with this application.

There are no national designations relating to the area over which the development is proposed, and it is therefore not defined as a 'sensitive' location in terms of the EIA Regs.

The principle test for a screening request is to determine whether or not the impacts of the development are likely to be significant. The significant effects could be through negative or positive impacts upon the environment, and factors such as the nature of development, its location and size can influence this.

Schedule 3 of the EIA Regulations sets out the selection criteria for screening Schedule 2 development, covering:
1. The characteristics of the development, including: size; cumulative impacts; use of natural resources; production of waste; pollution and nuisances; and risk.
2. The location of development, including: environmental sensitivity of the area; existing and proposed land use; the relative abundance of natural resources; and the absorption capacity of the environment.
3. The type and characteristics of the potential impact, including consideration of its magnitude; spatial extent; nature; complexity; probability; duration and frequency.

**EVALUATION**

The screening request provided by the Wood Group was comprehensive, setting out a description of the site and surrounding area, description of the proposed development and then considering the impacts in relation to a variety of areas taking into account the selection criteria set out in Schedule 3 of the EIA Regs. The report concluded that the proposed development:

"is not 'EIA development' because, although it is Schedule 2 development, it is not likely to have significant effects on the environment "by virtue of factors such as its nature, size or location". Furthermore, the site is not located within a sensitive area. Therefore, it is considered that the Proposed Scheme does not require EIA under the provisions of the EIA Regulations."

However as part of the evaluation of this proposal an EIA screening matrix has been completed for the proposed development, considering the areas in which the proposal might have an impact and whether the impacts are significant. The matrix considers the likely environmental effects of the proposal. Potential impacts across a range of environmental topics have been considered, considering the possible effects upon identified sensitive receptors, including residential properties and statutory designations.

The development that is being screened is for an increase to an airport of 19mppa and to temporarily increase the area enclosed by the daytime and night-time noise contours and would be deemed to fall within Schedule 2 (13) relating to changes and extensions to an existing use in effect.

The test to apply, taking into account all relevant factors under the Regs, is whether the proposal would be likely to give rise to significant environmental effects.

Whilst the proposal will not involve any built form and flights will only be altered by a small percentage figure, the application will result in a physical alteration to the contour areas and will result in an increase in the number of residents affected by daytime and night time noise exposure.

The increase in the noise contour areas will result in 443 dwellings being exposed to noise at or above 63 dB LAeq, during the daytime, and an additional 2,887 dwellings exposed to noise at or above 54 dB LAeq, during the night-time. The increase in noise exposure is likely to lead to some additional cases of hypertension, stroke, ischaemic heart disease and dementia. Furthermore, the increased noise exposure is also likely to lead to additional annoyance and sleep disturbance within the exposed population.

For those residents experiencing daytime noise levels at or above 63 dB LAeq,16hr, and night-time noise levels at or above 55 dB LAeq,8hr, the change in noise exposure is above the Significant Observed Adverse Effect Level (SOAEL). The magnitude of change is therefore moderate. This takes account of the more disruptive effect of noise during sleep and consequent effects on work performance and learning because of lower quality sleep and the higher occurrence of health effects at these higher exposure levels. As such, it is considered that there is a likely significant adverse impact. Therefore, for those residents experiencing daytime noise levels at or above 63 dB LAeq and night-time noise levels at or above 55 dB LAeq, the significance of the heath effect is judged to be moderate-large. As such, it is considered that there is a likely significant adverse impact.

Whilst the report concludes that, provided that mitigation is implemented, the health effects related to a change in noise exposure as a result of the Proposed Scheme are likely to have a slight-moderate significant adverse effect at the population level, there is concern regarding this conclusion. Firstly this requires that all residential dwellings experiencing daytime and evening noise levels above the SOAEL will uptake sound mitigation measures such as insulation and window replacements and secondly this would only address the impact of such noise levels when residents are indoors with all windows and doors closed. In this regard it is considered that the

mitigation may not be sufficient to downgrade the health effects of the proposed scheme to slight-moderate and in this regard, it is considered that there is likely to be a significant adverse impact in this regard and this should be assessed.

Whilst the proposed increase to the daytime and night time contours will be temporary and for a period of 4 years, this length of time may give rise to health effects that cannot be disregard and should be assessed.

In light of the above it is considered that an EIA would be required in respect of the proposed development.

**CONCLUSIONS**

In assessing the potential impacts of the proposed development, the relevant environmental impacts have been considered. Given that the proposal would result in more dwellings (and people) falling within the SOAEL, a consequence of which could be a significant adverse impact on human health, it is considered that the proposal would be development that would generate the need for an EIA.

**RECOMMENDATION**

It is recommended that a screening opinion be issued to the effect that an Environmental Statement is required.

# EIA ANALYSIS AND SCREENING PROFORMA

| Analysis | | |
|---|---|---|
| **1** | **Case Details** | |
| a | Applicant Case reference | |
| | -- | |
| b | LPA case reference | |
| | 20/00826/EIASCR | |
| c | Site Address | |
| | London Luton Airport, Airport Way, Luton | |
| d | Brief description of development | |
| | Request for screening pursuant to Regulation 6 of the Town and Country Planning (Environmental Impact Assessment) Regulations 2017. - To increase the passenger cap from 18 mppa to 19 mppa at London Luton Airport. | |
| e | Approval of reserved matters? | |
| | ~~Yes~~ | |
| | No | |
| | Approval of conditions? | |
| | ~~Yes~~ | |
| | No | |
| | If Yes, enter the description of development subject of the related planning permission | |
| | N/A | |
| f | Area of development/works/new floorspace (as appropriate) | |
| | 245ha | |
| **2** | **EIA details** | |
| **A** | **Schedule 1** | |
| (i) | Is the proposed development Schedule 1 development as described in Schedule 1 of the EIA Regulations? | |
| | ~~Yes~~ | |
| (ii) | No | No (note that WOOD state that the development does not fall under any of the categories of Schedule 1 of the EIA Regs) |
| | If YES, under which description of development i.e. Nos. 1-21? | |
| | N/A | |
| **B** | **Schedule 2** | |
| (i) | Is the proposed development Schedule 2 development as described in Column 1 of Schedule 2 of the EIA Regulations? | |
| | Yes | Yes |
| | ~~No~~ | |
| (ii) | If YES, under which description of development in Column 1 i.e. Nos. 1-13? | |
| | Sch.2(13)(a) Any change to or extension of development of a description listed in Schedule 1 (other than a change or extension falling within paragraph 24 of that Schedule) where that development is already authorised, executed or in the process of being executed. The Sch.1(7)(1) being construction of an airport with a basic runway length of >2,100m<br>Or<br>Sch.2(13) (b) Any change to or extension of development of a description listed in paragraphs 1 to 12 of column 1 of this table, where that development is already authorised, executed or in the process of being executed. The Sch2(10)(e) development being the construction of an airfield where the area exceeds 1ha (the previous expansion project ref: 12/01400/FUL [and subsequent s73 application ref: `5/00950/VARCON] fell into this category. | |
| (iii) | Is the development within, partly within, or near a 'sensitive area' as defined by Regulation 2 | |

| | | |
|---|---|---|
| | of the EIA Regulations? | |
| | ~~Yes~~ | |
| | No | Not SSSI, National Park, the Broads, WHS, Sch Monument, AONB, or European Site. |
| (iv) | If YES, which area? | |
| | N/A | |
| (v) | Are the applicable thresholds/criteria in Column 2 exceeded/met? | |
| | Yes | Yes in that the site area is over 1ha (however, the application involves no operational development). |
| | ~~No~~ | |
| (vi) | If yes, which applicable threshold/criteria? | |
| | The area of the works exceeds 1.0 hectare | |
| **3** | **LPA/SOS Screening** | |
| | **All applications including reserved matters/conditions** | |
| (i) | Has the LPA issued a Screening Opinion (SO)? | |
| | ~~Yes~~ | |
| | No | The purpose of this exercise is to screen the development. |
| (ii) | Has the SoS (GO) issued a Screening Direction (SD)? | |
| | ~~Yes~~ | |
| | No | No. |
| (iii) | If yes, is a copy of the SO/SD on the file? | |
| | ~~Yes~~ | |
| | No | Screening request will go on line when issued following this exercise. |
| (iv) | If yes, is the SO/SD positive? | |
| | ~~Yes~~ | |
| | No | Initial assessment is that the development involves no physical works, is for an additional one million passengers over a year and would be contained within the airport boundary. However, due to the proposed increase to the daytime and night time contour areas, there will be an increased number of people exposed to the SOAEL which is a significant environmental effect that has the potential to harm human health. It is therefore anticipated the development will result in significant environmental effects. |
| | **Reserved matters/conditions applications only** | |
| (i) | Was original PP subject to EIA screening? | |
| | ~~Yes~~ | N/A |
| | ~~No~~ | |
| (ii) | Was a SO/SD issued for the original PP? | |
| | ~~Yes~~ | N/A |
| | ~~No~~ | |
| (iii) | If yes, is a copy of the SO/SD for the original PP on file? | |
| | ~~Yes~~ | N/A |
| | ~~No~~ | |
| **4** | **Environmental Statement (ES)** | |
| | Has the applicant supplied an ES for the current or previous (if reserved matters or conditions) application? | |
| | ~~Yes~~ | |
| | ~~No~~ | N/A |

## EIA ANALYSIS AND SCREENING PROFORMA

| | |
|---|---|
| **Name** | Gemma Davies |
| **Date** | 28.07.2020 |

## EIA ANALYSIS AND SCREENING PROFORMA

### SCREENING

| A. CHECKLIST | | | |
|---|---|---|---|
| **Questions to be considered** | | **Likely/Unlikely – briefly describe** | **Is this likely to result in a significant effect? Yes/No - why?** |
| 1 | Will construction, operation or decommissioning of the Project involve actions which will cause physical changes in the locality (topography, land use, changes in waterbodies, etc)? | Unlikely – no infrastructure is proposed as part of the development. | No significant impact. There are no sensitive buildings or land uses that will be affected by this proposal. |
| 2 | Will construction or operation of the Project use natural resources such as land, water, materials or energy, especially any resources which are non-renewable or in short supply? | Likely – an increase of 1mppa will use more resources both in terms of getting to the airport and whilst at the airport (water, electricity, etc) | No significant impact. |
| 3 | Will the Project involve use, storage, transport, handling or production of substances or materials which could be harmful to human health or the environment or raise concerns about actual or perceived risks to human health? | Unlikely – no physical works proposed. | No significant impact. |
| 4 | Will the Project produce solid wastes during construction or operation or decommissioning? | Unlikely-no construction activity | No significant impact. |
| 5 | Will the Project release pollutants or any hazardous, toxic or noxious substances to air? | Unlikely – no significant increase in aircraft movements predicted. | No significant impact. |
| 6 | Will the Project cause noise and vibration or release of light, heat energy or electromagnetic radiation? | unlikely – no significant increase in aircraft movements predicted | No significant impact. |
| 7 | Will the Project lead to risks of contamination of land or water from releases of pollutants onto the ground or into surface waters, groundwater, coastal waters or the sea? | Unlikely – increase in numbers will make use of existing facilities (surface water/foul water sewers). | No significant impact. |
| 8 | Are there any areas on or around the location which are already subject to pollution or environmental damage e.g. where existing legal environmental standards are exceeded, which could be affected by the project? | No. Luton has a number of AQMAs though these are adjacent to the M1 and in the town centre. | No significant impact. |
| 9 | Will there be any risk of accidents during construction or operation of the Project which could affect human health or the environment? | Unlikely – no physical construction and no significant increase in aircraft numbers. | No significant impact. |
| 10 | Will the Project result in social changes, for example, in demography, traditional lifestyles, employment? | Unlikely – no significant increase in employment likely with additional passenger numbers. | No significant impact. |
| 11 | Are there any areas on or around the location which are protected under international or national or local legislation for their ecological, landscape, cultural or other value, which could be affected by the project? | Yes – Scheduled Monument at Someries Castle, Grade I listed building at Luton Hoo and Grade II* registered parks and gardens, also Grade II listed building at Wigmore Hall. | No significant impact. |

| | | | |
|---|---|---|---|
| 12 | Are there any other areas on or around the location which are important or sensitive for reasons of their ecology e.g. wetlands, watercourses or other waterbodies, the coastal zone, mountains, forests or woodlands, which could be affected by the project? | No (though there is a district wildlife site to the west of the airport and a county wildlife site to the east). | No significant impact. |
| 13 | Are there any areas on or around the location which are used by protected, important or sensitive species of fauna or flora e.g. for breeding, nesting, foraging, resting, overwintering, migration, which could be affected by the project? | No | No significant impact. |
| 14 | Are there any inland, coastal, marine or underground waters on or around the location which could be affected by the project? | Yes – whilst there are no rivers the airport is within a Groundwater Source Protection Zone (Zone 3). | No significant impact. |
| 15 | Are there any areas or features of high landscape or scenic value on or around the location which could be affected by the project? | No | No significant impact. |
| 16 | Is the project in a location where it is likely to be highly visible to many people? | No – there is no construction activity proposed with the increase in passenger numbers. | No significant impact. |
| 17 | Are there any routes on or around the location which are used by the public for access to recreation or other facilities, which could be affected by the project? | No – there are roads and footpaths around the airport that provide access to recreation facilities (Wigmore Valley Park) but they are not directly affected by the proposed development. | No significant impact. |
| 18 | Are there any transport routes on or around the location which are susceptible to congestion or which cause environmental problems, which could be affected by the project? | Yes – the Transport Assessment submitted with the New Century Park application (17/02300/EIA) showed that some junctions in the area are functioning at near capacity. | No significant impact. |
| 19 | Are there any areas or features of historic or cultural importance on or around the location which could be affected by the project? | Unlikely – the airport has a heritage record (HER No. 9271) but is a non-designated heritage asset. The Scheduled Monument at Someries and the listed building/registered parks and gardens at Luton Hoo were assessed as not being significantly affected by the operation of an 18mppa airport with application 12/01400/FUL. | No significant impact. |
| 20 | Is the project located in a previously undeveloped area where there will be loss of greenfield land? | No. | No significant impact. |
| 21 | Are there existing land uses on or around the location e.g. homes, gardens, other private property, industry, commerce, recreation, public open space, community facilities, agriculture, forestry, tourism, mining or quarrying which could be affected by the project? | Likely – there are residential properties around the airport and under the flightpath and the proposal would result in some increase in the annual air transport movements in the summer period. Further the proposed variation would increase the number of | Significant adverse impact. |

| | | | |
|---|---|---|---|
| | | residents exposed to noise at or above63 dB during daytime and 54 dB during the night time - these levels represent the level of noise exposure above which significant adverse effects on health and quality of life occur (Significant Observed Adverse Effects Level [SOAEL]). | |
| 22 | Are there any areas on or around the location which are densely populated or built-up, which could be affected by the project? | Likely – as noted above there are residential areas around the airport and under the flightpath, whilst the increase in air transport movements is unlikely to be significant the proposal will increase the number of residential dwellings exposed to SOAEL of noise. | Significant adverse impact. |
| 23 | Are there any areas on, or around, the location which are occupied by sensitive land uses e.g. hospitals, schools, places of worship, community facilities, which could be affected by the project? | Unlikely – there are a couple of schools in the residential areas to the north of the airport. | No significant impact. |
| 24 | Are there any areas on or around the location which contain important, high quality or scarce resources e.g. groundwater, surface waters, forestry, agriculture, fisheries, tourism, minerals, which could be affected by the project? | Unlikely – the Groundwater Source Protection Zone has been referred to above. | No significant impact. |
| 25 | Is the project location susceptible to earthquakes, subsidence, landslides, erosion, flooding or extreme or adverse climatic conditions e.g. temperature inversions, fogs, severe winds, which could cause the project to present environmental problems? | No. | No significant impact. |
| 26 | Are there any plans for future land uses on or around the location which could be affected by the project? | Unlikely – major proposals in the area include the New Century Park development and residential developments to the north in Cockenhoe (NHDC) | No significant impact. |
| 27 | Are there any other factors which should be considered, such as consequential development which could lead to environmental effects, or the potential for cumulative impacts with other existing or planned activities in the locality? | The screening request did not identify any projects within the noise contours that have been granted consent (suggesting that the ES on the 2012 application had accounted for these). However, there are schemes taking place currently (such as the DART) or that have been recently approved or awaiting decisions (such as New Century Park, Bartlett Square and the Cockenhoe housing schemes) that could have been considered. Though since the development does not propose any physical development there are unlikely to be cumulative effects | No significant impact. |

| B. CONCLUSIONS | | |
|---|---|---|
| (i) | Schedule and category of development | |
| | Schedule 2, Class 13(a) alteration to a Sch.1 development or Class 13(b) alteration to a Sch.2 Class 10(e) development (being the previously approved expansion to 18mppa [ref: 12/01400/FUL]) | |
| (ii) | Summary of features of project and of its location | |
| | a | Characteristics of development |
| | | The airport covers an area of approximately 245ha. The proposal is to increase the number of passengers by 1mppa above the 18mppa cap imposed on the previous permission (ref:LPA 15/00950/VARCON). The screening report suggests a 0.83% increase in ATMs over the 92 day summer period by 2028**.** Consent is also sought to vary the wording of condition 10 to provide a less restrictive day and night noise contour, on a temporary basis up to 2024. This will enable the area enclosed by the 57 dB(A) daytime noise contour to increase from 19.4 km2 to 21.4 km2 and the area enclosed by the 48 dB(A) night time noise contour to increase from 37.2 km2 to 44.1 km2. At the end of this period condition 10 would revert back to its current wording. |
| | b | Location of development |
| | | The site is located to the south of Luton. |
| | c | Characteristics of the potential impact |
| | | The screening request identified the following areas against which potential effects should be considered:<br><br>1. Air Quality: The AQMAs within Luton were identified (none at the airport). It was noted that there were no construction or demolition activities proposed and that the potential increase in on-airport and off-airport activity was likely to be minor and that the proposed development would not result in any significant impacts on air quality.<br>2. Biodiversity: noted no designated sites within 2km and referenced a number of local sites around the airport (County Wildlife and District Wildlife Sites). Noted that the airport itself was a developed site and unlikely to have any protected species. With no physical development, it was unlikely that the increase would significantly affect biodiversity.<br>3. Climate Change: Since the proposal involves no new infrastructure, it is not proposed to provide a standalone climate change resilience assessment, however the screening considered greenhouse gas emissions and noted that since there would be increased vehicle, aircraft movements and energy consumption of the existing buildings, standalone Carbon and Greenhouse Gas Assessment would accompany any planning application, but that does not trigger an EIA requirement.<br>4. Ground Conditions: The principal aquifer is mentioned in this section together with groundwater vulnerability, but since no construction activity is proposed that would be likely to disturb ground conditions it is concluded that there is no need for further assessment<br>5. Historic Environment: identified the Scheduled Monument at Someries Castle, the listed parks, gardens and mansion at Luton Hoo and various other listed buildings and conservation areas within 2km. However, the same reasoning was applied in relation to the lack of physical development and the limited impact of the ATM change.<br>6. Human Health: the health of people in Luton was considered (including life expectancy, obesity, alcohol related hospital stays and noise exposure), with the screening report noting that whilst passenger numbers will grow, the ATMs will only marginally increase and direction of flights will remain the same, consequently there |

will be a negligible impact from noise and vibrations from in-air and ground aircraft and traffic. However, the proposed variation to condition 10 will result in an additional 443 dwellings exposed to noise at or above 63 dB during the daytime and an additional 2,887 dwelling exposed to noise at or above 54 dB during the night time. This increase in noise exposure is likely to lead to additional cases of hypertension, stroke, ischaemic heart disease and dementia and lead to additional annoyance and sleep disturbance. The level of change in noise exposure in these cases is therefore moderate to large and there is likely to be a significant adverse impact. It is advised that mitigation will be provided to reduce noise exposure indoors, resulting in a moderate significant health effect. However the increase in noise would continue to be experienced when windows are open and residents are outdoors. For workers and visitors experiencing daytime and night time noise levels above 63 dB and 55 dB (SOAEL) the EIA screening judges the significance of the health effect to be slight. The effect on noise-sensitive non-residential facilities is judged to be slight to moderate.

7. Landscape and Visual: identified the character of the area, the fact that there are some woodlands around, the Luton Hoo registered park and gardens and the Chilterns AONB 3km distant. There will be no physical infrastructure proposed and the change in summer period ATMs would be minor. However it is acknowledged that there would be a slight increase in the extent of the 57 dB daytime noise contour over the Chilterns AONB for the 19 mppa scenario, decreasing in 2020. The screening report predicts that there would however be a negligible impact from the increase to 19 mppa from 18 mppa from in air and ground aircraft noise and road traffic noise and therefore a negligible change to the noise environment of the designated sites, however no significant adverse effects are expected in relation to the landscape and visual effects.
8. Major Accidents and Disasters: the screening report notes that the slight increase in ATMs is unlikely to increase the likelihood of a major accident or disaster.
9. Noise and Vibration: the noise environment associated with aircraft increase and road traffic increase was addressed, noting no construction noise effects, whilst traffic effects would only be a small percentage of overall traffic levels. In terms of aviation in-air noise, it is identified that overall there would be a minor adverse impact at receptors, with beneficial impacts identified for 2028 in comparison with the future baseline predicated in the 2012 ES. Therefore no significant effects would be predicted from aviation noise. Whilst a change in fleet mix is likely to result in quieter aircraft both in flight and on the ground, the details of how much quieter the modernised fleet would be are not known. However based on the differences in aviation movements the impact of aviation ground noise, would result in a marginal increase in aircraft noise which would not be significant. The impact in terms of in air and ground aircraft noise and traffic noise is assessed in the screening report as being negligible. However, the increase in the area covered by the 57dB daytime noise contour and the 55dB night time noise contour, would bring more dwellings into the SOAEL and expose more people to significant adverse effects (as noted above under 'Human Health').
10. Socio-Economic: The existing number of employees and benefit to the local and national economy were set out, and whilst there may be some positive benefit, there would not be a significant effect. An economic assessment would accompany any planning application.
11. Transport: The likely peak hour increase (AM and PM) was identified in terms of accommodating the additional 1mppa, with an increase of 2 % and 3 % in two way trips respectively. This was not considered significant. It was identified that parking demand is likely to increase by 413 spaces to a total demand of 8,929, the existing

| | | |
|---|---|---|
| | | 18 mppa car parking strategy was deemed appropriate to manage this increase. Controlled parking and capacity and pricing for car parks will be monitored through the Airport Surface Access Strategy as well as the 2019 Luton Airport Travel Plan focusing on reducing private vehicle travel and promoting sustainable travel alternatives. Based on mitigation measures, no significant impacts on transport are anticipated.<br>12. Waste and Resource Use: Whilst there is a landfill area within the airport boundary, no physical changes are proposed. Further, although 1mppa will generate additional waste it is not considered to be a significant environmental impact.<br>13. Water Resources and Flood Risk: No mention of the aquifer within this section, though drainage is covered and it is noted that the airport is within flood zone 1. Conclusion is that it is not expected that there would be any adverse effects needing further assessment.<br>14. Cumulative Effects: The screening report does not identify significant cumulative effects, either from the interaction of activities arising from the proposed development, or from cumulative effects with other development<br>15. Transboundary Effects: The relatively small increase in ATMs associated with the development is not likely to have a significant transboundary effect. The temporary increase in the noise contour does not extend outside of the jurisdiction of the UK and as such is not considered to have any significant transboundary effects. |
| (iii) | If a SO/SD has been provided do you agree with it? | |
| | Yes | N/A |
| | No | |
| (iv) | Is it necessary to issue a SO/SD? | |
| | Yes | This screening opinion will be published. |
| | ~~No~~ | |
| (v) | Is an ES required? | |
| | Yes | |
| | ~~No~~ | |

| **C. SCREENING DECISION** (Indicate below which assessment applies) | | | | | |
|---|---|---|---|---|---|
| **Assessment** | | **Action** | | **Response due from** | **Date response due** |
| Sch 1 development | ES required | **Issue positive or negative SO/SD** | ☐ | | |
| Sch 2 development – threshold exceeded/criterion met/sensitive area and likely to have significant effects on the environment | ES required | **Issue positive or negative SO/SD** | ☒ | | |
| Sch 2 development – not likely to have significant effects on the environment | ES not required | **Issue positive or negative SO/SD** | ☐ | | |
| Sch 2 development but effects not clear at this stage – file to be reviewed at a later stage | N/K | **Review when appropriate – new info/case progresses** | ☐ | | |
| Sch 2 but not EIA development – negative screening opinion - SoS agrees | ES not required | **No action required** | ☐ | | |
| Sch 2 but not EIA development – | ES not | **Issue negative** | ☐ | | |

| | | | | | |
|---|---|---|---|---|---|
| positive screening opinion - SoS disagrees | required | **SO/SD** | | | |
| **Name** | Gemma Davies | | | | |
| **Date** | 28th July 2020 | | | | |

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# Appendix 1C
# **Scoping meeting**

# London Luton Airport Expansion to 19 mppa

Approach to the EIA

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# Project Description – Condition 8

- LLA has experienced unprecedented growth in passengers over the last decade, allowing the airport to reach the 18 mppa consented cap 9 years early than forecast.

- Seeking to modify Condition 8 to allow the airport to continue to operate and expand viably in the short to medium term. The proposed change will increase the cap to 19 mppa and would come into effect in 2024.

- The capacity increase will be accommodated without the requirement for any new physical infrastructure to be built.

# Project Description

## Proposed Condition 8 variation:

*"At no time shall the commercial passenger throughput of the airport exceed ~~18~~* ***19*** *million passengers in any twelve-month period. From the date of this permission the applicant shall every quarter report in writing to the Local Planning Authority the moving annual total numbers of passengers through the airport (arrivals plus departures). The report shall be made no later than 28 days after the end of each quarter to which the data relates.*

# Project Description – Condition 10

- The consented scheme used fleet mix modernisation predictions available in 2012 to anticipate the noise levels associated with the airport as it reached 18 mppa.

- The predictions estimated that airlines would acquire quieter aircraft by 2028 (the estimated time LLA would reach 18 mppa).

- The fleet modernisation predictions have not materialized as forecast, and nor have the airport growth rates.

- We are therefore seeking to modify Condition 10 to temporarily (until 2024) increase the area enclosed by the contours for daytime and night-time noise. This will ensure the airport will not exceed the contours again prior to the variation to Condition 8 coming into play in 2024.

# Project Description

## Proposed Condition 10 variation:

*"~~The development shall be operated in accordance with the Noise report approved on 2 March 2015 (ref: 14/01519/DOC), including providing details of forecast aircraft movements and consequential noise contours as set out in that report.~~*

*The area enclosed by the 57dB(A) Leq16hr (0700-2300) contour shall not exceed ~~19.4 sq km~~* ***21.4 sq km*** *for daytime noise, and the area enclosed by the 48dB(A) Leq8hr (2300-0700) contour shall not exceed ~~37.2 sq km~~* ***44.1 sq km*** *for night time noise, when calculated by the Federal Aviation Authority Integrated Noise Model version 7.0d (or as may be updated and amended)* ***for the period up to the end of 2024. Post 2024 the area enclosed by the by the 57dB(A) Leq16hr (0700-2300) contour shall not exceed 19.4sq km for daytime noise, and the area enclosed by the 48dB(A) Leq8hr (2300-0700) contour shall not exceed 37.2 sq km for night time noise.***

*Within five years of the commencement of development a strategy shall be submitted to the LPA for their approval which defines the methods to be used by LLAOL or any successor or airport operator to reduce the area of the noise contours by 2028 for daytime noise to 15.2 sq km for the area exposed to 57dB(A) Leq16hr (0700-2300) and above and for night time noise to 31.6 sq km for the area exposed to 48dB(A) Leq8hr (2300-0700) and above.*

***Forecast aircraft movements and consequential noise contours (Day, Night and Quota Periods) for the forthcoming calendar year shall be reported on the 1st December each year to the LPA, which shall utilise the standard 92 day summer contour****."*

# Topics scoped out

# Waste

**Approach / scope**

- A Site Waste Management Plan has been produced to update the Waste Management Statement submitted with the original planning application to the variation of Condition 8.

**Initial findings / mitigation**

- There will be a slight – moderate impact on total waste arisings due to the additional passengers, and a minimal impact on the day-to-day management of operational waste. Strategies for managing and minimisation of waste are the airport have been outlined (add them), with targets to reduce passenger waste rates.
- There is sufficient capacity within the airports existing infrastructure for routine operational waste arisings. The application does not include any physical changes to the airport infrastructure therefore no waste is to be generated from construction, demolition, or excavation activities.
- Existing procedures for waste management at the airport will be sufficient to manage the additional waste produced from the increase in passengers.

**Mitigation**

- The variation to Condition 8 will not result in any likely significant effects on waste at the airport and the existing infrastructure at the airport will be able to handle the increase in passengers.
- Due to this a Waste assessment has been scoped out of the EIA.

# Water

**Approach / scope**

- A Drainage and Water Supply Infrastructure Appraisal has been carried out to assessing the potential effects on drainage and water supply arising from the variation to Condition 8. This has assessed the existing surrounding public infrastructure conveying contaminated surface and foul water, and incoming water supply.

**Initial findings / mitigation**

- There will be an increase in demand of water from the network due to the additional 1 mppa. However, as the airport plan to restrict peak passenger throughput to current 18 mppa levels neither foul water discharge or potable water demand will be subject to an increase at peak times due to the variation of Condition 8. This demand can be met by the local water supplier (Affinity Water).
- There will be no increase in peak foul rate as peak passenger throughput will be restricted. There will be an increase of foul effluent discharge annually, this increase in volume can discharged into the local network (Thames Water).
- An increase in surface water contamination from de-icer use will be minimal due to improved operational techniques and additional aircraft movements during non-winter months.

**Mitigation**

- The variation to Condition 8 will not result in any likely significant effects and the local network is able to handle the additional increase in passengers.
- Due to this a Water assessment has been scoped out of the EIA.

# Topic scoped out

The following topics have been scoped out as it is unlikely that there will be significant effects due to the proposed condition variations, and the absence of physical infrastructure required.

- Biodiversity
- Ground conditions
- Historic environment
- Landscape and visual
- Major accidents and disasters
- Socio-economics

# Topics scoped in

# Air Quality

**Approach / scope**

- Assessment and modelling to predict effects on nitrogen oxide and particulate matter (PM10 and smaller) concentrations due to aircraft and road traffic emissions on human receptors.
- 8 km x 6 km grid at 100 m resolution, and 16 km x 9 km grid at 200 m resolution covering airport and vicinity modelled.

**Initial findings**

- Impact of the Proposed Development on air quality associated with human health receptors classified as negligible.
- Impact of the Proposed Development on air quality associated with ecological receptors classified as not significant.

**Mitigation**

- Monetisation using the WebTAG guidance will be used to predict costs of air quality impacts.

# Climate

**Approach / scope**

- Total emissions per annum associated with the Proposed Development at peak airport usage have been estimated and assessed (to give the reasonable worst-case effect on climate change).
- Emission sources from aviation (up to 3,000 ft), non-aviation, and surface access have been considered.
- The assessment considers the global climate as the receptor.

**Initial findings**

- Impact of the proposed variation on the global climate classified as minor adverse.

**Mitigation / targets**

- Non-aviation measures: installing energy saving technology, sourcing all electricity from renewable sources by 2021, generating 25% of electricity via on-site renewables.
- Surface access emissions: Travel Plan objectives and promotion of walking, cycling, and public transport.
- Aviation: contractual agreements with airlines based on incentivising efficiency gains through the use of more modern aircraft.

# Transport

**Approach / scope**

- Transport assessment analysed the impact of 1 mppa increase on the local road network.
- Trip forecast based on modelling carried out by ARUP.
- Variation to Condition 10 is unlikely to have a significant impact on transport.

**Initial findings**

- Highways England and LBC concluding no further modelling work or junction mitigation required.
- Bus and coach demand increased.
- Traffic volumes generated by the passenger show insignificant increase.
- The existing car park management strategy is deemed appropriate.

**Mitigation / targets**

- No highway mitigation required.
- Targets to reduce employee and passenger single-occupancy non-electric private car travel.
- Targets to increase employee and passenger travel by sustainable modes of transport.
- Targets to increase employee and passenger travel by bus, coach, and rail.

# Noise

**Approach / scope**

- Assessment of aviation (in-air) noise to be updated along the lines of original 2012 ES submission with key year of assessment being 2028 with a comparison of 19 mppa and the without development scenario of 12.5 mppa and 18 mppa.
- Short term effects will be assessed comparing worst case 19 mppa year to Condition 10 extents.
- 19 mppa will be reached by 2024. Interim years (2022, 2023) would not have a higher impact than the current predicted 2021 because of increasing modernisation. Therefore, worst case year based on current predicted 2021 flows and fleet mix. By 2024, when flows expected to be 19 mppa, fleet mix will be such to meet the old Condition 10.
- Temporary relaxation to Condition 10 to be based upon worst case year – condition extents to be confirmed.
- Precautionary approach applied to worst-case year in terms of noise levels from modernised fleet and modernisation.
- Basic 'screening' assessments for road traffic noise and ground noise (no computer noise modelling).
- The assessment considers residential and non-residential sensitive receptors.

**Initial findings**

- Non-residential receptors to experience negligible effect on noise levels due to the proposed variations.
- Temporary increase in number of residential receptors significantly effected due to proposed variations.

**Mitigation / targets**

- Continued contributions to Noise Insulation Fund and one-off grants to local councils.
- Revisions to the Sound Installation Grant Scheme to capture new residences over SOAEL in worst case year.
- No night-time flights for the noisiest aircraft for summer 2020.
- No further delay time slots allocated to noisiest aircraft during daytime June – Sept.
- No non-emergency diverted flights accepted.
- New airline / aircraft slots at night not to exceed quieter noise levels.
- Differential charging implemented to incentivise rapid modernisation of fleet.

# Health

**Approach / scope**

- The assessment will focus on community effects to residents and vulnerable groups within non-residential noise receptors.
- Study area encompasses LBC authority area, and all areas within the noise contour. Encapsulating affected populations of Luton, North Hertfordshire, St. Albans, and Dacorum.
- Variation to Condition 8 is unlikely to have a significant impact on health.

**Initial findings**

- Health related effects in relation to Condition 10 variation are likely to have a slight-moderate adverse health effects on the population.

**Mitigation / targets**

- As per noise measures.

# Thank you for your attention

Do you have any further questions?

# Minutes

| | | | | |
|---|---|---|---|---|
| **Date:** | 07/09/2020 | **Meeting at:** | Microsoft Teams | |
| **Subject / purpose:** | | | | |
| To discuss and agree on a proportionate environmental assessment scope of works for the Luton Airport 19 mppa EIA | | | | |
| **Attendees:** | | **Apologies:** | | |
| Alejo Perez Monsalvo (LLAOL)<br>Gemma Davies (LBC)<br>Katie Lidington (Wood)<br>Bho Nam (Wood)<br>Alistair Billington (Wood)<br>Mark Evans (Wood)<br>Rob Rand (Wood) | | David Gurtler (LBC) | | |

**Agenda:**

- Welcome
- Introduction to the application
- Topics scoped out:
  - Water
  - Waste
  - Other scoped out topics
- Topics scoped in:
  - Air quality
  - Climate
  - Transport
  - Noise
  - Health
- Further questions for discussion

**Meeting notes:**

This meeting was organised to discuss and agree the baseline and approach for the environmental topics to be included in the Environmental Impact Assessment for the Luton Airport Expansion – 19 mppa project. The proposed scheme seeks the variation of two conditions attached to the 2014 consented application for the airports operations.

Variation to Condition 8: to increase the number of passengers from 18 mppa to 19 mppa.

Variation to Condition 10: to temporarily increase the area enclosed by the day-time and night-time noise contours associated with the airport.

Continued…

Neither of the proposed variations would necessitate the need for additional infrastructure development on-site, and the additional passengers would be accommodated through a small increase in the number of air transport movements.

The ES is currently being prepared and will be submitted at draft to LBC in early October.

Wood are currently reviewing the noise assessment on condition 10 extents following Vernon Cole's review.

LBC unable to provide opinion on approach to environmental topics without David present. Gemma to discuss information from meeting with David and will be able to provide an opinion by the end of the week (11th September).

LBC's concern with the minor effects reported in the health assessment are that this relies on local resident uptake of the insulation measures proposed.

| **Minutes:** | | **Action by:** | **Deadline:** |
|---|---|---|---|
| 1 | Do LBC agree that a waste chapter will not be required in the ES? | LBC | 11/09/2020 |
| 2 | Do LBC agree that a water chapter will not be required in the ES? | LBC | 11/09/2020 |
| 3 | Do LBC agree that biodiversity, ground conditions, historic environment, landscape and visual, major accidents & disasters, and socio-economic chapters can be scoped out of the assessment? | LBC | 11/09/2020 |
| 4 | Does LBC agree with the approach for the air quality chapter within the ES? | LBC | 11/09/2020 |
| 5 | Does LBC agree with the approach for the climate chapter within the ES? | LBC | 11/09/2020 |
| 6 | Does LBC agree with the approach for the transport chapter within the ES? | LBC | 11/09/2020 |
| 7 | Does LBC agree with the approach for the noise chapter within the ES? | LBC | 11/09/2020 |
| 8 | Does LBC agree with the approach for the health chapter within the ES? | LBC | 11/09/2020 |
| 9 | Meeting to be set up for W/C 14th September to discuss changes to the noise assessment. | Wood / Vernon Cole, LBC | 11/09/2020 |

[redacted]

**From:** [redacted]
**Sent:** 11 September 2020 13:03
**To:** [redacted]
**Cc:** [redacted]
**Subject:** RE: Luton Airport 19 mppa carbon review

**CAUTION:** External email. Please do not click on links/attachments unless you know the content is genuine and safe.

[redacted]

Is the presentation one that will be for public consumption, because as with the comments received from Vernon on the noise aspect, I would say that the explanation as to the unprecedented growth will be massively criticised by members of the public, as it does not really reflect what has happened at the airport and why.

So on slide 4:

- Second bullet point is not strictly accurate, the 18mppa (or something like 17.8mppa was shown as being reached a few years prior to 2028 and staying at that level).
- Saying that fleet modernisation has not been as quick as forecast needs looking at, since my recollection from the documents associated with the 2012 application was that it was in line with forecasts, it is the passenger growth that is the issue, fleet modernisation was seeing new generation aircraft delivered from around 2017 with the mid 2020s (so 23/25 I think) seeing about 50% of the wide bodied single aisle aircraft being new gen (so something like 35% of fleet) – BAP had predictions on this within the appendices to the ES I think.

Whilst you are scoping things out of the ES you will still need to provide various reports for what is a major application, in line with LBC's checklist for validation (both local and national requirements).

In terms of topics scoped out:

1. Waste scoped out of ES – agree
2. Water scoped out – agree, but there will be an annual increase in foul from 1mppa extra passengers, so have you discussed with TWUL whether there is capacity, or whether there needs to be improvements to the East Hyde treatment facility? I understand from Gemma that during the meeting it was stated that whist there would be an increase in foul there is no capacity to accommodate this on site, so it is intended that passenger numbers will be restricted during peak times back to the 18 mppa figure in order to address this. I believe that only addresses the peak flow but not the overall capacity of TWUL's treatment plant.
3. Biodiversity – agree (no operational development)
4. Ground conditions – agree (no operational development)
5. Historic environment – agree (but will need to address nearby heritage assets in the planning statement)
6. Landscape and visual – agree (but will need to address AONB/additional flights over sensitive areas)
7. Major accidents and disasters – agree (will you provide info on risk and any likely necessity to change PSZ?)
8. Socio-economics – agree (it would be useful to know how the forecast has changed between 2012 and now in terms of benefits, with employees, contribution to the economy, etc – presume that you are including this within the planning statement)

So the topics that will be in the ES are:

a. Air quality – agree it should be in (you will have seen comments that were made on AQ at the airport in a report that was prepared to the Oversight and Scrutiny Board the same night as the AMR was reported to the OSB – those need to be considered as it is clear that there is concern with the air quality in the area)
b. Climate – agree it should be in (you will see that Ricardo have reference to CCC 2050, LBC's 2040, DfT growth predictions, other airports expansion proposals – so you may need to reconsider this when you have their review next week – though Gemma informs me that it was noted during the meeting that once comments have been received from Ricardo you may amend this approach).
c. Transport – agree it should be in (I do think that you will need a sensitivity test re public transport based on what has happened since March with covid and assume much greater % using private cars and public transport only operating at 30% or so of capacity – this could have serious implications for accessibility and mitigation despite the fact that you currently indicate that none is necessary – this may therefore mean that you need to undertake some additional modelling).
d. Noise – agree it should be in (you have had Vernon's comments on the issues that still need to be addressed in the noise report when it becomes an ES chapter)
e. Health – agree it should be in (you have had our comments on this aspect in the EIA screening and you will need to address the take up of the Sound Insulation Scheme, how many properties within the contours have been insulated to date? how many will be insulated each year [not just proposed but realistic]? what will be the benefit? what is the disbenefit to those who do not have the insulation? what about the wider issues with noise in the summer period when windows are open, gardens are in use, etc?)

I trust that this answers the questions that you raised.

Regards

[redacted]

# Appendix 1D
# List of Competent Experts

Competent experts involved in the preparation of this ES are listed in the table below.

| Individual | Name of Company | Qualifications | Relevant Experience | Contribution to Environmental Statement |
|---|---|---|---|---|
| **Alistair Billington**<br>Technical Director | Wood | MIEMA<br><br>BSc Geography<br><br>MSc Environmental Assessment and Management | Alistair is a Technical Director with 27 years of consultancy experience gained within the UK and EMEA. During this time he has gained extensive experience from leading and managing teams of technical experts on complex, high-profile EIA projects across a variety of sectors through all the major consenting routes.<br><br>Alistair is a highly experienced environmental impact assessment practitioner and contributes to the development of best practice and technical excellence in this discipline. He provides expert advice on EIA and application strategy has a proven ability to engage effectively with internal and external project stakeholders, including engineers, planners, legal advisors, and statutory consultees. | EIA Project Director<br><br>Overseeing, reviewing, and approving |
| **Katie Lidington**<br>Principal Consultant | Wood | CEnv<br><br>MIEMA<br><br>Affiliate Member of the Royal Town Planning Institute<br><br>BSc (Hons) Geography | Katie is a Chartered Environmentalist and Full Member of the Institute of Environmental Management and Assessment. She has 12 years of experience in EIA across a variety of sectors including transport, water, and mixed-use development.<br><br>Katie's experience includes infrastructure planning, EIA, project management and co-ordination. | EIA Project Manager<br><br>Co-ordinating, overseeing, and reviewing |
| **Rob Rand**<br>Consultant | Wood | PIEMA<br><br>MSc Environmental Biology: Conservation and Resource Management<br><br>BSc Marine Biology | Rob is an EIA consultant with four years' of consultancy experience and a Practitioner of the Institute of Environmental Management and Assessment. The projects he has worked on span a wide variety of sectors (offshore wind, ports, coastal projects, aviation, nuclear, commercial, residential, and transport) covering all air, marine, and terrestrial realms. | EIA Project Manager<br><br>Co-ordinating, overseeing, reviewing, and author of Chapters 1, 2, 3, 4, 5, 13, and Non-Technical Summary |
| **Martin Pierce**<br>Principle consultant | Wood | BSc (Hons), Mathematics with Astronomy<br><br>MSc Nonlinear Mathematics | Martin has performed many assessments of air quality and greenhouse gas emissions around major airports over the last 20 years. Some of these are aimed at allowing the airport operator to understand its current impacts, help inform the local community | Author of Chapter 6: Air quality |

| Individual | Name of Company | Qualifications | Relevant Experience | Contribution to Environmental Statement |
|---|---|---|---|---|
| | | | under Section 106 agreements, and develop action plans; others are to assess the impacts of proposed developments ranging from a new heating plant, a reconfiguration of the airfield, or new terminals and runways. Still others provide a strategic comparison of the effects of different aviation expansion options across a range of airports. | |
| **Chris Harris**<br>Associate Director | Wood | BSc Marine Geography<br><br>MSc Climate Change<br><br>PhD Civil Engineering | Christopher Harris is a specialist with 10 years of experience in climate change adaptation, the resilience of infrastructure systems, climate change mitigation, sustainability, and Greenhouse Gas (GHG) assessment. He has experience of developing some of the largest infrastructure projects and operators in the UK. He is a Key Specialty Lead for Sustainable Infrastructure in the global Wood business. He is a member of the BSI Greenhouse Gas management and related activities group of experts. Christopher has experience in the use of PAS 2080 – Carbon Management in Infrastructure, amongst other GHG emissions standards, and continues to serve as a peer reviewer for two academic journals focussing on climate change. | Author of Chapter 7: Climate change |
| **Salim Vohra** | Health by Design | PhD Public Health and Policy<br><br>MSc Environmental Epidemiology and Policy<br><br>MBChB (Bachelor of Medicine, Bachelor of Surgery) | Salim has over 25 years of experience in public health and over 15 years of experience in health impact assessment. During this time he has led, and been a team member of EIA teams within a variety of sectors including, housing, infrastructure, industrial, and policy development projects in the UK and internationally. | Author of Chapter 8: Human health |
| **Filipe Silva** | Health by Design | MSc Public Health, UK<br><br>MD (Degree in Medicine), Portugal | Filipe has over 10 years of experience in public health and over 5 years of experience in health impact assessment of being a team member of, and leading, housing, infrastructure and industrial projects and policies in the UK and internationally. | Author of Chapter 8: Human health |
| **Mark Evans**<br>Principal Consultant | Wood | Member of the Institute of Acoustics<br><br>Diploma in Acoustics and Noise Control<br><br>MSc Environmental Management | Mark has over 14 years of experience a large variety of noise and vibration assessments. He has vast experience with assessments on aviation projects, large scale infrastructure projects, port developments, highways and rail schemes, and mixed-use developments. He has worked on multiple high-profile projects in the UK (Heathrow Expansion, HS2) and abroad (South Caucus pipeline extension, Yanpet Industrial City petrochemical area expansion). | Author of Chapter 9: Noise |

| Individual | Name of Company | Qualifications | Relevant Experience | Contribution to Environmental Statement |
|---|---|---|---|---|
| **David Charles**<br>Partner | Bickerdike Allen Partners | Member of the Institute of Acoustics<br><br>BSc (Hons) Mathematics<br><br>Post-graduate Diploma in Environmental Acoustics | David has over 25 years of experience in acoustics and specialises in aircraft noise. He has significant experience with assessments on aviation projects and other large-scale infrastructure projects. He has been involved with noise modelling on many projects including for the Airports Commission, major planning applications, and the regular noise mapping required by EU directive. He has also been involved with the noise modelling at Luton Airport for over 10 years. | Undertaken noise modelling |
| **Duncan Rogers**<br>Acoustic Consultant | Bickerdike Allen Partners | Associate Member of the Institute of Acoustics<br><br>BSc (Hons) Mathematics and Physics | Duncan has 6 years of experience in a large variety of noise and vibration assessments and specialises in aircraft noise modelling and assessment. He has worked on many major airport projects, including for the Airports Commission, and major planning applications for London City Airport and Dublin Airport. He has also been involved with the noise modelling at Luton Airport for several years. | Undertaken noise modelling |
| **Monika Crouse**<br>Technical Director | Wood | Member of Chartered Institute of Highways and Transportation<br><br>Chartered Member of Institute of Logistics and Transport<br><br>MA Spanish and South American Studies | Monika is a Transport Planner with over 14 years of experience in transport assessments as part of the EIA process, junction and network reviews and improvements, as well as transport modelling.<br><br>During her career she has acted as a Technical Lead, Project Manager, and Project Director on multiple high-profile projects in the UK and abroad, strategically overseeing, monitoring and managing teams delivering projects for clients as diverse as Transport for London, London Boroughs, and the World Bank. | Author of Chapter 10: Transport |

# Appendix 1E
# Competent Experts Statement

*London Luton Airport Operations Limited (LLAOL) has engaged the services of Wood Environment and Infrastructure Solutions ('the Environmental Consultants') to carry out an Environmental Impact Assessment in respect of the scheme and to prepare this Environmental Statement. In accordance with the Regulation 15(5)(a), (b) of the Town and Country Planning (Environmental Impact Assessment) Regulations 2017 (the '2017 EIA Regulations'), LLAOL confirms that to the best of their knowledge and belief, the Environmental Consultants are competent experts within the meaning of the 2017 EIA Regulations. This belief is based on the Environmental Consultants' relevant expertise, level of experience and qualifications in preparing environmental statements. The evidence of the Environmental Consultants' competence is demonstrated in Appendix 1C.*

# Appendix 1F
# Glossary

| Term | Definition |
|---|---|
| **Ambient noise** | Usually expressed using the $L_{Aeq,T}$ unit, commonly understood to include all sound sources present at any particular site, regardless of whether they are actually defined as noise. |
| **Apron** | The airport apron is the area of an airport where aircraft are parked, unloaded or loaded, refuelled, or boarded. |
| **A-weighting** | The sensitivity of the ear is frequency dependent. Sound level meters are fitted with a weighting network which approximates to this response and allows sound levels to be expressed as an overall single figure value, in dB(A). |
| **Background noise** | This is the steady noise attributable to less prominent and mostly distant sound sources above which identifiable specific noise sources intrude. It is usually expressed using the LA90 unit. |
| **Baseline** | A study of existing environmental conditions |
| **Biodiversity** | The concept of a variety in all species of plants and animals through which nature finds its balance. |
| **Carbon Budget** | The UK Carbon Budget is the total quantity of greenhouse gas emissions permitted in the United Kingdom over a specified period. |
| **Carbon dioxide equivalent** | A measure used to compare the emissions from various greenhouse gases based on their global warming potential relative to that of carbon dioxide. |
| **Carbon emission** | The release of carbon into the atmosphere. |
| **Climate change mitigation** | Action to reduce the causes of climate change (e.g. emissions of greenhouse gases), as well as reducing future risks associated with climate change. |
| **Committee on Climate Change** | An independent advisory body, established under section 32 of the Climate Change Act 2008, tasked with helping the UK Government set and meet carbon budgets and adapt to climate change. |
| **Cumulative Effect** | The combined effects of foreseeable human induced changes within a specific geographical area over a certain period of time. Effects can be both direct and indirect. |
| **dB / Decibel** | The unit used to describe the magnitude of sound is the decibel (dB) and the quantity measured is the sound pressure level. The decibel scale is logarithmic and it ascribes equal values to proportional changes in sound pressure, which is a characteristic of the ear. Use of a logarithmic scale has the added advantage that it compresses the very wide range of sound pressures to which the ear may typically be exposed to a more manageable range of numbers. The threshold of hearing occurs at approximately 0 dB (which corresponds to a reference sound pressure of 2 x 10-5 Pascals) and the threshold of pain is around 120 dB.<br>The sound energy radiated by a source can also be expressed in decibels. The sound power is a measure of the total sound energy radiated by a source per second, in watts. The sound power level, Lw is expressed in decibels, referenced to 10-12 watts. |
| **Effect** | A temporary or permanent consequence of a singular or collective impact associated with the proposal. |

| Term | Definition |
|---|---|
| **EIA regulations** | Town and Country Planning (Environmental Impact Assessment) Regulations 2017 (SI No 571) |
| **Emissions scenario** | Scenarios of how greenhouse gas emissions may vary in future. These are used by scientists to generate climate change projections. |
| **Environment** | Our physical surroundings including air, water and land. |
| **Environmental impact assessment** | An assessment undertaken to determine the potential impacts of a proposed development on various elements of the environment, such as on air quality and ecology and social issues such as socio-economics and transport. |
| **Environmental statement** | The report of the Environmental Impact Assessment of a proposed development. |
| **Extreme weather event** | Unusual, severe or unseasonal weather; or weather at the extremes of the range of weather seen in the past. |
| **Frequency (Hz)** | Frequency is analogous to musical pitch. It depends upon the rate of vibration of the air molecules that transmit the sound and is measured as the number of cycles per second or Hertz (Hz). The human ear is sensitive to sound in the range 20 Hz to 20,000 Hz (20 kHz). For acoustic engineering purposes, the frequency range is normally divided up into discrete bands. The most commonly used bands are octave bands, in which the upper limiting frequency for any band is twice the lower limiting frequency, and one-third octave bands, in which each octave band is divided into three. The bands are described by their centre frequency value and the ranges which are typically used for building acoustics purposes are 63 Hz to 4 kHz (octave bands) and 100 Hz to 3150 Hz (one-third octave bands). |
| **Future baseline** | The situation that would occur if the proposed development that is the subject of the Environmental Impact Assessment does not proceed. The predicted impacts of the development are compared against this theoretical scenario. |
| **Greenhouse Gas** | A gas such as carbon dioxide, methane, chlorofluorocarbons, nitrous oxide, ozone, and water vapour that contributes to the greenhouse effect by absorbing infrared radiation. |
| **Groundwater** | Water held underground in the soil or in pores and crevices in rock. |
| **Health** | A state of complete physical, mental and social wellbeing and not merely the absence of disease or infirmity. |
| **Health impact assessment** | A means of assessing the health impacts of policies, plans and projects in diverse economic sectors using quantitative, qualitative and participatory techniques. |
| **Hypertension** | Abnormally high blood pressure. |
| **Impact** | Something which temporarily or permanently causes a change to the environmental baseline, whether adverse or beneficial, as a result of the proposals. |
| **Indices of multiple deprivation** | A UK government qualitative study of deprived areas in English local counties. Commonly known as the IMD, is the official measure of relative deprivation for small areas in England. |
| **Indirect impacts** | Impacts on the environment, which are not a direct result of the development but are often produced away from it or as a result of a complex pathway. |
| **Inter-project effects assessment** | An assessment of how the environmental effects resulting from the Proposed Development could combine with the same topic-related effects generated by other proposed or committed developments to affect a common receptor. For example, noise generated by the construction of the Proposed Development and that generated from another construction site nearby could affect the same residential property receptor. |

| Term | Definition |
|---|---|
| **$L_{A90}$** | Level exceeded 90% of the time (background noise). |
| **$L_{Aeq,T}$** | Equivalent continuous A-weighted sound pressure level. |
| **$L_{Amax,T}$** | The maximum A-weighted sound pressure level, normally associated with a time weighting, F (fast), or S (slow), such as $L_{AF,max}$ or $L_{AS,max}$. |
| **Lowest observable adverse effect level** | This is one of three observed effect level definitions to the assessment of noise in England, in order to identify and rate noise impact on the community from any development. It is the level above which adverse effects on health and quality of life can be detected. |
| **Lower super output area** | Geographic hierarchy designed to improve the reporting of small area statistics in England and Wales. |
| **Land use** | The primary use of the land, including both rural and urban activities. |
| **MAGIC** | A website that provides geographic information about the natural environment from across government. |
| **Methodology** | The specific approach and techniques used for a given study. |
| **Mitigation** | Any process, activity or entity designed to avoid, reduce, or remedy adverse environmental effects likely to be caused by a development project. |
| **N60 & N70** | Nx contours define ground receptors exposed to a number of events with a maximum noise level of x dB $L_{ASmax}$ or greater. |
| **No observed effect level** | This is one of three observed effect level definitions to the assessment of noise in England, in order to identify and rate noise impact on the community from any development. It is the level below which no effect can be detected and below which there is no detectable effect on health and quality of life due to noise. |
| **Non-technical summary** | The 'executive summary' of an Environmental Statement prepared in non-technical language so that it can be read by the layperson. |
| **Nx** | Nx or Number Above is the total number of aircraft operations that exceed a specified sound level threshold. For example, N65 is the count of departure and arrival events in express of 65dB $L_{AMAX}$. |
| **Operational phase** | Standard operation after commissioning. |
| **Parent permission** | The planning permission granted in 2014 for expansion of the airport with a cap of 18 million passengers per annum, which provides the overall baseline and context for subsequent planning consents, and this current application. |
| **Paris Agreement** | An agreement within the United Nationals Framework Convention on Climate Change (UNFCCC) that sets out a global action plan to mitigate greenhouse gas emissions and limiting global warming to well below 2°C, as well as strengthening the ability of countries to deal with the impacts of climate change. |
| **Particulate matter** | Particulate matter (PM), also known as particle pollution, is a complex mixture of extremely small particles and liquid droplets that get into the air. Once inhaled, these particles can affect the heart and lungs and cause serious health effects. |
| **Peak Day Air Transport Movements** | The busiest day in terms of the number of Air Traffic Movements |
| **Potential receptors** | Locations used by people at which there is an environmental or social change that could affect a health outcome. |

| Term | Definition |
|---|---|
| **Proposed scheme** | The proposed expansion of Luton Airport beyond the permitted passenger cap of 18 million passengers per annum to 19 million passengers per annum through a planning application to Luton Borough Council. |
| **Ramsar site** | A designation of wetland sites of international importance under the Ramsar Convention. |
| **Rating level, $L_{Ar,Tr}$** | The specific sound level plus any adjustment for the characteristic features of the sound. |
| **Receptors** | A component of the natural or man-made environment such as water or a building that is affected by an impact. |
| **Residual impacts** | Effects remaining after mitigation measures have been implemented. |
| **Scheduled Monument** | In the United Kingdom, a scheduled monument is a nationally important archaeological site or historic building, given protection against unauthorised change. |
| **Scoping** | An early stage within the Environmental Impact Assessment Process where the significance of environmental issue and scope of the environmental studies are determined. |
| **Significant effect** | Significant effects are those identified as 'Major' within the significance evaluation matrix (contained within Chapter 4: Approach to preparing the Environmental Statement). |
| **Significant observed adverse effect level** | This is one of three observed effect level definitions to the assessment of noise in England, in order to identify and rate noise impact on the community from any development. It is the level above which significant adverse effects on health and quality of life occur. |
| **Sound** | This is a physical vibration in the air, propagating away from a source, whether heard or not. |
| **Sound power levels ($L_w$)** | Sound power levels ($L_w$) are used to describe the sound output of a sound source. |
| **Spatial scope** | The area over which changes to the environment are predicted to occur as a consequence of a Proposed Scheme. |
| **Surface water** | Water found on the surface of the Earth (not underground or in the atmosphere), for example in rivers, seas, lakes and reservoirs. |
| **Taxiing** | Taxiing is the slow movement of an aircraft on the ground, under its own power, before take-off or after landing. |
| **Temporal scope** | The time period over which changes to the environment and the resultant effects are predicted to occur. |
| **Topic** | The environment that could be affected by the proposed development. |
| **Traffic flows** | The interactions between travellers and infrastructure. |
| **Transboundary effects** | Effects that would affect the environment in another state within the European Economic Area (EEA) |
| **Unacceptable Adverse Effect Level** | The level above which extensive and regular changes in behaviour and/or an inability to mitigate the effect of noise leading to psychological stress or physical effects occurs. |
| **Vibration** | Vibration is an oscillatory motion. The magnitude of vibration can be defined in terms of displacement, i.e. how far from the equilibrium something moves, velocity (how fast something moves), or acceleration (the rate of change of the velocity). |
| **Visual Effect** | The change in the appearance of the townscape as a result of the development. This can be positive or negative. |

| Term | Definition |
|---|---|
| **Wellbeing** | A state in which every individual realises his or her own potential, can cope with the normal stresses of life, can work productively and fruitfully and is able to make a contribution to her or his community. |
| **92-Day Peak Period Air Transport Movements** | The 92-day period within which the highest number of Air Transport Movements occurs. |

# Appendix 1G
# Abbreviations

| Abbreviation | Term |
|---|---|
| **ACA** | Airport Carbon Accreditation |
| **ACI** | Airports Council International |
| **ACOG** | Airspace Change Organising Group |
| **ADMS** | Atmospheric Dispersion Modelling System |
| **AEDT** | Aviation Environmental Design Tool |
| **AEM** | Advanced Emissions Model |
| **AIP** | Aeronautical Information Package |
| **ANCON** | Aircraft Noise Contour Model |
| **ANG** | Air Navigation Guidance |
| **ANPS** | Airports National Policy Statement |
| **AONB** | Area of Outstanding Natural Beauty |
| **APF** | Aviation Policy Framework |
| **APIS** | Air Pollution Information System |
| **APU** | Auxiliary Power Unit |
| **AQAL** | Air Quality Assessment Level |
| **AQMA** | Air Quality Management Area |
| **AQO** | Air Quality Objective |
| **AQS** | Air Quality Standard |
| **ASAS** | Airport Surface Access Strategy |
| **ATC** | Air Traffic Control |
| **ATM** | Air Traffic Movement |
| **ATWP** | Air Transport White Paper |
| **BEIS** | Business, Energy and Industrial Strategy |
| **BSI** | British Standards Institute |
| **CAA** | Civil Aviation Authority |
| **CCC** | Committee on Climate Change |
| **CCD** | Climb, Cruise and Descent |

| Abbreviation | Term |
|---|---|
| **CCO** | Continuous Climb Operations |
| **CCS** | Carbon Capture and Storage |
| **CDA** | Continuous Descent Approaches |
| **CEA** | Cumulative Effects Assessment |
| **CEMP** | Construction Environmental Management Plan |
| **CL** | Critical Load |
| **CLE** | Critical Level |
| **CMD** | Common Mental Health Disorders |
| **CO** | Carbon monoxide |
| **COMEAP** | Committee on the Medical Effects of Air Pollutants |
| **CORSIA** | Carbon Offsetting and Reduction Scheme for International Aviation |
| **$CO_2$** | Carbon dioxide |
| **$CO_2e$** | Carbon dioxide equivalent |
| **CPMP** | Car Parking Management Plan |
| **CRP** | Carbon Reduction Plan |
| **CTA** | Central Terminal Area |
| **CTF** | Community Trust Fund |
| **$C_6H_6$** | Benzene |
| **DART** | Direct Air-Rail Transit |
| **dB** | Decibels |
| **DCLG** | Department for Communities and Local Government |
| **DCO** | Development Consent Order |
| **Defra** | Department for Environment, Food and Rural Affairs |
| **DfT** | Department for Transport |
| **EAL** | Environmental Assessment Level |
| **EC** | European Commission |
| **EEA** | European Economic Area/European Environment Agency |
| **EEP** | Energy and Emissions Projections |
| **EFT** | Emission Factors Toolkit |
| **EIA** | Environmental Impact Assessment |

| Abbreviation | Term |
|---|---|
| **EMEP** | European Monitoring and Evaluation Programme |
| **END** | Environmental Noise Directive |
| **EPUK** | Environmental Protection UK |
| **ES** | Environmental Statement |
| **ETS** | Emissions Trading Scheme |
| **EU** | European Union |
| **FAA** | Federal Aviation Administration |
| **FASI** | Future Airspace Strategy Implementation |
| **FES** | Future Energy Scenarios |
| **GCD** | Great Circle Distance |
| **GDG** | Guideline Development Group |
| **GHG** | Greenhouse Gas |
| **GSE** | Ground Support Equipment |
| **HA** | High Annoyance |
| **HIA** | Health Impact Assessment |
| **IAQM** | Institute of Air Quality Management |
| **IAS** | International Aviation and Shipping |
| **ICAO** | International Civil Aviation Organisation |
| **IEMA** | Institute of Environmental Management and Assessment |
| **INM** | Integrated Noise Model |
| **IPA** | Impact Pathway Approach |
| **IPCC** | Intergovernmental Panel on Climate Change |
| **km** | kilometre |
| **$km^2$** | Square kilometres |
| **LAQM** | Local Air Quality Management |
| **LBC** | Luton Borough Council |
| **LCC** | Low-Cost Carrier |
| **LLA** | London Luton Airport |
| **LLACC** | London Luton Airport Consultative Committee |
| **LLAOL** | London Luton Airport Operations Limited |

| Abbreviation | Term |
|---|---|
| **LOAEL** | Lowest Observed Adverse Effect Level |
| **LRTAP** | Long-Range Transboundary Air Pollution |
| **LSOA** | Lower Layer Super Output Areas |
| **LTO** | Landing and Take-Off |
| **LTP** | Local Transport Plan |
| **m** | meter |
| **MAGIC** | Multi Agency Geographic Information for the Countryside |
| **MHCLG** | Ministry of Housing, Communities and Local Government |
| **mppa** | Million Passengers Per Annum |
| **NAEI** | National Atmospheric Emissions Inventory |
| **NNG** | Night Noise Guideline |
| **NO** | Nitric oxide |
| **NOEL** | No Observed Effect Level |
| **$NO_X$** | Oxides of nitrogen |
| **$NO_2$** | Nitrogen Dioxide |
| **NPPF** | National Planning Policy Framework |
| **NPPG** | National Planning Practice Guidance |
| **NPRs** | Noise Preferential Routes |
| **NPS** | National Policy Statement |
| **NPSE** | Noise Policy Statement for England |
| **NSIP** | Nationally Significant Infrastructure Project |
| **NTS** | Non-Technical Summary |
| **NVL** | Noise Violation Limits |
| **ORR** | Office of Road and Rail |
| **OS** | Ordnance Survey |
| **PAS** | Publicly Available Standard |
| **Pb** | Lead |
| **PC** | Process Contribution |
| **PCM** | Pollution Climate Mapping |
| **PEC** | Predicted Environmental Contribution |

| Abbreviation | Term |
|---|---|
| **PM** | Particulate Matter |
| **QC** | Quota Count |
| **RAF** | Royal Air Force |
| **ROC** | Renewables Obligation Certificate |
| **SAC** | Special Area of Conservation |
| **SAF** | Sustainable Aviation Fuel |
| **SEL** | Single Event Level |
| **SET** | Small Emitters Tool |
| **SIDs** | Standard Instrument Departures |
| **SIGS** | Sound Insulation Grant Scheme |
| **SOAEL** | Significant Observed Adverse Effect Level |
| **SofS** | Secretary of State |
| **SoNA** | Survey of Noise Attitudes |
| **SoR** | Start of Take-off Roll |
| **SoS** | Secretary of State |
| **SOV** | Single Occupancy Vehicle |
| **$SO_2$** | Sulphur dioxide |
| **SPA** | Special Protection Area |
| **SRT** | Systematic Review Team |
| **SSSI** | Site of Special Scientific Interest |
| **STARs** | Standard Arrival Routes |
| **STS** | Staff Travel Survey |
| **SWMP** | Site Waste Management Plan |
| **TA** | Transport Assessment |
| **TDP** | Transport Decarbonisation Plan |
| **TNIP** | Transport Noise Information Package |
| **TP** | Travel Plan |
| **T&D** | Transmission and Distribution |
| **UAEL** | Unacceptable Adverse Effect Level |
| **UK** | United Kingdom |

| Abbreviation | Term |
|---|---|
| **UN** | United Nations |
| **UNFCCC** | United Nations Framework Convention on Climate Change |
| **WebTAG** | Web-based Transport Analysis Guidance |
| **WHO** | World Health Organisation |
| **ZoI** | Zone of Influence |
| **µg** | Micro-gram |

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# Appendix 3A
# Aircraft flows

Table 3A.1 Forecast flows

| | Day 2011* | Night 2011* | Day 2018 18 mppa | Night 2018 mppa | 2021 18mppa | 2021 18mppa | 2028 without Dev Day | 2028 without Dev Night | 2028 18mppa | 2028 18mppa | Day 2021 19mppa | Night 2021 19mppa | 2028 19mppa |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **A300** | 170 | 97 | 229 | 148 | 229 | 148 | 429 | 117 | 287 | 168 | 229 | 148 | 226 |
| **A318ceo** | 14 | n/a | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **A318 neo** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **A319ceo** | 6315 | 1121 | 3257 | 455 | 3257 | 455 | 3194 | 440 | 55 | 1 | 3264 | 456 | 49 |
| **A319 neo** | 0 | 0 | 0 | 0 | 0 | 0 | 3194 | 440 | 0 | 0 | 0 | 0 | 0 |
| **A320ceo** | 5142 | 1286 | 11106 | 2254 | 11106 | 2254 | 4314 | 441 | 5024 | 644 | 10417 | 2230 | 1888 |
| **A320 neo** | 0 | 0 | 2625 | 542 | 2625 | 542 | 4314 | 441 | 12162 | 2061 | 2634 | 546 | 14088 |
| **A321ceo** | 594 | 191 | 4532 | 556 | 4532 | 556 | 1135 | 610 | 389 | 11 | 5294 | 386 | 0 |
| **A321 neo** | 0 | 0 | 1046 | 12 | 1046 | 12 | 1135 | 610 | 4027 | 605 | 1008 | 209 | 5638 |
| **A330** | 0 | 0 | 12 | 0 | 12 | 0 | 0 | 0 | 0 | 0 | 12 | 0 | 11 |
| **B737- Max** | 0 | 0 | 637 | 142 | 637 | 142 | 1905 | 329 | 2735 | 771 | 639 | 142 | 4108 |
| **B737-300 / 73C** | 52 | 19 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **B737-400** | 128 | 40 | 12 | 104 | 12 | 104 | 0 | 0 | 0 | 112 | 12 | 105 | 13 |

| | Day 2011* | Night 2011* | Day 2018 18 mppa | Night 2018 mppa | 2021 18mppa | 2021 18mppa | 2028 without Dev Day | 2028 without Dev Night | 2028 18mppa | 2028 18mppa | Day 2021 19mppa | Night 2021 19mppa | 2028 19mppa |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **B737-500** | 0 | 0 | 17 | 0 | 17 | 0 | 0 | 0 | 0 | 0 | 17 | 0 | 21 |
| **B737-600** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **B737-700** | 1055 | 94 | 32 | 0 | 32 | 0 | 13 | 39 | 0 | 0 | 32 | 0 | 39 |
| **B737-800 / 73H** | 2665 | 660 | 4054 | 675 | 4054 | 675 | 1905 | 329 | 1897 | 301 | 4063 | 677 | 541 |
| **B737-900** | 0 | 0 | 191 | 41 | 191 | 41 | 0 | 0 | 0 | 0 | 192 | 41 | 190 |
| **B757** | 312 | 92 | n/a | 130 | n/a | 130 | 143 | 13 | 0 | 112 | n/a | 131 | n/a |
| **B767-200** | 38 | n/a | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **B767-300** | 123 | n/a | 0 | 0 | 0 | 0 | | | 0 | 0 | 0 | 0 | 0 |
| **B787-800 / 900** | 0 | 0 | 17 | 0 | 17 | 0 | 368 | 0 | 0 | 0 | 17 | 0 | 29 |
| **Dash 8** | 314 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **DO328** | 18 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **E135/145** | 335 | 65 | 406 | n/a | 406 | 0 | 0 | 0 | 0 | 0 | 407 | 0 | 366 |
| **E175/195** | 22 | 0 | 0 | 0 | 0 | 0 | 1630 | 0 | 0 | 0 | 0 | 0 | 11 |
| **F10062** | 31 | 0 | 0 | 0 | 0 | 0 | | | 0 | 0 | 0 | 0 | 0 |
| **OTHER** | 6434 | 799 | 6218 | 72 | 6218 | 72 | 9827 | 1649 | 7998 | 76 | 6232 | 73 | 7631 |
| **Total** | 23762 | 4464 | 34391 | 5131 | 34391 | 5131 | 33505 | 5457 | 34574 | 4863 | 34469 | 5143 | 34849 |

# Appendix 6A
# Air quality - Relevant planning policy and technical guidance: further details

## EU legislation

### *Directive 2008/50/EC on Ambient Air Quality and Cleaner Air for Europe*[1]

*Directive 2008/50/EC* (the '*Directive*'), which came into force in June 2008, consolidates existing EU-wide air quality legislation (with the exception of *Directive 2004/107/EC*) and provides a new regulatory framework for $PM_{2.5}$.

The *Directive* sets limits or target levels for selected pollutants that are to be achieved by specific dates and details procedures EU Member States should take in assessing ambient air quality. The limit and target levels relate to concentrations in ambient air. At Article 2(1), the *Directive* defines ambient air as:

*"…outdoor air in the troposphere, excluding workplaces as defined by Directive 89/654/EEC where provisions concerning health and safety at work apply and to which members of the public do not have regular access."*

In accordance with Article 2(1), Annex III, Part A, paragraph 2 details locations where compliance with the limit values does not need to be assessed:

*"Compliance with the limit values directed at the protection of human health shall not be assessed at the following locations:*

*a) any locations situated within areas where members of the public do not have access and there is no fixed habitation;*

*b) in accordance with Article 2(1), on factory premises or at industrial installations to which all relevant provisions concerning health and safety at work apply; and*

*c) on the carriageway of roads; and on the central reservation of roads except where there is normally pedestrian access to the central reservation."*

## UK legislation, policy, and guidance

### *The Environment Act 1995*[2]

Part IV of the *Environment Act 1995* requires that Local Authorities periodically review air quality within their individual areas. This process of Local Air Quality Management (LAQM) is an integral part of delivering the Government's Air Quality Objectives (AQOs).

To carry out an air quality Review and Assessment under the LAQM process, the Government recommends a three-stage approach. This phased review process uses initial simple screening methods and progresses

[1] EUR-Lex Access to European Union law. *Cleaner air for Europe.* [online] Available at: https://eur-lex.europa.eu/legal-content/EN/LSU/?uri=celex:32008L0050#:~:text=ACT-,Directive%202008%2F50%2FEC%20of%20the%20European%20Parliament%20and%20of,and%20cleaner%20air%20for%20Europe.&text=WHAT%20DOES%20THE%20DIRECTIVE%20DO,environmental%20quality%20up%20to%202020. [Accessed 23/11/2020

[2] UK Government. *Environment Act 1995.* [online] Available at: https://www.legislation.gov.uk/ukpga/1995/25/contents . [Accessed 23/11/2020].

through to more detailed assessment methods of modelling and monitoring in areas identified to be at potential risk of exceeding the AQOs in the Regulations.

Review and assessments of local air quality aim to identify areas where national policies to reduce vehicle and industrial emissions are unlikely to result in air quality meeting the Government's AQOs by the required dates.

For the purposes of determining the focus of Review and Assessment, Local Authorities should have regard to those locations where members of the public are likely to be regularly present and are likely to be exposed over the averaging period of the objective.

Where the assessment indicates that some or all of the objectives may be potentially exceeded, the Local Authority has a duty to declare an AQMA. The declaration of an AQMA requires the Local Authority to implement an Air Quality Action Plan (AQAP), to reduce air pollution concentrations so that the required AQOs are met.

### *The Air Quality Standards Regulations 2010*[3]

*The Air Quality Standards Regulations 2010* (the '*Regulations*') came into force on the 11 June 2010 and transpose *Directive 2008/50/EC* into UK legislation. The Directive's limit values are transposed into the Regulations with attainment dates in line with the Directive. These limit values are commonly referred to as Air Quality Standards (AQS).

These limit values are legally binding concentrations of pollutants in the atmosphere which can broadly be taken to achieve a certain level of environmental quality. The standards are based on the assessment of the effects of each pollutant on human health including the effects of sensitive groups or on ecosystems.

Similarly to *Directive 2008/50/EC*, the *Regulations* define ambient air as:

*"…outdoor air in the troposphere, excluding workplaces where members of the public do not have regular access."*

with direction provided in Schedule 1, Part 1, Paragraph 2 as to where compliance with the AQS' does not need to be assessed:

*"Compliance with the limit values directed at the protection of human health does not need to be assessed at the following locations:*

*a) any location situated within areas where members of the public do not have access and there is no fixed habitation;*

*b) on factory premises or at industrial locations to which all relevant provisions concerning health and safety at work apply; and*

*c) on the carriageway of roads and on the central reservation of roads except where there is normally pedestrian access to the central reservation."*

### *The Air Quality Strategy for England, Scotland, Wales, and Northern Ireland*[4]

The *2007 Air Quality Strategy for England, Scotland, Wales, and Northern Ireland* provides a framework for improving air quality at a national and local level and supersedes the previous strategy published in 2000. It

[3] UK government. *The Air Quality Standards Regulations 2010.* [online] Available at: https://www.legislation.gov.uk/uksi/2010/1001/made . [Accessed 23/11/2020]

[4] Department for Environment, Food & Rural Affairs. *The Air Quality Strategy for England, Scotland, Wales and Northern Ireland – Volume 1.* [online]. Available at; https://www.gov.uk/government/publications/the-air-quality-strategy-for-england-scotland-wales-and-northern-ireland-volume-1. [Accessed 23/11/2020]

imposes a number of obligations on local authorities to manage air quality but does not directly impose obligations on developers.

Central to the Air Quality Strategy are health-based criteria for certain air pollutants; these criteria are based on medical and scientific evidence on how and at what concentration each pollutant affects human health. The AQOs derived from these criteria are policy targets often expressed as a maximum ambient concentration not to be exceeded, either without exception or with a permitted number of exceedances, over a specified averaging period. At paragraph 22 of the *2007 Air Quality Strategy*, the point is made that the objectives are:

*"…a statement of policy intentions or policy targets. As such, there is no legal requirement to meet these objectives except where they mirror any equivalent legally binding limit values in EU legislation."*

### *Clean Air Strategy 2019*[5]

The *Clean Air Strategy 2019* was issued by Defra to describe the government's approach to tackling air pollution in England. It runs parallel to the *Air Quality Strategy* but proposes that the LAQM regime may be overhauled in future. It increases the emphasis on ammonia and $PM_{2.5}$ as pollutants of concern, including a commitment to halve the population living in areas with concentrations of fine particulate matter above World Health Organization (WHO) guideline levels (10 µg $m^{-3}$) by 2025.

It also considers the contribution to be made by various sectors. Aviation is briefly discussed, but the *Clean Air Strategy* largely defers to *Aviation Strategy*.

### *Aviation 2050*[6]

In 2018–2019, the government consulted on its draft aviation strategy, *Aviation 2050*, which addresses a wide range of aviation issues around the strategic case, implementation, burdens, and overall acceptability. In relation to air quality, the draft strategy proposes the following measures:

- improving the monitoring of air pollution, including ultrafine particles (UFP), in order to improve understanding of aviation's impact on local air quality;
- ensuring comprehensive information on aviation-related air quality issues is made available to better inform interested parties;
- requiring all major airports to develop air quality plans to manage emissions within local air quality targets;
- validation of air quality monitoring to ensure consistent and robust monitoring standards that enable the identification of long-term trends; and
- supporting industry in the development of cleaner fuels to reduce the air quality impacts of aviation fuels.

### *Environment Bill*[7]

The *Environment Bill*, currently working its way through parliament, aims to set out an overarching framework for environmental law following the UK's departure from the European Union (EU). While specific legislation

[5] Department for Environment, Food & Rural Affairs. *Clean Air Strategy 2019* [online]. Available at: https://www.gov.uk/government/publications/clean-air-strategy-2019 . [Accessed 23/11/2020

[6] Department for Transport. *Aviation 2050 the future of UK aviation.* [online] Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/769695/aviation-2050-web.pdf . [Accessed 23/11/2020]

[7] Department for Environment, Food & Rural Affairs. *Environment Bill 2020.* [online] Available at: https://www.gov.uk/government/publications/environment-bill-2020 . [Accessed 23/11/2020]

remains in force after Brexit, the EU's acquis provided wider context, and some its provisions no longer apply, for example the role of the European Commission and European Court in enforcing and reviewing compliance.

A key measure of the bill is the creation of the Office for Environmental Protection (OEP) to provide oversight and enforcement of environmental legislation, as well as examining new environmental policies and investigating complaints. Enforcement will be done through new kind of legal mechanism, called an 'environmental review', that can compel public authorities to take action if a court finds they have breached environmental law.

With regard to air quality specifically, amendments to reduce the limit value for annual mean $PM_{2.5}$ from 25 µg $m^{-3}$ to 10 µg $m^{-3}$ were rejected by parliament. All legal limits therefore remain unchanged by the bill. However, the bill introduces a requirement on the Secretary of State to set a new target for $PM_{2.5}$ by 2022.

### *National Planning Policy Framework (NPPF)*[8]

The *NPPF* is a key part of the government's reforms to make the planning system less complex and more accessible. The framework acts as guidance for local planning authorities and decision-takers, both in drawing up plans and making decisions about planning applications.

Paragraph 181 of the *NPPF* states:

*"Planning policies and decisions should sustain and contribute towards compliance with relevant limit values or national objectives for pollutants, taking into account the presence of Air Quality Management Areas and Clean Air Zones, and the cumulative impacts from individual sites in local areas. Opportunities to improve air quality or mitigate impacts should be identified, such as through traffic and travel management, and green infrastructure provision and enhancement. So far as possible these opportunities should be considered at the plan-making stage, to ensure a strategic approach and limit the need for issues to be reconsidered when determining individual applications. Planning decisions should ensure that any new development in Air Quality Management Areas and Clean Air Zones is consistent with the local air quality action plan."*

Further detail in relation to air quality is contained in the air quality section of the planning practice guidance website.

## Other guideline values

In the absence of statutory standards for the other prescribed substances that may be found in the emissions, there are several sources of applicable air quality guidelines.

### *Air Quality Guidelines for Europe, the World Health Organization (WHO)*[9]

The aim of the *WHO Air Quality Guidelines* is to provide a basis for protecting public health from adverse effects of air pollutants and to eliminate or reduce exposure to those pollutants that are known or likely to be hazardous to human health or well-being. These guidelines are intended to provide guidance and information to international, national, and local authorities making risk management decisions, particularly in setting air quality standards. The 2005 update includes the guideline value of 10 µg $m^{-3}$ for annual mean $PM_{2.5}$.

[8] Ministry of Housing, Communities & Local Government. *National Planning Policy Framework.* [online] Available at: https://www.gov.uk/government/publications/national-planning-policy-framework--2 . [Accessed 23/11/2020]
[9] World Health Organization. *Air Quality Guidelines.* [online] Available at: https://www.euro.who.int/__data/assets/pdf_file/0005/74732/E71922.pdf [Accessed 23/11/2020]

### Environment Agency assessment levels[10]

The *Environment Agency* (EA) guidance note "*Air emissions risk assessment for your environmental permit*" contains long- and short-term assessment levels for releases to air derived from a number of published UK and international sources.

As well as repeating the AQSs and AQOs, the guidance note includes an additional assessment level of relevance to this assessment, namely a target of 75 µg $m^{-3}$ for the maximum daily mean oxides of nitrogen ($NO_x$) at ecological receptors. This is based on guidance from the WHO produced in 2000, which states:

*"Experimental evidence exists that the CLE [critical level] decreases from around 200 µg $m^{-3}$ to 75 µg $m^{-3}$ when in combination with $O_3$ or $SO_2$ at or above their critical levels. In the knowledge that short-term episodes of elevated $NO_x$ concentrations are generally combined with elevated concentrations of $O_3$ or $SO_2$, 75 µg $m^{-3}$ is proposed for the 24 h mean."*

In general, current conditions in the UK are such that elevated concentrations of ozone ($O_3$) or sulphur dioxide ($SO_2$) are rare. In particular, $SO_2$ levels are much lower than they were in 2000 when the WHO guidance was written, UK emissions having fallen by 86% from 1.29 Mt to 0.17 Mt between 2000 and 2017. As such, it is considered that 200 µg $m^{-3}$ is the more appropriate assessment level for daily mean $NO_x$. This has been accepted by regulators including Natural England (NE), the EA and Natural Resources Wales in relation to air quality assessments for other development applications.

[10] Department for Environment, Food & Rural Affairs. *Air emissions risk assessment for your environmental permit.* [online] Available at: https://www.gov.uk/guidance/air-emissions-risk-assessment-for-your-environmental-permit . [Accessed 23/11/2020]

# Appendix 6B
# Air quality - Background concentrations and deposition rates

The background concentrations in air in 2024 at each of the specific receptors, as assumed in the modelling for this assessment, are given in **Table 6B.1**, taken from the Department for Environment, Food and Rural Affairs (Defra) data. The background deposition rates at each of the specific ecological receptors, as assumed in the modelling for this assessment, are given in Table 6B.2, derived from Air Pollution Information Service (APIS) data. Details of the receptor locations are given in **Appendix 6C** in **Volume 3: Figures and Appendices**. Air pollutants are:

- oxides of nitrogen ($NO_x$);
- nitrogen dioxide ($NO_2$);
- particulate matter ($PM_{10}$ and $PM_{2.5}$);
- nitrogen (N); and
- sulphur (S).

Table 6B.1 Background 2024 air concentrations assumed for this assessment (µg $m^{-3}$)

| Receptor | $NO_x$ | $NO_2$ | $PM_{10}$ | $PM_{2.5}$ | Receptor | $NO_x$ | $NO_2$ | $PM_{10}$ | $PM_{2.5}$ |
|---|---|---|---|---|---|---|---|---|---|
| **H01** | 11.4 | 12.2 | 15.3 | 9.6 | **S06** | 21.5 | 22.0 | 14.7 | 9.8 |
| **H02** | 17.0 | 15.8 | 15.1 | 9.9 | **S07** | 21.5 | 22.0 | 14.7 | 9.8 |
| **H03** | 17.0 | 15.8 | 15.1 | 9.9 | **S08** | 21.5 | 22.0 | 14.7 | 9.8 |
| **H04** | 17.0 | 15.8 | 15.1 | 9.9 | **S09** | 21.5 | 22.0 | 14.7 | 9.8 |
| **H05** | 18.0 | 16.4 | 15.5 | 10.4 | **S10** | 21.5 | 22.0 | 14.7 | 9.8 |
| **H06** | 18.0 | 16.4 | 15.5 | 10.4 | **S11** | 21.5 | 22.0 | 14.7 | 9.8 |
| **H07** | 21.5 | 22.0 | 14.7 | 9.8 | **S12** | 11.7 | 12.9 | 15.6 | 10.0 |
| **H08** | 21.5 | 22.0 | 14.7 | 9.8 | **S13** | 15.2 | 16.3 | 16.7 | 10.8 |
| **H09** | 21.5 | 22.0 | 14.7 | 9.8 | **E01** | 15.7 | 13.8 | 14.5 | 9.9 |
| **H10** | 21.5 | 22.0 | 14.7 | 9.8 | **E02** | 11.4 | 10.3 | 14.3 | 9.1 |
| **H11** | 21.5 | 22.0 | 14.7 | 9.8 | **E03** | 10.3 | 9.6 | 13.9 | 8.8 |
| **H12** | 21.5 | 22.0 | 14.7 | 9.8 | **E04** | 10.3 | 9.6 | 13.9 | 8.8 |
| **H13** | 21.5 | 22.0 | 14.7 | 9.8 | **E05** | 13.3 | 17.3 | 14.2 | 9.0 |
| **H14** | 21.5 | 22.0 | 14.7 | 9.8 | **E06** | 13.3 | 17.3 | 14.2 | 9.0 |
| **H15** | 21.5 | 22.0 | 14.7 | 9.8 | **E07** | 13.3 | 17.3 | 14.2 | 9.0 |

| Receptor | $NO_x$ | $NO_2$ | $PM_{10}$ | $PM_{2.5}$ | Receptor | $NO_x$ | $NO_2$ | $PM_{10}$ | $PM_{2.5}$ |
|---|---|---|---|---|---|---|---|---|---|
| **H16** | 21.5 | 22.0 | 14.7 | 9.8 | **E08** | 13.3 | 17.3 | 14.2 | 9.0 |
| **H17** | 21.5 | 22.0 | 14.7 | 9.8 | **E09** | 13.3 | 17.3 | 14.2 | 9.0 |
| **H18** | 21.5 | 22.0 | 14.7 | 9.8 | **E10** | 10.4 | 9.7 | 14.3 | 8.8 |
| **H19** | 21.5 | 22.0 | 14.7 | 9.8 | **E11** | 10.4 | 9.7 | 14.3 | 8.8 |
| **H20** | 21.5 | 22.0 | 14.7 | 9.8 | **E12** | 11.5 | 11.9 | 14.4 | 9.0 |
| **H21** | 21.5 | 22.0 | 14.7 | 9.8 | **E13** | 11.5 | 11.9 | 14.4 | 9.0 |
| **H22** | 21.5 | 22.0 | 14.7 | 9.8 | **E14** | 11.5 | 11.9 | 14.4 | 9.0 |
| **H23** | 21.5 | 22.0 | 14.7 | 9.8 | **E15** | 10.6 | 9.9 | 14.1 | 8.9 |
| **H24** | 21.5 | 22.0 | 14.7 | 9.8 | **E16** | 10.6 | 9.9 | 14.1 | 8.9 |
| **H25** | 21.5 | 22.0 | 14.7 | 9.8 | **E17** | 10.6 | 9.9 | 14.1 | 8.9 |
| **H26** | 21.5 | 22.0 | 14.7 | 9.8 | **E18** | 11.4 | 11.0 | 14.2 | 9.0 |
| **H27** | 21.5 | 22.0 | 14.7 | 9.8 | **E19** | 12.8 | 12.1 | 14.3 | 9.2 |
| **H28** | 21.5 | 22.0 | 14.7 | 9.8 | **E20** | 12.8 | 12.1 | 14.3 | 9.2 |
| **H29** | 15.7 | 13.8 | 14.5 | 9.9 | **E21** | 11.3 | 10.3 | 13.6 | 8.9 |
| **H30** | 15.7 | 13.8 | 14.5 | 9.9 | **E22** | 11.1 | 10.4 | 14.0 | 9.0 |
| **H31** | 15.7 | 13.8 | 14.5 | 9.9 | **E23** | 10.3 | 14.9 | 16.4 | 10.1 |
| **H32** | 15.7 | 13.8 | 14.5 | 9.9 | **E24** | 9.8 | 13.2 | 16.4 | 10.0 |
| **H33** | 15.7 | 13.8 | 14.5 | 9.9 | **E25** | 10.3 | 14.9 | 16.4 | 10.1 |
| **H34** | 15.7 | 13.8 | 14.5 | 9.9 | **E26** | 9.9 | 9.2 | 14.0 | 8.9 |
| **H35** | 15.7 | 13.8 | 14.5 | 9.9 | **E27** | 17.0 | 15.8 | 15.1 | 9.9 |
| **H36** | 15.7 | 13.8 | 14.5 | 9.9 | **E28** | 13.3 | 12.2 | 14.8 | 9.4 |
| **H37** | 15.7 | 13.8 | 14.5 | 9.9 | **E29** | 13.3 | 12.2 | 14.8 | 9.4 |
| **H38** | 15.0 | 14.0 | 14.0 | 9.5 | **E30** | 11.4 | 12.2 | 15.3 | 9.6 |
| **H39** | 15.0 | 14.0 | 14.0 | 9.5 | **E31** | 17.0 | 15.8 | 15.1 | 9.9 |
| **H40** | 15.0 | 14.0 | 14.0 | 9.5 | **E32** | 17.0 | 15.8 | 15.1 | 9.9 |
| **H41** | 15.0 | 14.0 | 14.0 | 9.5 | **E33** | 17.0 | 15.8 | 15.1 | 9.9 |
| **H42** | 15.0 | 14.0 | 14.0 | 9.5 | **E34** | 17.0 | 15.8 | 15.1 | 9.9 |
| **H43** | 15.0 | 14.0 | 14.0 | 9.5 | **E35** | 17.0 | 15.8 | 15.1 | 9.9 |
| **H44** | 15.0 | 14.0 | 14.0 | 9.5 | **E36** | 17.0 | 15.8 | 15.1 | 9.9 |
| **H45** | 15.0 | 14.0 | 14.0 | 9.5 | **E37** | 11.4 | 12.2 | 15.3 | 9.6 |

| Receptor | $NO_x$ | $NO_2$ | $PM_{10}$ | $PM_{2.5}$ | Receptor | $NO_x$ | $NO_2$ | $PM_{10}$ | $PM_{2.5}$ |
|---|---|---|---|---|---|---|---|---|---|
| **H46** | 15.0 | 14.0 | 14.0 | 9.5 | **E38** | 11.4 | 12.2 | 15.3 | 9.6 |
| **H47** | 15.0 | 14.0 | 14.0 | 9.5 | **E39** | 17.0 | 15.8 | 15.1 | 9.9 |
| **H48** | 15.0 | 14.0 | 14.0 | 9.5 | **E40** | 17.0 | 15.8 | 15.1 | 9.9 |
| **H49** | 15.0 | 14.0 | 14.0 | 9.5 | **E41** | 17.0 | 15.8 | 15.1 | 9.9 |
| **H50** | 15.0 | 14.0 | 14.0 | 9.5 | **E42** | 17.0 | 15.8 | 15.1 | 9.9 |
| **H51** | 15.0 | 14.0 | 14.0 | 9.5 | **E43** | 17.0 | 15.8 | 15.1 | 9.9 |
| **H52** | 15.0 | 14.0 | 14.0 | 9.5 | **E44** | 17.0 | 15.8 | 15.1 | 9.9 |
| **H53** | 15.0 | 14.0 | 14.0 | 9.5 | **E45** | 17.0 | 15.8 | 15.1 | 9.9 |
| **H54** | 15.0 | 14.0 | 14.0 | 9.5 | **E46** | 17.0 | 15.8 | 15.1 | 9.9 |
| **H55** | 15.0 | 14.0 | 14.0 | 9.5 | **M01** | 20.8 | 17.5 | 16.2 | 10.8 |
| **H56** | 15.0 | 14.0 | 14.0 | 9.5 | **M02** | 21.5 | 22.0 | 14.7 | 9.8 |
| **H57** | 15.0 | 14.0 | 14.0 | 9.5 | **M03** | 15.2 | 16.3 | 16.7 | 10.8 |
| **H58** | 15.0 | 14.0 | 14.0 | 9.5 | **M04** | 15.2 | 16.3 | 16.7 | 10.8 |
| **H59** | 15.0 | 14.0 | 14.0 | 9.5 | **M05** | 15.2 | 16.3 | 16.7 | 10.8 |
| **H60** | 15.0 | 14.0 | 14.0 | 9.5 | **M06** | 15.2 | 16.3 | 16.7 | 10.8 |
| **H61** | 12.4 | 12.5 | 14.5 | 9.1 | **M07** | 14.3 | 14.6 | 16.8 | 10.9 |
| **H62** | 12.4 | 12.5 | 14.5 | 9.1 | **M08** | 21.5 | 22.0 | 14.7 | 9.8 |
| **H63** | 11.1 | 11.0 | 14.5 | 9.0 | **M09** | 21.5 | 22.0 | 14.7 | 9.8 |
| **H64** | 11.1 | 11.0 | 14.5 | 9.0 | **M10** | 15.7 | 13.8 | 14.5 | 9.9 |
| **H65** | 11.1 | 11.0 | 14.5 | 9.0 | **M11** | 15.7 | 13.8 | 14.5 | 9.9 |
| **H66** | 10.9 | 11.1 | 14.6 | 9.0 | **M12** | 15.0 | 14.0 | 14.0 | 9.5 |
| **H67** | 10.9 | 11.1 | 14.6 | 9.0 | **M13** | 15.0 | 14.0 | 14.0 | 9.5 |
| **H68** | 13.3 | 17.3 | 14.2 | 9.0 | **M14** | 11.3 | 13.7 | 16.7 | 10.4 |
| **H69** | 13.3 | 17.3 | 14.2 | 9.0 | **M15** | 11.3 | 13.7 | 16.7 | 10.4 |
| **H70** | 10.4 | 9.7 | 14.3 | 8.8 | **M16** | 11.3 | 13.7 | 16.7 | 10.4 |
| **H71** | 10.4 | 9.7 | 14.3 | 8.8 | **M17** | 11.3 | 13.7 | 16.7 | 10.4 |
| **H72** | 10.4 | 9.7 | 14.3 | 8.8 | **M18** | 11.3 | 13.7 | 16.7 | 10.4 |
| **H73** | 10.1 | 9.1 | 14.6 | 8.9 | **M19** | 14.3 | 14.6 | 16.8 | 10.9 |
| **H74** | 10.1 | 9.1 | 14.6 | 8.9 | **M20** | 13.9 | 12.8 | 16.2 | 10.6 |
| **H75** | 10.6 | 9.9 | 14.1 | 8.9 | **M21** | 14.3 | 14.6 | 16.8 | 10.9 |

| Receptor | $NO_x$ | $NO_2$ | $PM_{10}$ | $PM_{2.5}$ | Receptor | $NO_x$ | $NO_2$ | $PM_{10}$ | $PM_{2.5}$ |
|---|---|---|---|---|---|---|---|---|---|
| **H76** | 11.5 | 11.9 | 14.4 | 9.0 | **M22** | 14.3 | 14.6 | 16.8 | 10.9 |
| **H77** | 11.5 | 11.9 | 14.4 | 9.0 | **M23** | 15.2 | 16.3 | 16.7 | 10.8 |
| **H78** | 13.8 | 17.5 | 13.8 | 8.9 | **M24** | 15.2 | 16.3 | 16.7 | 10.8 |
| **H79** | 11.4 | 11.0 | 14.2 | 9.0 | **M25** | 21.5 | 22.0 | 14.7 | 9.8 |
| **H80** | 15.5 | 18.7 | 14.5 | 9.4 | **M26** | 15.5 | 18.7 | 14.5 | 9.4 |
| **H81** | 15.5 | 18.7 | 14.5 | 9.4 | **M27** | 15.5 | 18.7 | 14.5 | 9.4 |
| **H82** | 13.9 | 12.8 | 16.2 | 10.6 | **M28** | 13.3 | 17.3 | 14.2 | 9.0 |
| **H83** | 14.3 | 14.6 | 16.8 | 10.9 | **M29** | 21.5 | 22.0 | 14.7 | 9.8 |
| **H84** | 14.3 | 14.6 | 16.8 | 10.9 | **M30** | 21.5 | 22.0 | 14.7 | 9.8 |
| **H85** | 14.3 | 14.6 | 16.8 | 10.9 | **M31** | 15.7 | 19.3 | 14.3 | 9.2 |
| **H86** | 15.2 | 16.3 | 16.7 | 10.8 | **M32** | 21.5 | 22.0 | 14.7 | 9.8 |
| **H87** | 15.2 | 16.3 | 16.7 | 10.8 | **M33** | 9.6 | 8.4 | 14.1 | 8.7 |
| **H88** | 12.6 | 15.7 | 16.5 | 10.5 | **M34** | 10.1 | 9.6 | 14.6 | 9.1 |
| **H89** | 12.6 | 15.7 | 16.5 | 10.5 | **M35** | 11.5 | 11.9 | 14.4 | 9.0 |
| **H90** | 12.4 | 15.2 | 16.7 | 10.5 | **M36** | 21.5 | 22.0 | 14.7 | 9.8 |
| **H91** | 11.1 | 17.4 | 16.7 | 10.3 | **M37** | 15.7 | 13.8 | 14.5 | 9.9 |
| **H92** | 10.3 | 14.9 | 16.4 | 10.1 | **M38** | 21.5 | 22.0 | 14.7 | 9.8 |
| **H93** | 9.8 | 14.0 | 16.6 | 10.0 | **M39** | 21.5 | 22.0 | 14.7 | 9.8 |
| **H94** | 18.0 | 16.4 | 15.5 | 10.4 | **M40** | 15.7 | 19.3 | 14.3 | 9.2 |
| **H95** | 18.0 | 16.4 | 15.5 | 10.4 | **M41** | 17.0 | 15.8 | 15.1 | 9.9 |
| **H96** | 18.0 | 16.4 | 15.5 | 10.4 | **M42** | 18.0 | 16.4 | 15.5 | 10.4 |
| **H97** | 18.0 | 16.4 | 15.5 | 10.4 | **M43** | 21.5 | 22.0 | 14.7 | 9.8 |
| **H98** | 14.3 | 14.6 | 16.8 | 10.9 | **M44** | 15.7 | 19.3 | 14.3 | 9.2 |
| **H99** | 17.9 | 15.0 | 15.4 | 10.4 | **M45** | 21.5 | 22.0 | 14.7 | 9.8 |
| **S01** | 18.0 | 16.4 | 15.5 | 10.4 | **M46** | 10.1 | 9.3 | 15.1 | 9.0 |
| **S02** | 18.0 | 16.4 | 15.5 | 10.4 | **M47** | 9.5 | 7.9 | 13.7 | 8.7 |
| **S03** | 15.5 | 18.7 | 14.5 | 9.4 | **M48** | 15.7 | 19.3 | 14.3 | 9.2 |
| **S04** | 15.5 | 18.7 | 14.5 | 9.4 | **M49** | 15.0 | 14.0 | 14.0 | 9.5 |
| **S05** | 15.5 | 18.7 | 14.5 | 9.4 | | | | | |

Table 6B.2 Background deposition rates assumed for this assessment

| Receptor | N deposition (kg N $ha^{-1}$ $y^{-1}$) | N component of acid deposition (keq $ha^{-1}$ $y^{-1}$) | S component of acid deposition (keq $ha^{-1}$ $y^{-1}$) | Feature |
|---|---|---|---|---|
| **E01** | 31.08 | 2.22 | 0.22 | Broadleaved deciduous woodland |
| **E02** | 31.08 | 2.22 | 0.22 | Broadleaved deciduous woodland |
| **E03** | 29.40 | 2.10 | 0.18 | Broadleaved deciduous woodland |
| **E04** | 29.40 | 2.10 | 0.18 | Broadleaved deciduous woodland |
| **E05** | 31.08 | 2.22 | 0.22 | Broadleaved deciduous woodland |
| **E06** | 31.08 | 2.22 | 0.22 | Broadleaved deciduous woodland |
| **E07** | 31.08 | 2.22 | 0.22 | Broadleaved deciduous woodland |
| **E08** | 31.08 | 2.22 | 0.22 | Broadleaved deciduous woodland |
| **E09** | 31.08 | 2.22 | 0.22 | Broadleaved deciduous woodland |
| **E10** | 31.08 | 2.22 | 0.22 | Broadleaved deciduous woodland |
| **E11** | 31.08 | 2.22 | 0.22 | Broadleaved deciduous woodland |
| **E12** | 31.08 | 2.22 | 0.22 | Broadleaved deciduous woodland |
| **E13** | 31.08 | 2.22 | 0.22 | Broadleaved deciduous woodland |
| **E14** | 31.08 | 2.22 | 0.22 | Broadleaved deciduous woodland |
| **E15** | 30.80 | 2.20 | 0.19 | Broadleaved deciduous woodland |
| **E16** | 30.80 | 2.20 | 0.19 | Broadleaved deciduous woodland |
| **E17** | 30.80 | 2.20 | 0.19 | Broadleaved deciduous woodland |
| **E18** | 30.80 | 2.20 | 0.19 | Broadleaved deciduous woodland |
| **E19** | 30.80 | 2.20 | 0.19 | Broadleaved deciduous woodland |
| **E20** | 30.80 | 2.20 | 0.19 | Broadleaved deciduous woodland |
| **E21** | 30.80 | 2.20 | 0.19 | Broadleaved deciduous woodland |
| **E22** | 30.80 | 2.20 | 0.19 | Broadleaved deciduous woodland |
| **E23** | 32.20 | 2.30 | 0.20 | Broadleaved deciduous woodland |
| **E24** | 32.20 | 2.30 | 0.20 | Broadleaved deciduous woodland |
| **E25** | 32.20 | 2.30 | 0.20 | Broadleaved deciduous woodland |
| **E26** | 32.20 | 2.30 | 0.20 | Broadleaved deciduous woodland |
| **E27** | 32.20 | 2.30 | 0.20 | Broadleaved deciduous woodland |
| **E28** | 30.80 | 2.20 | 0.19 | Broadleaved deciduous woodland |

| Receptor | N deposition (kg N $ha^{-1}$ $y^{-1}$) | N component of acid deposition (keq $ha^{-1}$ $y^{-1}$) | S component of acid deposition (keq $ha^{-1}$ $y^{-1}$) | Feature |
|---|---|---|---|---|
| **E29** | 30.80 | 2.20 | 0.19 | Broadleaved deciduous woodland |
| **E30** | 32.20 | 2.30 | 0.20 | Broadleaved deciduous woodland |
| **E31** | 32.20 | 2.30 | 0.20 | Broadleaved deciduous woodland |
| **E32** | 32.20 | 2.30 | 0.20 | Broadleaved deciduous woodland |
| **E33** | 32.20 | 2.30 | 0.20 | Broadleaved deciduous woodland |
| **E34** | 32.20 | 2.30 | 0.20 | Broadleaved deciduous woodland |
| **E35** | 32.20 | 2.30 | 0.20 | Broadleaved deciduous woodland |
| **E36** | 32.20 | 2.30 | 0.20 | Broadleaved deciduous woodland |
| **E37** | 32.20 | 2.30 | 0.20 | Broadleaved deciduous woodland |
| **E38** | 32.20 | 2.30 | 0.20 | Broadleaved deciduous woodland |
| **E39** | 32.20 | 2.30 | 0.20 | Broadleaved deciduous woodland |
| **E40** | 32.20 | 2.30 | 0.20 | Broadleaved deciduous woodland |
| **E41** | 32.20 | 2.30 | 0.20 | Broadleaved deciduous woodland |
| **E42** | 32.20 | 2.30 | 0.20 | Broadleaved deciduous woodland |
| **E43** | 32.20 | 2.30 | 0.20 | Broadleaved deciduous woodland |
| **E44** | 32.20 | 2.30 | 0.20 | Broadleaved deciduous woodland |
| **E45** | 32.20 | 2.30 | 0.20 | Broadleaved deciduous woodland |
| **E46** | 32.20 | 2.30 | 0.20 | Broadleaved deciduous woodland |

# Appendix 6C
# Air quality - Receptor locations

The list of human receptors is given in **Table 6C.1** and illustrated in **Figure 6C.1** to **Figure 6C.3**. Note that the descriptions are intended as an indication of the location of the receptor, rather than a precise address. Where there are a number of receptors along a road, these are distinguished with a reference number (not to be confused with the property's door number).

Table 6C.1 Human receptors used in modelling

| Receptor ID | Description | Easting (m) | Northing (m) | Height (m) |
|---|---|---|---|---|
| **H01** | Newlands Farm | 509116 | 218684 | 1.6 |
| **H02** | London Road | 509192 | 219354 | 1.6 |
| **H03** | Ludlow Avenue | 509302 | 219411 | 1.6 |
| **H04** | Ludlow Avenue | 509334 | 219426 | 1.6 |
| **H05** | Park Street | 510054 | 220265 | 1.6 |
| **H06** | Luton Hoo Lodge | 510193 | 220093 | 1.6 |
| **H07** | Harrowden | 511042 | 221642 | 1.6 |
| **H08** | Harrowden | 511006 | 221687 | 1.6 |
| **H09** | Eaton Green Road | 511121 | 221722 | 1.6 |
| **H10** | Eaton Green Road | 511169 | 221741 | 1.6 |
| **H11** | Eaton Green Road | 511302 | 221803 | 1.6 |
| **H12** | Eaton Green Road | 511318 | 221811 | 1.6 |
| **H13** | Eaton Green Road | 511333 | 221818 | 1.6 |
| **H14** | Eaton Green Road | 511357 | 221831 | 1.6 |
| **H15** | Eaton Green Road | 511383 | 221838 | 1.6 |
| **H16** | Eaton Green Road | 511408 | 221840 | 1.6 |
| **H17** | Eaton Green Road | 511437 | 221853 | 1.6 |
| **H18** | Eaton Green Road | 511465 | 221860 | 1.6 |
| **H19** | Eaton Green Road | 511497 | 221866 | 1.6 |
| **H20** | Eaton Green Road | 511523 | 221886 | 1.6 |
| **H21** | Eaton Green Road | 511568 | 221886 | 1.6 |
| **H22** | Eaton Green Road | 511611 | 221906 | 1.6 |
| **H23** | Eaton Green Road | 511630 | 221922 | 1.6 |

| Receptor ID | Description | Easting (m) | Northing (m) | Height (m) |
|---|---|---|---|---|
| **H24** | Eaton Green Road | 511639 | 221933 | 1.6 |
| **H25** | Eaton Green Road | 511659 | 221954 | 1.6 |
| **H26** | Eaton Green Road | 511671 | 221964 | 1.6 |
| **H27** | Eaton Green Road | 511688 | 221977 | 1.6 |
| **H28** | Eaton Green Road | 511720 | 221996 | 1.6 |
| **H29** | Eaton Green Road | 511738 | 222005 | 1.6 |
| **H30** | Eaton Green Road | 511759 | 222009 | 1.6 |
| **H31** | Eaton Green Road | 511779 | 222014 | 1.6 |
| **H32** | Eaton Green Road | 511878 | 222073 | 1.6 |
| **H33** | Eaton Green Road | 511894 | 222093 | 1.6 |
| **H34** | Eaton Green Road | 511907 | 222102 | 1.6 |
| **H35** | Eaton Green Road | 511930 | 222108 | 1.6 |
| **H36** | Eaton Green Road | 511965 | 222110 | 1.6 |
| **H37** | Eaton Green Road | 511986 | 222121 | 1.6 |
| **H38** | Eaton Green Road | 512001 | 222140 | 1.6 |
| **H39** | Eaton Green Road | 512028 | 222144 | 1.6 |
| **H40** | Eaton Green Road | 512042 | 222160 | 1.6 |
| **H41** | Eaton Green Road | 512055 | 222165 | 1.6 |
| **H42** | Eaton Green Road | 512075 | 222171 | 1.6 |
| **H43** | Eaton Green Road | 512090 | 222204 | 1.6 |
| **H44** | Eaton Green Road | 512130 | 222203 | 1.6 |
| **H45** | Eaton Green Road | 512152 | 222236 | 1.6 |
| **H46** | Eaton Green Road | 512388 | 222274 | 1.6 |
| **H47** | Eaton Green Road | 512437 | 222280 | 1.6 |
| **H48** | Eaton Green Road | 512456 | 222277 | 1.6 |
| **H49** | Eaton Green Road | 512503 | 222285 | 1.6 |
| **H50** | Eaton Green Road | 512522 | 222281 | 1.6 |
| **H51** | Eaton Green Road | 512541 | 222279 | 1.6 |
| **H52** | Eaton Green Road | 512601 | 222284 | 1.6 |
| **H53** | Eaton Green Road | 512667 | 222285 | 1.6 |

| Receptor ID | Description | Easting (m) | Northing (m) | Height (m) |
|---|---|---|---|---|
| **H54** | Eaton Green Road | 512701 | 222284 | 1.6 |
| **H55** | Eaton Green Road | 512767 | 222296 | 1.6 |
| **H56** | Eaton Green Road | 512824 | 222284 | 1.6 |
| **H57** | Eaton Green Road | 512880 | 222275 | 1.6 |
| **H58** | Eaton Green Road | 512924 | 222277 | 1.6 |
| **H59** | Wigmore Valley Park | 512444 | 222119 | 1.6 |
| **H60** | Allotments | 512586 | 222195 | 1.6 |
| **H61** | Wanden End Farm | 513307 | 222443 | 1.6 |
| **H62** | Green Acres | 513592 | 222328 | 1.6 |
| **H63** | Darleyhall | 514089 | 222461 | 1.6 |
| **H64** | Brownings Lane | 514664 | 222296 | 1.6 |
| **H65** | Medlow House | 514760 | 222131 | 1.6 |
| **H66** | Chapel Road | 514998 | 221902 | 1.6 |
| **H67** | Lye Hill | 514757 | 221356 | 1.6 |
| **H68** | Old Winch Hill Cottage | 513663 | 221942 | 1.6 |
| **H69** | Winch Hill House | 513746 | 221612 | 1.6 |
| **H70** | Diamond End | 514312 | 220788 | 1.6 |
| **H71** | Wandon Green Farm | 514611 | 220436 | 1.6 |
| **H72** | Wandon Green Cottages | 514715 | 220085 | 1.6 |
| **H73** | Rudwick Hall | 514902 | 219845 | 1.6 |
| **H74** | Lawrence End | 514226 | 219800 | 1.6 |
| **H75** | Forge Cottage | 513465 | 219599 | 1.6 |
| **H76** | Dane Street Farm | 513307 | 220740 | 1.6 |
| **H77** | Dane Street Cottages | 513137 | 220701 | 1.6 |
| **H78** | Chiltern Hall | 512971 | 220532 | 1.6 |
| **H79** | Copt Hall Cottages | 512415 | 219924 | 1.6 |
| **H80** | Someries Farm | 511988 | 220186 | 1.6 |
| **H81** | Someries Farm | 511911 | 220263 | 1.6 |
| **H82** | M1 North | 504715 | 223794 | 1.6 |
| **H83** | MI North | 505144 | 223587 | 1.6 |

| Receptor ID | Description | Easting (m) | Northing (m) | Height (m) |
|---|---|---|---|---|
| **H84** | M1 North | 505175 | 223359 | 1.6 |
| **H85** | M1 North | 505271 | 223161 | 1.6 |
| **H86** | MI North | 505328 | 222603 | 1.6 |
| **H87** | MI North | 505461 | 222320 | 1.6 |
| **H88** | MI North, Foxdell Junior School | 506173 | 221853 | 1.6 |
| **H89** | M1-New Airport Way | 506488 | 221503 | 1.6 |
| **H90** | M1-New Airport Way | 507591 | 220305 | 1.6 |
| **H91** | M1 North | 508258 | 218551 | 1.6 |
| **H92** | M1 South, Pepsalerd Farm | 508642 | 217125 | 1.6 |
| **H93** | M1 South, Hill and Coles Farm | 509009 | 215558 | 1.6 |
| **H94** | Kimpton Road (North-west) | 510327 | 220830 | 1.6 |
| **H95** | Kimpton Road (South-East) | 510545 | 220686 | 1.6 |
| **H96** | Future receptor at Kimpton Rd | 510555 | 220719 | 1.6 |
| **H97** | Future receptor at Kimpton Rd | 510498 | 220756 | 1.6 |
| **H98** | Challney School | 505394 | 223189 | 1.6 |
| **H99** | AQMA | 509399.9972 | 220896.8882 | 1.6 |
| **S01** | Sports Centre | 510439 | 220290 | 1.6 |
| **S02** | Sea Cadets | 510797 | 220162 | 1.6 |
| **S03** | Marriott | 511316 | 220767 | 1.6 |
| **S04** | Ibis | 511351 | 220805 | 1.6 |
| **S05** | Holiday Inn | 511384 | 220980 | 1.6 |
| **S06** | Ibis | 511455 | 221018 | 1.6 |
| **S07** | Holiday Inn | 511557 | 221036 | 1.6 |
| **S08** | Holiday Inn | 511571 | 221004 | 1.6 |
| **S09** | Holiday Inn | 511628 | 221030 | 1.6 |
| **S10** | Holiday Inn | 511621 | 221045 | 1.6 |
| **S11** | Holiday Inn | 511572 | 221043 | 1.6 |
| **S12** | M1, Luton Rugby Football club | 508203 | 219281 | 1.6 |
| **S13** | M1 North (sport center) | 505506 | 222929 | 1.6 |

Figure 6C.1 Human receptors used in modelling — all receptors

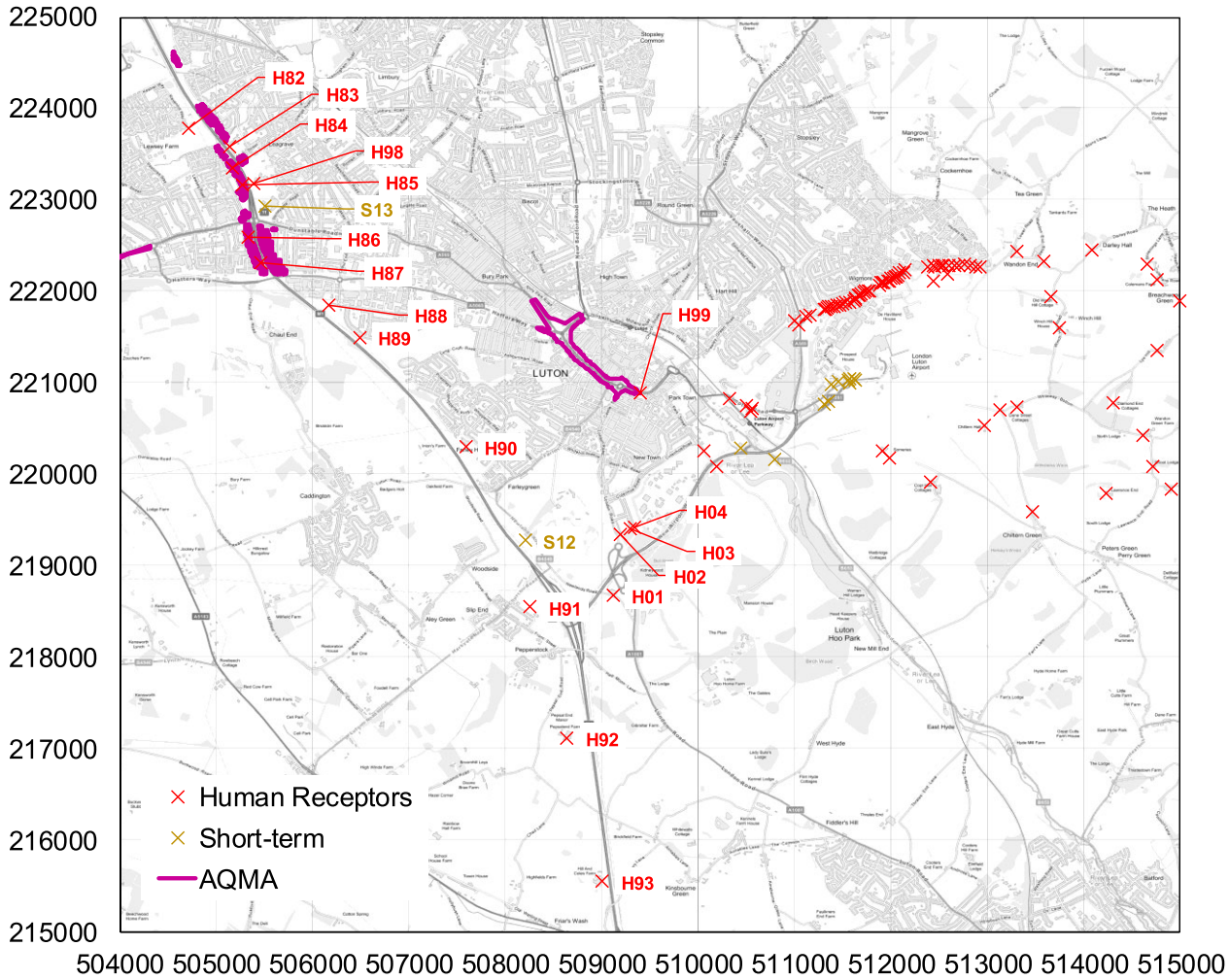


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Figure 6C.2 Human receptors used in modelling — near Luton Airport

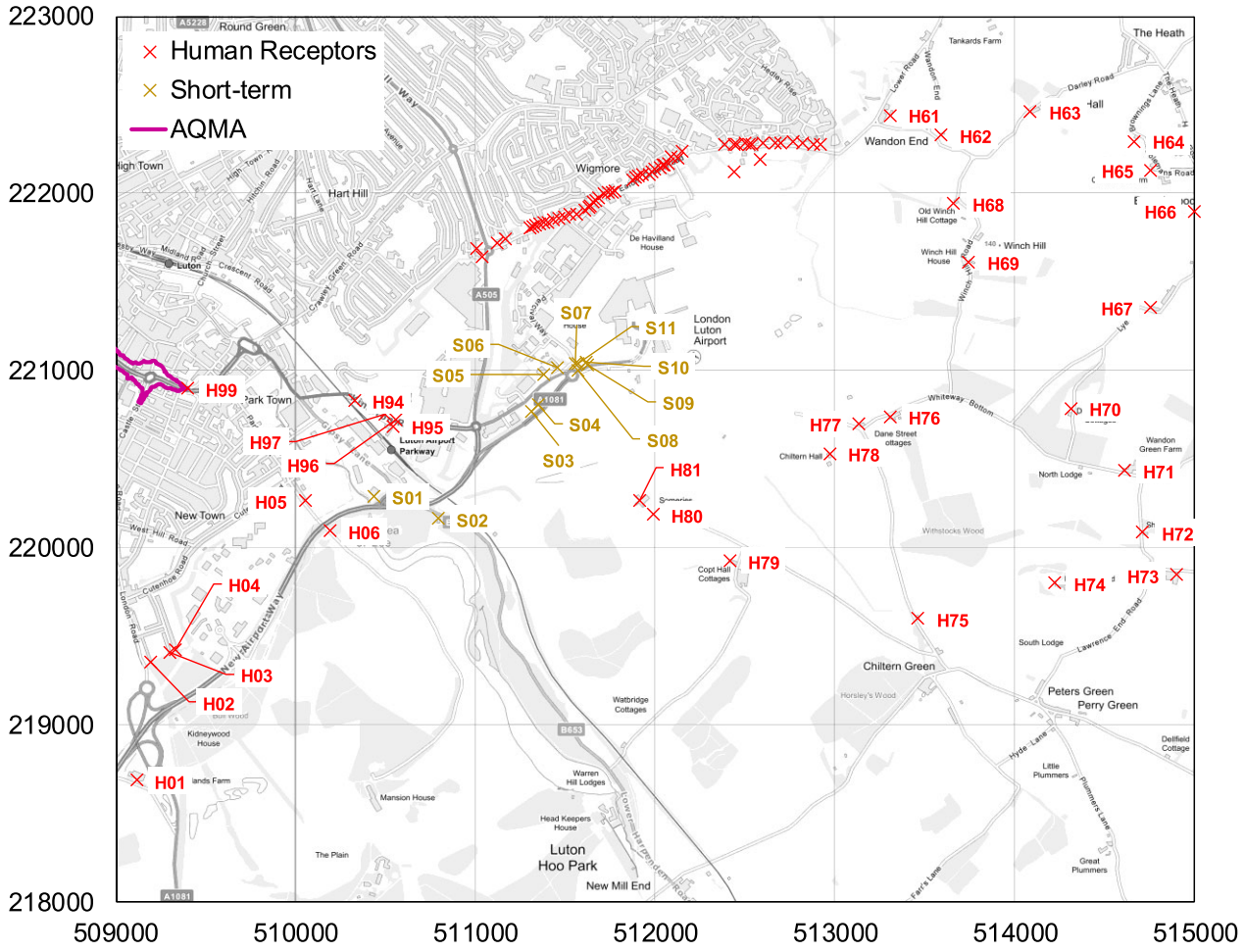


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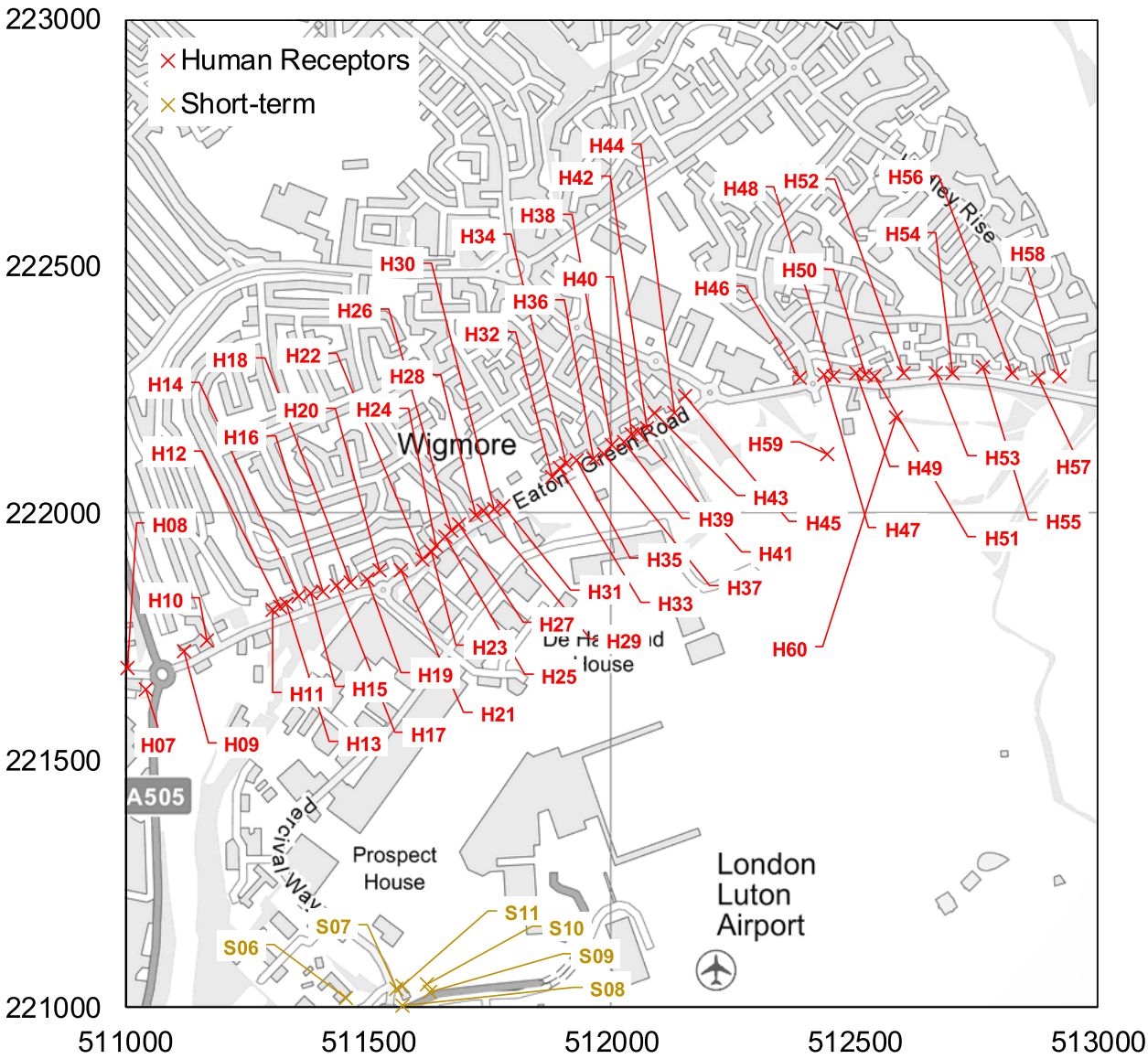
Figure 6C.3 Human receptors used in modelling — Eaton Green Road

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The list of ecological receptors is given in **Table 6C.2** and shown in **Figure 6C.4**

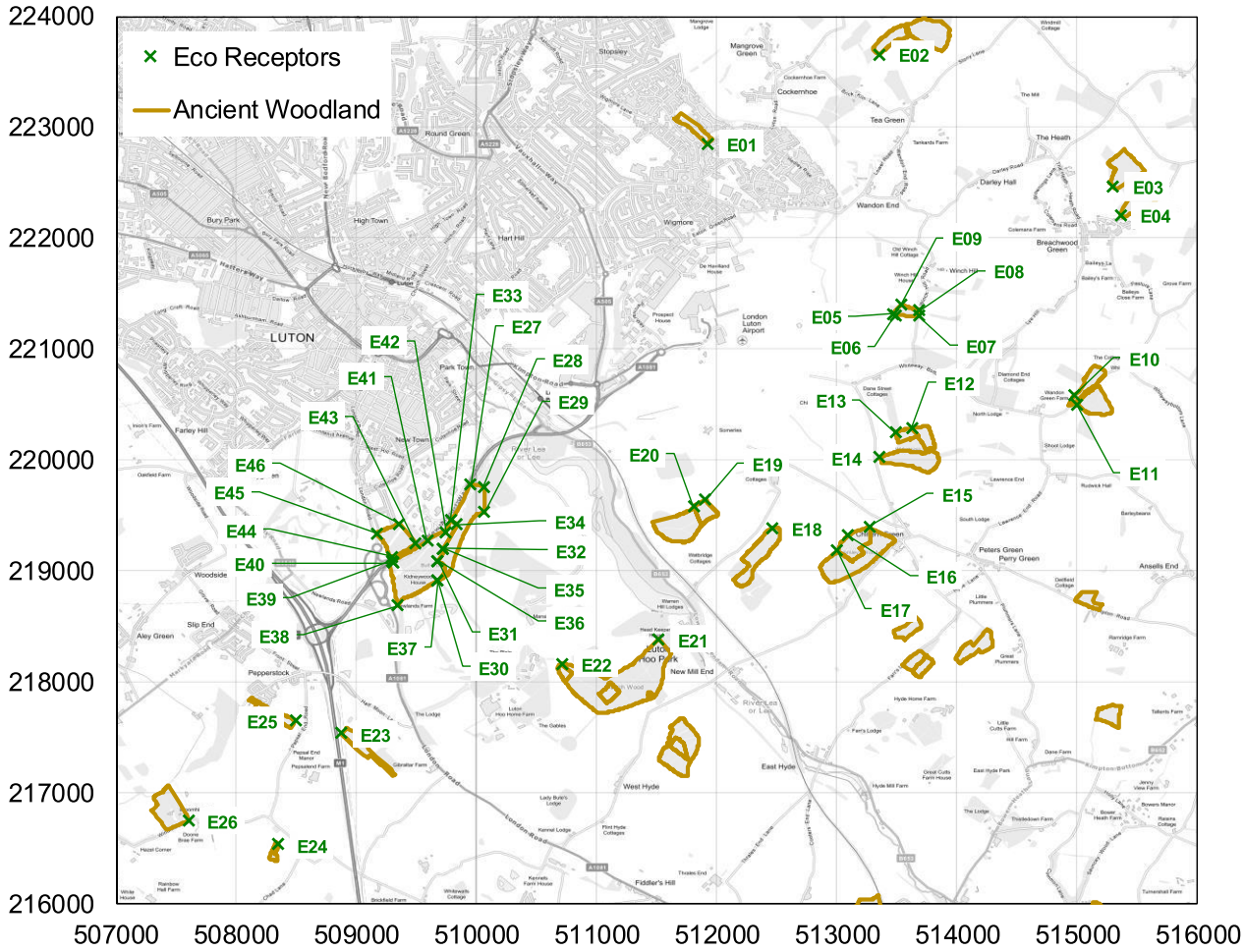
Table 6C.2 Ecological receptors used in modelling

| Receptor ID | Description | Easting (m) | Northing (m) | Height (m) |
|---|---|---|---|---|
| **E01** | Slaughter's Wood | 511925 | 222851 | 0 |
| **E02** | Stubbocks Wood | 513354 | 223659 | 0 |
| **E03** | Watkin's Wood | 515302 | 222468 | 0 |
| **E04** | Lord's Wood | 515363 | 222210 | 0 |
| **E05** | Winchill Wood | 513465 | 221316 | 0 |

| Receptor ID | Description | Easting (m) | Northing (m) | Height (m) |
|---|---|---|---|---|
| **E06** | Winchill Wood | 513488 | 221305 | 0 |
| **E07** | Winchill Wood | 513685 | 221298 | 0 |
| **E08** | Winchill Wood | 513688 | 221347 | 0 |
| **E09** | Winchill Wood | 513535 | 221399 | 0 |
| **E10** | Sewett's Wood | 514982 | 220590 | 0 |
| **E11** | Hurst Wood | 514996 | 220500 | 0 |
| **E12** | Withstocks Wood | 513625 | 220289 | 0 |
| **E13** | Withstocks Wood | 513488 | 220248 | 0 |
| **E14** | Withstocks Wood | 513355 | 220022 | 0 |
| **E15** | Horsley's Wood | 513273 | 219400 | 0 |
| **E16** | Horsley's Wood | 513095 | 219322 | 0 |
| **E17** | Horsley's Wood | 513003 | 219185 | 0 |
| **E18** | Hardingdell Wood | 512464 | 219388 | 0 |
| **E19** | George Wood | 511908 | 219642 | 0 |
| **E20** | George Wood | 511812 | 219581 | 0 |
| **E21** | Birch Wood | 511518 | 218384 | 0 |
| **E22** | Birch Wood | 510714 | 218165 | 0 |
| **E23** | Chalk Wood | 508876 | 217534 | 0 |
| **E24** | Cockrums | 508350 | 216533 | 0 |
| **E25** | Birchin Grove | 508494 | 217655 | 0 |
| **E26** | Broomhill Lets Wood | 507602 | 216752 | 0 |
| **E27** | Kidney and Bulls Woods | 509950 | 219779 | 0 |
| **E28** | Kidney and Bulls Woods | 510062 | 219756 | 0 |
| **E29** | Kidney and Bulls Woods | 510064 | 219528 | 0 |
| **E30** | Kidney and Bulls Woods | 509676 | 218908 | 0 |
| **E31** | Kidney and Bulls Woods | 509680 | 219089 | 0 |
| **E32** | Kidney and Bulls Woods | 509724 | 219203 | 0 |
| **E33** | Kidney and Bulls Woods | 509788 | 219454 | 0 |
| **E34** | Kidney and Bulls Woods | 509838 | 219418 | 0 |
| **E35** | Kidney and Bulls Woods | 509724 | 219203 | 0 |

| Receptor ID | Description | Easting (m) | Northing (m) | Height (m) |
|---|---|---|---|---|
| **E36** | Kidney and Bulls Woods | 509680 | 219089 | 0 |
| **E37** | Kidney and Bulls Woods | 509676 | 218908 | 0 |
| **E38** | Kidney and Bulls Woods | 509344 | 218686 | 0 |
| **E39** | Kidney and Bulls Woods (on carriageway; use E40) | 509297 | 219090 | 0 |
| **E40** | Kidney and Bulls Woods | 509307 | 219073 | 0 |
| **E41** | Kidney and Bulls Woods | 509589 | 219269 | 0 |
| **E42** | Kidney and Bulls Woods | 509744 | 219350 | 0 |
| **E43** | Kidney and Bulls Woods | 509493 | 219245 | 0 |
| **E44** | Kidney and Bulls Woods | 509298 | 219125 | 0 |
| **E45** | Kidney and Bulls Woods | 509168 | 219339 | 0 |
| **E46** | Kidney and Bulls Woods | 509357 | 219423 | 0 |

Figure 6C.4 Ecological receptors used in modelling

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# Appendix 6D
# Air quality - Detailed assessment methodology

## Study area

As detailed in **Section 6.4** of **Chapter 6** in **Volume 2: ES**, all receptors where there is a potentially significant impact from the Proposed Scheme have been modelled. A selection of receptors have been modelled individually in order to present detailed results at key locations. In addition, a 16 km × 9 km grid of receptors covering the whole of the Luton urban area was modelled, both to ensure that impacts on the wider population were addressed and to prepare contour plots which are a useful visual aid. For example, the monetisation of the impacts (**Section 6.10**) uses the gridded change in concentrations of pollutants across the whole of the 16 km × 9 km area.

All airport, road and background sources have been modelled. As is detailed below, road traffic has been modelled differently for road links with and without a significant amount of airport-related traffic. Roads with a significant amount of airport-related traffic have been modelled explicitly in ADMS-Roads, which provides accurate results close to the roads, where concentrations change quickly with distance from the road. A number of major roads without a significant amount of airport-related traffic have also been modelled explicitly in ADMS-Roads, using traffic flows from DfT count data uplifted by Tempro factors to 2024. Other roads without a significant amount of airport-related traffic have been modelled through the use of the Defra background maps, which includes the contribution from roads in each 1 km grid square. This means that contour plots clearly show some roads (those modelled explicitly) but not others. For this reason, contour plots should not be used to read concentrations in the town centre urban area. The contribution from LLA is very small at these locations since the vast majority of airport-related traffic does not pass through the town centre.

## Approach to air quality modelling

There are two principal sets of recommendations for undertaking an airport air quality study. The first arises from the Project for the Sustainable Development of Heathrow (PSDH)[11], a programme run by the DfT during 2005 – 2007, the objective of which was to develop the best practical methodology for assessing the air quality impacts of a third runway at Heathrow. This produced a number of specific recommendations; however, it contains significant omissions where the best approach depends on data availability. For example, PSDH does not make any recommendations about how to determine how long aircraft spend operating in various modes as there are various potential data sources, and it is left to the analyst to use their judgement as to the best way of extracting suitable operating durations. Few of the PSDH recommendations are specific to Heathrow and the methodology can be used for other airports of comparable size with similar aircraft types.

[11] Department for Transport (no date). Project for the Sustainable Development of Heathrow - Report of the Air Quality Technical Panels, [online]. Available at: http://webarchive.nationalarchives.gov.uk/20080306053058/http://www.dft.gov.uk/print_view/3b723f5b612c85bc79a526ca27c9d370 [Checked 22/03/2018].

The PSDH methodology was implemented by Heathrow Airport for its 2008/9 emissions inventory, modelling study and model evaluation study[12,13,14]. The reports give a detailed description of the methodology used and form a useful reference. The model evaluation found that it gave a generally good agreement with the extensive monitoring data around Heathrow and formed a suitable basis for evaluating the impacts of future airport developments there. Subsequent Heathrow inventories (e.g. Ricardo-AEA[15]) have used essentially the same methodology, with some updates where new airport-specific data has become available (e.g. for aircraft taxiing times).

The second methodology was published by the International Civil Aviation Organization (ICAO) in 2011[16]. This document deals with producing emission inventories for historic years, with very little attention paid to how inventories for future years might be produced. As such it is less directly relevant to the present work for the Proposed Scheme.

The ICAO methodology offers different levels of assessment, described as 'simple', 'advanced' and 'sophisticated', each requiring increasingly detailed data. The sophisticated approach generally requires detailed data on times, engine settings and so forth for each individual aircraft movement, so it is unsuitable for modelling future cases. The advanced approach is similar to the PSDH recommendations in terms of data requirements and can generally be adapted to future cases given suitable forecast data.

Much of the detail of the methodology is the same or similar between PSDH and ICAO.

A third "standard" is the Aviation Environmental Design Tool (AEDT), promulgated by the United States Federal Aviation Administration for airport air quality inventories and noise studies.

While various research groups have suggested ways in which parts of the inventory calculation can be improved, few of these have been generally incorporated into received methodologies. One notable exception is the so-called FOA 3a method for calculating $PM_{10}$ emissions from smoke number emissions.

Defra issues technical guidance on air quality management[17], which is an important source of guidance on approaching common sources of air pollution. However, other than providing a screening threshold of 10 million passengers per annum (mppa) or 1 million tonnes of freight, it does not provide recommendations on the technical issues of modelling air quality around large airports.

The methodology used in this assessment is generally consistent with the ICAO advanced and PSDH recommendations, with decisions about the best approach being led by the availability of data.

## The dispersion model

The PSDH carried out a model intercomparison study to compare the use of various dispersion modelling tools for airport air quality modelling. As a result, the PSDH endorsed the use of ADMS-Airport, a version of the long-established dispersion modelling tool ADMS adapted to account for the momentum and buoyancy fluxes from jet engines. However, the use of the regular version of ADMS with suitable initial dispersion characteristics was also found to be acceptable. ADMS was used for the planning applications for the

[12] Heathrow Airport. *Heathrow Airport Emission Inventory 2008/9.* [online] Available at: https://planning.hillingdon.gov.uk/OcellaWeb/viewDocument?file=dv_pl_files%5C41573_APP_2013_1288%5CAppendix+H+Heathrow+Airport+Emission+Inventory+2008+2009.pdf&module=pl . [Accessed 23/11/2020]

[13] Underwood B Y, Walker C T and Peirce M J (2010b). Air Quality Modelling for Heathrow Airport 2008/9: Methodology. AEAT/ENV/R/2915 Issue 1.

[14] Underwood B Y, Walker C T and Peirce M J (2010c). Air Quality Modelling for Heathrow Airport 2008/9: Results and Model Evaluation. AEAT/ENV/R/2948 Issue 1.

[15] Ricardo-AEA (2015). Heathrow Airport 2013 Air Quality Assessment. Ricardo-AEA/R/3438.

[16] ICAO (2011). *Airport Air Quality Manual*. Doc 9889, [online]. Available at: https://www.icao.int/environmental-protection/Documents/Publications/FINAL.Doc%209889.1st%20Edition.alltext.en.pdf [Checked 22/03/2018].

[17] Defra (2018) Local Air Quality Management: Technical Guidance (TG16). February 2018.

Stansted G1 and G2 projects and found by the planning inspector[18] and the Secretaries of State to be fit for purpose and enabling a robust assessment.

ADMS was developed in the UK by Cambridge Environmental Research Consultants (CERC) in collaboration with the Meteorological Office, National Power, and the University of Surrey. AEDT uses AERMOD for the dispersion modelling. AERMOD was developed in the United States by the American Meteorological Society (AMS)/United States Environmental Protection Agency (USEPA) Regulatory Model Improvement Committee (AERMIC). Both AERMOD and ADMS are termed 'new generation' models, parameterising stability, and turbulence in the planetary boundary layer by the Monin-Obukhov length and the boundary layer depth. This approach allows the vertical structure of the planetary boundary layer to be more accurately defined than by the stability classification methods of earlier dispersion models.

Numerous model inter-comparison studies have demonstrated little difference between the output of ADMS and AERMOD, except in certain complex terrain scenarios. The principal difference between ADMS and ADMS-Airport is the jet engine module, which tends to reduce modelled ground-level concentrations from aircraft engines, especially at high thrust settings, as a result of the heat of the plume.

Taking the above into consideration, ADMS (Version 5.2) has been selected as an appropriate model to use for the purposes of this particular study.

## Emissions sources: aircraft emissions

### Aircraft activity

Aircraft movement information for 2017 and 2018 was provided by LLAOL for each actual movement in the year. The details of aircraft movements for each of the future year scenarios is taken from forecast annual totals provided by LLAOL for the 18 mppa and 19 mppa scenarios. For these scenarios, LLAOL provided forecast movements for a 92-day summer period (**Table 6D.1**). This was based on the same period for 2019, but with aircraft types and routes modified to reflect expected changes over the coming years. These forecasts were used to create an annual forecast by scaling movements by factors derived from actual 2017 movements: passenger movements were scaled by a factor of 3.5, and cargo movements by a factor of 4.4, and general aviation (GA)/other movements by a factor of 3.9.

Table 6D.1 Number of movements per year, scaled from 92-day forecast

| | 18 mppa, 2024 | 19 mppa, 2024 |
|---|---|---|
| **92-day Passenger** | 31,564 | 31,422 |
| **92-day Cargo** | 645 | 645 |
| **92-day GA/other** | 8,403 | 8,398 |
| **92-day total** | 40,612 | 40,465 |
| **Annual total** | 145,517 | 145,002 |

To model the 18 mppa and 19 mppa scenarios, the 2017 annual movement data was used as a basis to provide information on stand and runway usage (noting that the runway assignment for each movement needs to be consistent with the meteorological data used). Each movement from 2017 was weighted by a scaling factor to ensure that the total number of movements for each aircraft type matched the forecast. For example, the number of Airbus A321 movements in 2017 was 9,869, but was forecast to be 13,232 in the

[18] The Planning Inspectorate (2008). Report to the Secretary of State for Communities and Local Government & the Secretary of State for Transport: Appeal by BAA plc and Stansted Airport Ltd. File Reference: APP/C1570/A/06/2032278.

19 mppa scenario, so the calculated emissions for each A321 movement in the 2017 schedule were multiplied by 13,232/9,869 = 1.34. The number of movements of each principal aircraft type is given in **Table 6D.2**.

Table 6D.2 Number of movements per year of each aircraft type

| Aircraft description | 2017 | 2024, 18 mppa | 2024, 19 mppa |
|---|---|---|---|
| **Airbus A319** | 27,931 | 8,043 | 7,729 |
| **Airbus A320** | 48,261 | 31,338 | 28,252 |
| **Airbus A320 neo** | 0 | 30,936 | 24,688 |
| **Airbus A321** | 9,869 | 5,430 | 13,232 |
| **Airbus A321 neo** | 0 | 14,720 | 16,177 |
| **Airbus A300-600 freighter** | 896 | 1,653 | 1,653 |
| **Boeing 737-400** | 1,202 | 0 | 0 |
| **Boeing 737-800** | 14,242 | 12,365 | 3,050 |
| **Boeing 737-MAX8** | 0 | 6,411 | 15,653 |
| **Boeing 757-200** | 1,243 | 596 | 596 |
| **Other** | 31,873 | 34,025 | 33,971 |
| **Total** | 135,517 | 145,517 | 145,002 |

Emissions are calculated to a height of 3,000 ft (914 m) above aerodrome level, as is conventional in airport emission inventories. Emissions above this height have a negligible impact on local air quality at ground level.

### Main engine emissions: Engine assignments

For each aircraft type in the schedule, a single engine was assigned, and a single entry (identified by UID or unique identifier) in the ICAO databank or FOI database (see below) was chosen. Engine models were based on the most commonly fitted engines in the current fleet using LLA. Where an engine model has more than one entry in the ICAO databank with significantly different emission factors, the entry was chosen with a test date in between 2000 and 2010 where available; this reflects the typical age of aircraft.

The aircraft engine assignments for the most common aircraft types are summarised in **Table 6D.3**. The UID is the engine identifier used in the ICAO emissions databank. MTOW is maximum take-off weight, used in the calculation of brake and tyre wear. Data has been compiled from various public domain sources.

Table 6D.3 Aircraft data

| Aircraft description | MTOW (kg) | Number of engines | UID | Engine description |
|---|---|---|---|---|
| **Airbus A320 neo** | 77,000 | 2 | 20CM089 | CFM LEAP-1A26 |
| **Airbus A321 neo** | 93,500 | 2 | 20CM090 | CFM LEAP-1A32 |
| **Airbus A300-600 Freighter** | 171,700 | 2 | 1PW048 | PW PW4158 |

| Aircraft description | MTOW (kg) | Number of engines | UID | Engine description |
|---|---|---|---|---|
| **Airbus A319** | 75,500 | 2 | 8CM056 | CFM56-5B5/3 |
| **Airbus A320** | 77,000 | 2 | 8CM055 | CFM56-5B4/3 |
| **Airbus A321** | 93,500 | 2 | 8CM054 | CFM56-5B3/3 |
| **Boeing 737-400** | 68,050 | 2 | 1CM007 | CFM56-3C1 |
| **Boeing 737-800** | 70,533 | 2 | 11CM072 | CFM56-7B26E |
| **Boeing 757-200** | 115,680 | 2 | 3RR028 | RB211 535E4 |
| **Boeing 737-Max8** | 82,191 | 2 | 20CM098 | LEAP-1B27 |
| **Cessna 500 501 525 526 Citation 1** | 5,375 | 2 | 1PW036 | PWC JT15D-4 |
| **Cessna 510 Citation Mustang** | 3,930 | 2 | 1AS002 | PWC PW615F |
| **Cessna 560XL 560XLS Citation Excel** | 9,163 | 2 | 1AS002 | PWC PW545B |
| **Canadair Challenger 350** | 18,416 | 2 | 14HN009 | HTF7350 |
| **Canadair Challenger 605** | 21,863 | 2 | 5GE084 | GE CF34-3B |
| **Embraer Legacy 600 - 650** | 24,300 | 2 | 6AL006 | RR AE3007-A1 |
| **Embraer Phenom 300** | 8,150 | 2 | 1AS002 | PWC PW535E |
| **Dassault Falcon 2000 EX LX** | 18,597 | 2 | 7PW080 | PWC PW308C |
| **Dassault Falcon 7X** | 31,751 | 3 | 16PW114 | PWC PW307A |
| **Canadair Global Express** | 41,957 | 2 | 4BR009 | RR BR710A2-20 |
| **Gulfstream G4 G300 G350 G400 G450** | 33,203 | 2 | 11RR048 | RR RB183 Tay 611-8 |
| **Gulfstream G5 G500 G550** | 41,050 | 2 | 4BR009 | RR BR710A2-20 |
| **Gulfstream G650** | 45,178 | 2 | 11BR011 | RR BR725 |
| **BAE (Hawker) HS125-700** | 12,701 | 2 | 1AS002 | GA TFE731-5BR |

### Main engine emissions: emission factors

Emission factors for jet engines are taken from the ICAO databank, version 27[19]. The databank provides emission indices for $NO_x$, CO and HC, fuel flow rates and smoke numbers; each of these is given at four power settings (100%, 85%, 30% and 7% of rated thrust). Emission indices are multiplied by fuel flow rates to obtain an emission factor in g $s^{-1}$.

The ICAO databank gives smoke numbers which need to be converted to emission indices. This is done using the FOA3a method[20], with the amendment that the factor of (1 − bypass ratio) in equation 7a is only applied

[19] European Union Aviation Safety Agency. *ICAO Aircraft Engine Emissions Databank*. [online] Available at: https://www.easa.europa.eu/domains/environment/icao-aircraft-engine-emissions-databank . [Accessed 23/11/2020]
[20] Kinsey J and Wayson R L (2009), Appendix C PM methodology discussion paper. In: G Ratliff et al., Aircraft Impacts on Local and Regional Air Quality in the United States. PARTNER Project 15 final report. PARTNER-COE-2009-002.

to mixed turbofan engines[12]. For some engines, smoke number data points at certain thrust settings are missing, so an approach originally developed by Qinetiq has been used in which factors are applied to the maximum smoke number[12].

For turboprop engines, emission factors are taken from the Swedish FOI database[21].

ICAO databank emission factors are based on new production engines, so in-service engines are likely to have suffered deterioration which may affect their emissions. PSDH recommended correction factors to account for this, namely a 4.3% increase in fuel flow and a 4.5% increase in $NO_x$ emission rate (the product of emission index and fuel flow rate). There was not sufficient data to resolve these factors into individual engine types, ages or thrust setting, so they have been applied uniformly across the engine fleet for all phases of the Landing and Take-Off (LTO) cycle.

The PSDH recommended a procedure for taking into account changes in ambient temperature, pressure, and humidity on aircraft engine emissions, which it found changed overall aircraft $NO_x$ emissions by about 2 or 3% (DfT, n.d.). The PSDH also recommended an elaborate methodology for take-off roll, accounting for non-uniform acceleration, effects of the forward speed on the engine thrust, etc. It found that these made a difference of between 2 and 7% on average to $NO_x$ emissions from the take-off roll phase. Unfortunately, the engine-specific data that underlie these methodologies were not published and remain proprietary. In the absence of detailed data, $NO_x$ emissions from aircraft engines at all thrust settings have been uplifted by 3% to account for the temperature-pressure-humidity effect, and $NO_x$ emissions for the take-off roll and climb phases have been uplifted by 7% to account for the forward speed effect.

No improvement in emission factors has been assumed for the future scenarios, for example through the introduction of new engine models or combustors before 2024. However, the penetration of recent engines through their use on recent aircraft types such as the A320neo and the B737Max has been accounted for.

### Main engine emissions: Times in mode

The following assumptions have been made about times in mode, that is, the amount of time aircraft spend in various stages of the Landing and Take Off (LTO) cycle. It is assumed that times in mode are independent of aircraft type. It is also assumed that any dependence on time of day or time of year (e.g. congestion during busy periods resulting in increased taxi or hold times) is negligible. Mostly, these times are considered to be realistic best estimates, rather than being intentionally conservative.

Times for approach (from 3,000 ft to touchdown), initial climb (from wheels-off to 1,500 ft) and climb-out (from 1,500 ft to 3,000 ft) have been taken from data for Heathrow Airport[12]. By design, aircraft of the types that operate at LLA have very similar times for take-off, climb, approach, and landing. These are tightly constrained to be uniform in order to manage and optimise separation distances, so there is very little variation in these times between airports or between (large) aircraft. Taxi times are based on measured distances between aprons and runway ends, with an assumed average speed of 15 knots. Landing roll times are effective times, assuming a landing roll duration of 60 s, and that 50% of aircraft do not use reverse thrust (landing roll time of 60 s at idle) and 50% of aircraft use reverse thrust for 15 s of the 60 s landing roll.

These times are not necessarily accurate for general aviation aircraft, but in view of the very small contribution these aircraft make to total air quality emissions, the same times have been used for simplicity.

Times in mode used in the assessment are summarised in **Table 6D.4**.

[21] FOI (2017). Aircraft Engine Emissions Database. Available on request from https://www.foi.se/en/our-knowledge/aeronautics-and-air-combat-simulation/fois-confidential-database-for-turboprop-engine-emissions.html/ [Checked 31/01/2017].

Table 6D.4 Times in mode

| Mode | Apron | Time in mode (s) | |
|---|---|---|---|
| | | Runway 08 | Runway 26 |
| **Pushback** | All | 120 | 120 |
| **Taxi Out** | Apron 62 | 230 | 208 |
| **Taxi Out** | Cargo | 244 | 222 |
| **Taxi Out** | East | 217 | 195 |
| **Taxi Out** | Main 1 | 185 | 270 |
| **Taxi Out** | Main 2 | 155 | 223 |
| **Taxi Out** | North | 249 | 226 |
| **Taxi Out** | South | 111 | 132 |
| **Hold** | All | 60 | 60 |
| **Take-off roll** | All | 30 | 30 |
| **Initial Climb** | All | 30 | 30 |
| **Climb-Out** | All | 70 | 70 |
| **Approach** | All | 230 | 230 |
| **Land idle thrust** | All | 52.5 | 52.5 |
| **Land reverse thrust** | All | 7.5 | 7.5 |
| **Taxi In** | Apron 62 | 208 | 230 |
| **Taxi In** | Cargo | 222 | 244 |
| **Taxi In** | East | 195 | 217 |
| **Taxi In** | Main 1 | 270 | 185 |
| **Taxi In** | Main 2 | 223 | 155 |
| **Taxi In** | North | 226 | 249 |
| **Taxi In** | South | 132 | 111 |

### Main engine emissions: thrust settings

In the absence of airport-specific data, the ICAO standard thrust settings have been used for each mode: take-off roll and initial climb at 100%, climb-out at 85%, approach at 30% and other modes at 7%.

It is common for aircraft to take off at less than 100% thrust, sometimes as low as 75%, primarily to reduce wear on the engines. At Heathrow Airport, for example, it is most common for aircraft to take off at around 85-90% thrust, reducing total NOx emissions from take-off roll by as much as 25% relative to full thrust take-offs. However, in the absence of airport-specific information, especially regarding the effect of the shorter runway at LLA, a conservative assumption has been adopted that all aircraft take off at 100% thrust.

Aircraft sometimes use reverse thrust on landing, usually where the runway is short and/or when weather conditions are poor (e.g. wet or icy). No information on reverse thrust practices at LLA has been obtained. For this assessment, it is assumed that 50% of arriving jet aircraft use reverse thrust on landing, for 15 seconds per landing, at an engine thrust setting of 30%.

### Auxiliary Power Unit (APU) emissions

As well as their main engines, many aircraft have APUs, which are small engines used to generate electrical power for purposes such as starting the main engines, powering air conditioning and other services. Emissions from APUs are not regulated and emissions data is considered proprietary, and therefore is difficult to obtain.

The ICAO advanced methodology provides emission factors for different aircraft size and age groups and three APU operating modes, along with typical operating times for each operating mode. These have been used to calculate $NO_x$ emissions per arrival and per departure. For PM, ICAO does not provide emission factors as g $s^{-1}$ but recommend their simple methodology, which consists of a simple factor of 25 g per movement for narrow-bodied aircraft and 40 g per movement for wide-bodied aircraft.

The ICAO methodology suggests a total APU running time of 25 minutes per arrival–departure cycle. In the absence of specific data for operations at LLA, this time has been used in the assessment.

### Brake and tyre wear emissions

Emissions of PM from brake and tyre wear are calculated using the PSDH methodology (ICAO omits this source). Brake wear emissions, in g $PM_{10}$ per arrival, are calculated as $2.53 \times 10^{-4} \times$ MTOW, where MTOW is the maximum take-off weight in kg. Tyre wear emissions, in g $PM_{10}$ per arrival, are calculated as $2.23 \times 10^{-4} \times$ MTOW − 8.74 for aircraft with an MTOW > 50,000 kg, and 2.41 × MTOW / 50,000 for smaller aircraft.

$PM_{2.5}$ emissions are calculated by multiplying the $PM_{10}$ emission by 0.4 for brake wear and 0.7 for tyre wear.

### Aircraft emissions: spatial disaggregation

Aircraft emissions are treated as volume sources with an initial vertical extent of 20 m. Stand-based emissions (pushback and APUs) are assigned to polygons covering the apron areas. Taxiway- and runway-based emissions are treated as long boxes with a width of 50 m and a length dependent on the mode.

The apron area has been divided into six polygons:

- Main 1 (Stands 1–4, 14–19, 54–58);
- Main 2 (Stands 5–9, 10–13, 60, 81);
- Cargo (Stands 30, 31, 71, 80);
- North (Stands 41, 42, 62)
- East (Stands 43–49);
- Stand 62; and
- South (Stands 20–23).

When arriving, jet aircraft normally leave the runway at the end (Taxiway Bravo or Taxiway Alpha). It is therefore assumed that all aircraft use the full length of the runway from the touchdown point for their landing roll, turning off the runway at the end onto Taxiway Alpha (in easterlies) or Taxiway Bravo (in westerlies).

Taxi routes are assumed to be the most direct route between the apron and the runway. The apron polygons are each small and simple enough that it is reasonable to assume a single point in the centre of the respective aprons as the end point of all taxiing activity. Taxi-in routes are the reverse of taxi-out routes. Each taxi route is divided into straight-line sections, and a volume source has been built around each straight-line section, of vertical extent 20 m, width 50 m, and length equal to the straight-line length.

It is assumed that there is at most one aircraft in the hold area at any time, so the hold queues have been assumed to be 70 m long. The hold emissions are assumed to occur in a rectangular box of this length, and 50 m wide.

It is assumed that aircraft require 1,500 m for the take-off roll. Aircraft start 50 m from the end of the runway (to allow for aircraft straightening up when joining the runway). The roll is divided into ten volume sources, each 150 m long, 50 m wide and 20 m in vertical extent. The departing aircraft is assumed to accelerate at a constant rate, and the emissions are partitioned between the ten volume sources accordingly (so about 32% of the emissions are assigned to the first volume source).

The PSDH recommended a more elaborate methodology for take-off roll, accounting for non-uniform acceleration. In view of the small difference that this effect makes to concentrations at receptors, it has been omitted from this assessment.

Initial climb is assumed to start where the take-off roll ends. Aircraft are assumed to climb at an angle of 10° to a height of 457 m (1,500 ft) at constant speed. The constant speed assumption is conservative, since in reality, the continuing acceleration of the aircraft means a greater proportion of the emissions occur at a greater height. ADMS is unable to model inclined sources, so the initial climb phase is again divided into ten volume sources, each of length 259 m (= 457 / tan(10°) / 10). The bottom of the first volume source is assumed to be at ground level, with successive volume sources 45.7 m higher. This tends to put the emissions closer to the ground than in reality, so is a conservative assumption.

The climb-out phase is treated similarly and is assumed to start where the initial climb ends. Aircraft are assumed to climb at the same angle from a height of 457 m to 914 m (3,000 ft) at constant speed. Again, the climb-out is divided into ten volume sources, each of length 259 m.

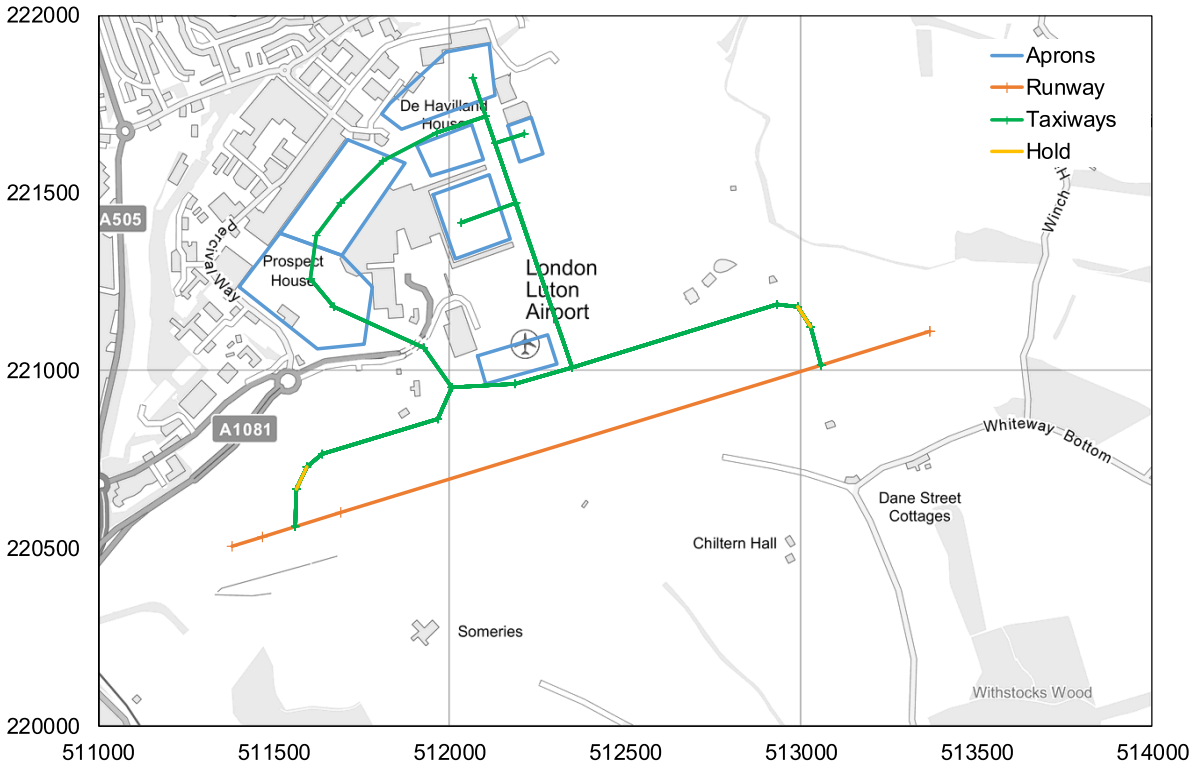
The approach phase is treated similarly. Approach is assumed to start at a height of 914 m above the runway and to finish at the runway touchdown point, with aircraft descending at a constant speed and a constant angle of 3°. The approach is divided into a number of volume sources; to reduce the number of these, the approach length is divided into ten equal sections of 150 m horizontal (7.86 m vertical) plus ten equal sections of 1,594 m horizontal (83.5 m vertical). It should be noted that emissions from approaching aircraft more than a few tens of metres above the ground make very little contribution to ground-level concentrations.

The landing roll is assumed to extend from the touchdown point to the end of the runway and is divided into ten volume sources of length 175 m each. Uniform deceleration is assumed, and emissions are assigned to the volume sources accordingly, in the same way as for the take-off roll.

Brake wear emissions are assigned to the length of the runway from touchdown to runway end, and uniform along that length (it is assumed that a higher brake wear emission rate at the start of the landing roll will cancel out the reduced dwell time). Tyre wear emissions are assigned to a single volume source of length 200 m centred on the touchdown point.

A schematic of the disaggregation of the airport sources is given in **Figure 6D.1**.

Figure 6D.1 Schematic of airport sources used in modelling




### Aircraft emissions: runway assignments and temporal variation

LLA has a single runway, but it can be used in two directions, with aircraft moving along it either eastwards (referred to as Runway 08) or westwards (Runway 26). In general, the choice of runway direction is determined by the weather, with both arriving and departing aircraft heading into the wind. Since the wind direction also affects the dispersion of pollutants, it is essential to ensure that runway assignments are aligned with the met data used for the dispersion modelling.

In addition, the number of aircraft movements varies with hour of the day (there is more activity during the daytime) and the time of year (at LLA, there is more activity during the summer than the winter). Since the weather also varies systematically between hours of the day, and between seasons of the year, it is therefore desirable for the model to take this temporal variation in emissions into account.

Data was available for each movement in 2017 giving the hour of the year and the runway assignment. This was used to create an hour-by-hour weighting factor, which incorporated both the difference in activity between hours of the day and days of the year, and the runway used. This was used to generate an ADMS time-varying emissions ("var") file for each emission source. The model used met data for 2017, so this procedure ensured that the runway usage and met conditions were correctly aligned. The same weightings and met data were used for the two future scenarios.

## Emissions sources: on-airport, non-aircraft emissions

### Ground support equipment (GSE)

GSE is the term for the various vehicles and items of plant and equipment used airside, such as tugs and loading platforms. GSE is normally a mix of road vehicles and non-road mobile machinery.

In view of the wide variety of GSE types and duty cycles, obtaining good-quality data is difficult and performing a bottom-up calculation of emissions is highly onerous, and the results would be highly uncertain. Therefore, emissions have been calculated by taking emissions from GSE at Heathrow in 2013[15] and scaling by total activity at the two airports.

For dispersion modelling, GSE emissions have been spread over polygons representing the aprons, in the same way as pushback and APU emissions, but with an initial mixing height of 3 m.

## Emissions sources: road traffic emissions

### Calculation of emissions

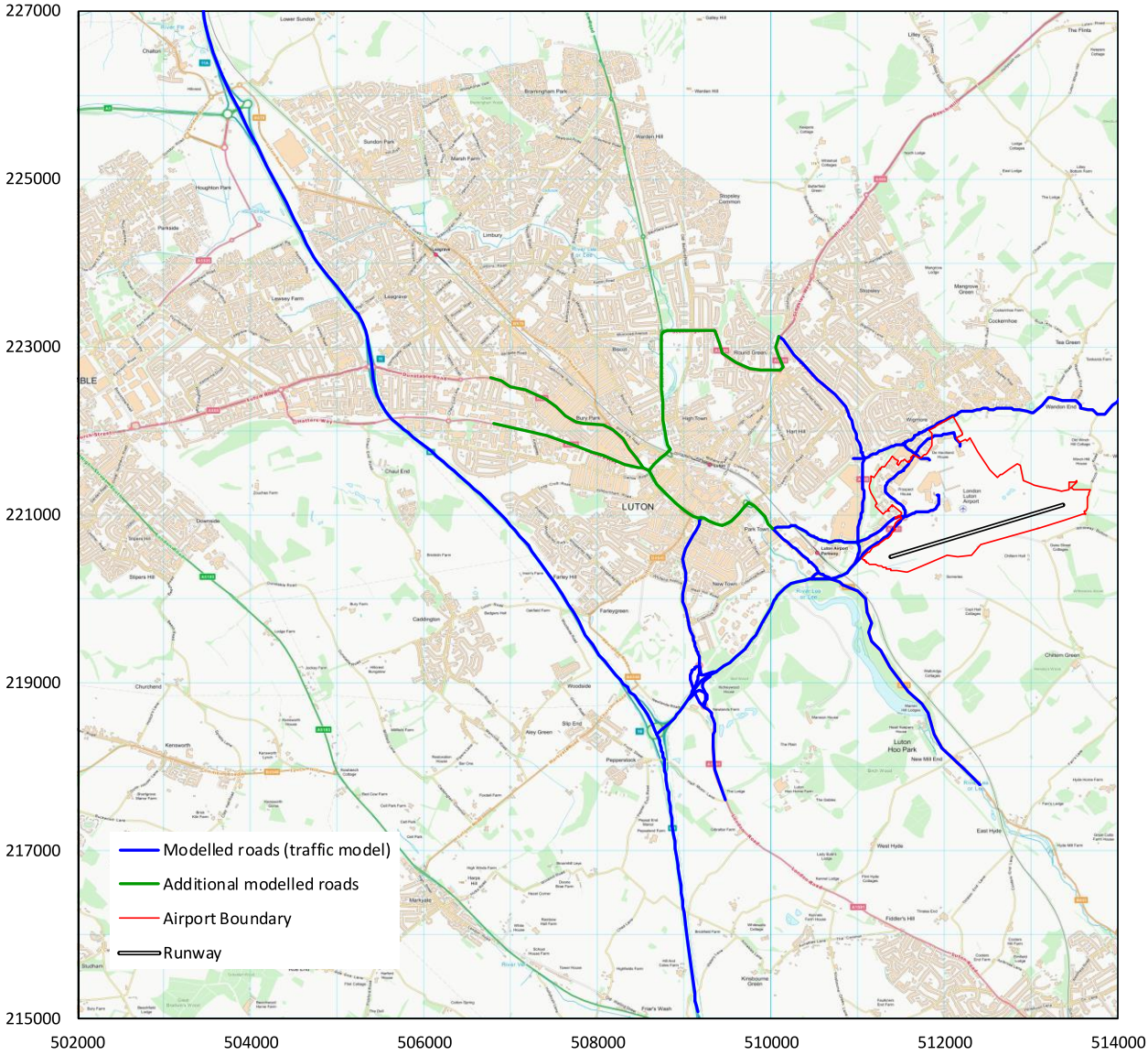
As part of the traffic assessment, see **Chapter 10** in **Volume 2: ES**, forecasts of road traffic were generated. These forecasts provide the number of traffic movements on selected road links serving LLA, including the M1 motorway, for 2017 and 2024 18 mppa and 19 mppa scenarios. Movements are provided as two-way traffic flows, separately for Light Duty Vehicles (LDVs) and Heavy Duty Vehicles (HDVs).

In addition, a selection of other major roads through the core study area were modelled by using DfT traffic count data (DfT 2020), scaled up to 2024 using Tempro growth factors. These roads are not expected to have any significant airport-related traffic but were included to provide additional spatial resolution over using the Defra background maps.

Emissions were calculated using the Defra emission factors from the Emission Factor Toolkit (EFT) v10.1.

Locations of modelled links are shown in **Figure 6D.2**.

Figure 6D.2 Modelled road links




## Verification

Verification of the model was undertaken using the method recommended by Defra[17]. The $NO_2$ concentrations from the 2017 modelling (including aircraft and background contributions and calculated from $NO_x$ concentrations using the Defra tool described below) were compared against monitored $NO_2$ results. Verification was carried out for two separate zones. One for the M1 motorway road links and for the other road links. The roadside receptors used in the verification are given in **Table 6D.5**.

Table 6D.5 Receptors used in roads model verification

| Motorway verification | | Other roads verification | |
|---|---|---|---|
| **ID** | **Description** | **ID** | **Description** |
| **M04** | LN15 Armitage Garden | **M08** | LN22 1 Mistletoe Hill |
| **M05** | LN16 Belper Road | **M09** | LN23 Eaton Green Road 1 |
| **M06** | LN17 Wyndham Road | **M10** | LN24 19 Barnston Close |
| **M07** | LN18 Copperfields | **M11** | LN25 Eaton Green Road 2 |
| **M14** | LN28 Caddington Road | **M12** | LN26 8 Keeble Close |
| **M15** | LN53 3rd Floor Bagshawe Court F.F. | **M13** | LN27 Eaton Green Road 3 |
| **M16** | LN54 M1 Corner Bagshawe Court F.F. | **M26** | LLA 2 (LA02) Airport Approach Road |
| **M17** | LN55 M1 Corner Wyatt Court FF | **M30** | LLA 6 (LA06) President Way Jct |
| **M18** | LN56 20 Wyatt Court FF | **M37** | LLA 13 (LA15) Eaton Green Road |
| **M19** | LN81 Bank Close | | |
| **M20** | LN82 11 Withy Close | | |
| **M21** | LN83 b/h 9 Copperfields | | |
| **M22** | LN84 97 Lime Avenue | | |
| **M24** | LN86 Bradley Road (by M1 Bridge) | | |

The road contribution to $NO_x$ was adjusted to produce the best correlation between modelled and monitored $NO_2$ concentrations at these receptors. The resulting adjustment factor was calculated to be 1.07 for the motorway and 1.68 for the other roads. These factors were applied to $NO_x$ concentrations (which were used to calculate $NO_2$ concentrations) and also to PM concentrations (in the absence of any roadside monitoring for PM).

### Dispersion modelling and calculation of $NO_2$ concentrations

Dispersion modelling was carried out using ADMS-Roads, version 5.0. Sources were modelled as road sources, which allows ADMS-Roads to include appropriate initial dispersion, including the effects of traffic-induced turbulence which depends on traffic flows and heavy-duty vehicle fraction. For consistency with the verification, a single meteorological year, 2017, was used, as recommended by Defra's TG(16) methodology[17].

Concentrations of $NO_2$ were calculated from $NO_x$ concentrations using Defra's tool for this purpose[22].

## Calculation of short-period average concentrations

As described previously, the emissions are assigned to about 200 sources, each of which is represented in the model as a polyhedral volume within which the emissions occur and undergo initial mixing with the air. ADMS is unable to handle this many volume sources in a single run, so runs have been split into phase-specific runs with concentrations being combined externally. This makes it possible to obtain the total annual

[22] Defra (2019b). NOx to NO2 conversion spreadsheet, Version 5.1, [online]. Available at: https://laqm.defra.gov.uk/review-and-assessment/tools/background-maps.html#NOxNO2calc.

mean concentration of each pollutant at each receptor as a direct output (and assists checking and source apportionment). However, it means ADMS cannot calculate concentrations over short-term averaging periods, e.g. for comparison with the hourly mean $NO_2$ limit value.

Therefore, the empirical relationships suggested in Defra's TG(16) guidance[17] are used to estimate short-period concentrations, as follows:

- *"Exceedances of the $NO_2$ 1-hour mean are unlikely to occur where the annual mean is below 60 µg $m^{-3}$."*

and:

- *"To estimate potential exceedances of the $PM_{10}$ 24-hour mean objective, local authorities should use the following relationship, provided in previous Technical Guidance, but still considered adequate:*
  *No. 24-hour mean exceedances = -18.5 + 0.00145 × annual mean$^3$ + (206/annual mean)"*

## Conversion of NO to $NO_2$

Emissions of $NO_x$ from combustion processes are predominantly in the form of NO. Excess oxygen in the combustion gases and further atmospheric reactions cause the oxidation of NO to $NO_2$. $NO_x$ chemistry in the lower troposphere is strongly interlinked in a complex chain of reactions involving VOCs and Ozone ($O_3$). Two of the key reactions interlinking NO and $NO_2$ are detailed below:

$$NO_2 + O_2 \xrightarrow{h\nu} NO + O_3 \qquad \text{(R1)}$$

$$NO + O_3 \rightarrow NO_2 + O_2 \qquad \text{(R2)}$$

*where hv is used to represent a photon of light energy (i.e. sunlight).*

Taken together, reactions R1 and R2 produce no net change in $O_3$ concentrations, and NO and $NO_2$ adjust to establish a near steady state reaction (photo-equilibrium). However, the presence of VOCs and CO in the atmosphere offer an alternative production route of $NO_2$ for photolysis, allowing $O_3$ concentrations to increase during the day with a subsequent decrease in the $NO_2$:$NO_x$ ratio.

However, at night, the photolysis of $NO_2$ ceases, allowing reaction R2 to promote the production of $NO_2$, at the expense of $O_3$, with a corresponding increase in the $NO_2$:$NO_x$ ratio.

Near to an emission source of NO, the result is a net increase in the rate of reaction R2, suppressing $O_3$ concentrations immediately downwind of the source, and increasing further downwind as the concentrations of NO begin to stabilise to typical background levels.

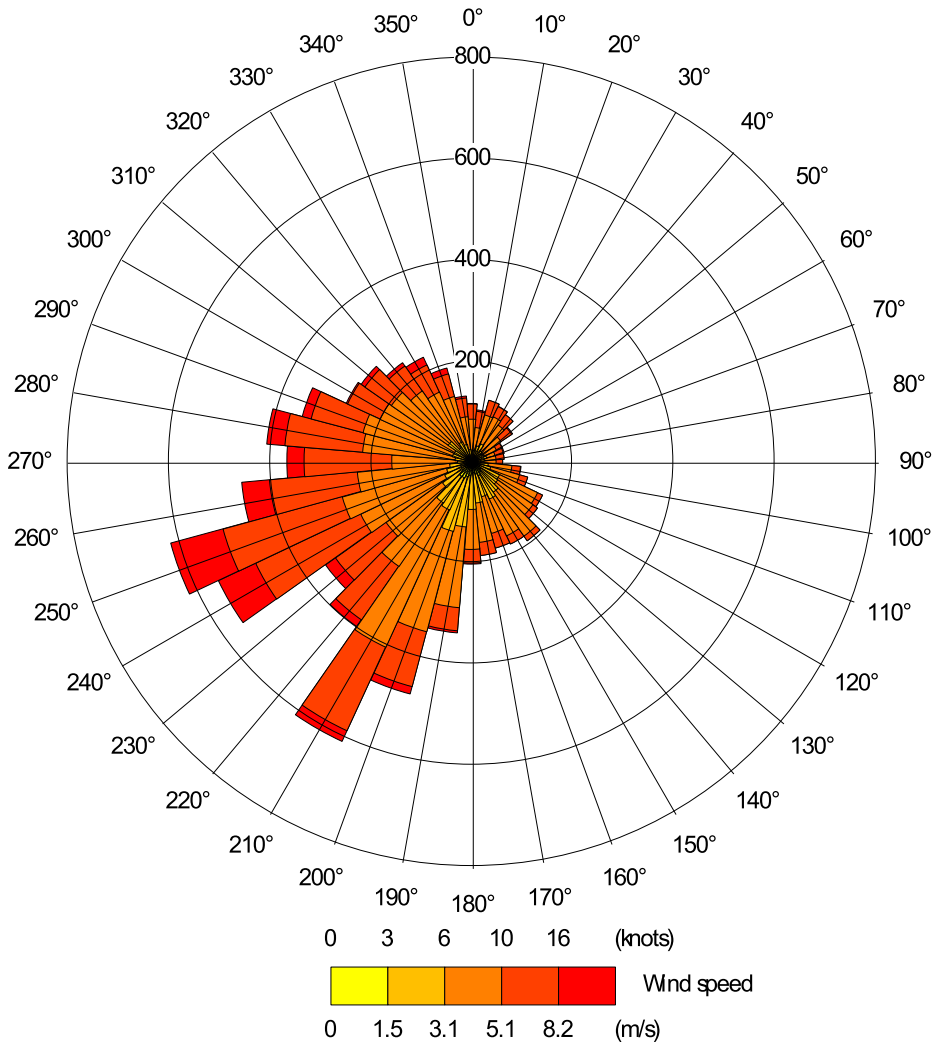
Given the complex nature of $NO_x$ chemistry, a number of approaches have been suggested to estimate $NO_2$ concentrations. Defra offers a tool[22] for calculating $NO_2$ concentrations from $NO_x$ concentrations, which may be partitioned into roads and "background" contributions. The Defra tool has been used for this assessment, with the contribution from aircraft sources treated as part of the "background" term. Using this tool is consistent with the use of the Defra background maps to obtain the background contribution, and the roads verification procedure described above.

## Meteorology

For meteorological data to be suitable for dispersion modelling purposes, a number of meteorological parameters need to be measured on an hourly basis. These parameters include wind speed, wind direction, cloud cover and temperature. There are only a limited number of sites where the required meteorological measurements are made. The year of meteorological data that is used for a modelling assessment can also have a significant effect on ground level concentrations.

This assessment has used meteorological data recorded at the Luton Airport meteorological station for the calendar year 2017. The meteorological station is the nearest synoptic station to the site offering data in a suitable format for the model. The wind rose is presented in **Figure 6D.3**. The wind rose shows that winds are predominantly from the south-west quadrant, with relatively few low wind speeds.

Figure 6D.3 Wind rose for 2017 met data




Most large meteorological datasets contain rows which cannot be used by the dispersion model, because of instrument faults or because of very low wind speeds. For the 2017 met data, ADMS was able to use 8,496 hours, or 97%, which is adequate for modelling purposes.

## Dispersion modelling parameters

### Terrain

The concentrations of an emitted pollutant found in elevated, complex terrain differ from those found in simple level terrain. There have been numerous studies on the effects of topography on atmospheric flows.

The UK ADMLC[23] provides a summary of the main effects of terrain on atmospheric flow and dispersion of pollutants:

*"Plume interactions with windward facing terrain features:*

*Plume interactions with terrain features whereby receptors on hills at a similar elevation to the plume experience elevated concentrations;*

*Direct impaction of the plume on hill slopes in stable conditions;*

*Flow over hills in neutral conditions can experience deceleration forces on the upwind slope, reducing the rate of dispersion and increasing concentrations; and*

*Recirculation regions on the upwind side of a hill can cause partial or complete entrainment of the plume, resulting in elevated ground level concentrations.*

*Plume interactions with lee sides of terrain features:*

*Regions of recirculation behind steep terrain features can rapidly advect pollutants towards the ground culminating in elevated concentrations; and*

*As per the upwind case, releases into the lee of a hill in stable conditions can also be recirculated, resulting in increased ground level concentrations.*

*Plume interactions within valleys:*

*Releases within steep valleys experience restricted lateral dispersion due to the valley sidewalls. During stable overnight conditions, inversion layers develop within the valley essentially trapping all emitted pollutants. Following sunrise and the erosion of the inversion, elevated ground level concentrations can result during fumigation events; and*

*Convective circulations in complex terrain due to differential heating of the valley side walls can lead to the impingement of plumes due to crossflow onto the valley sidewalls and the subsidence of plume centrelines, both having the impact of increasing ground level concentrations."*

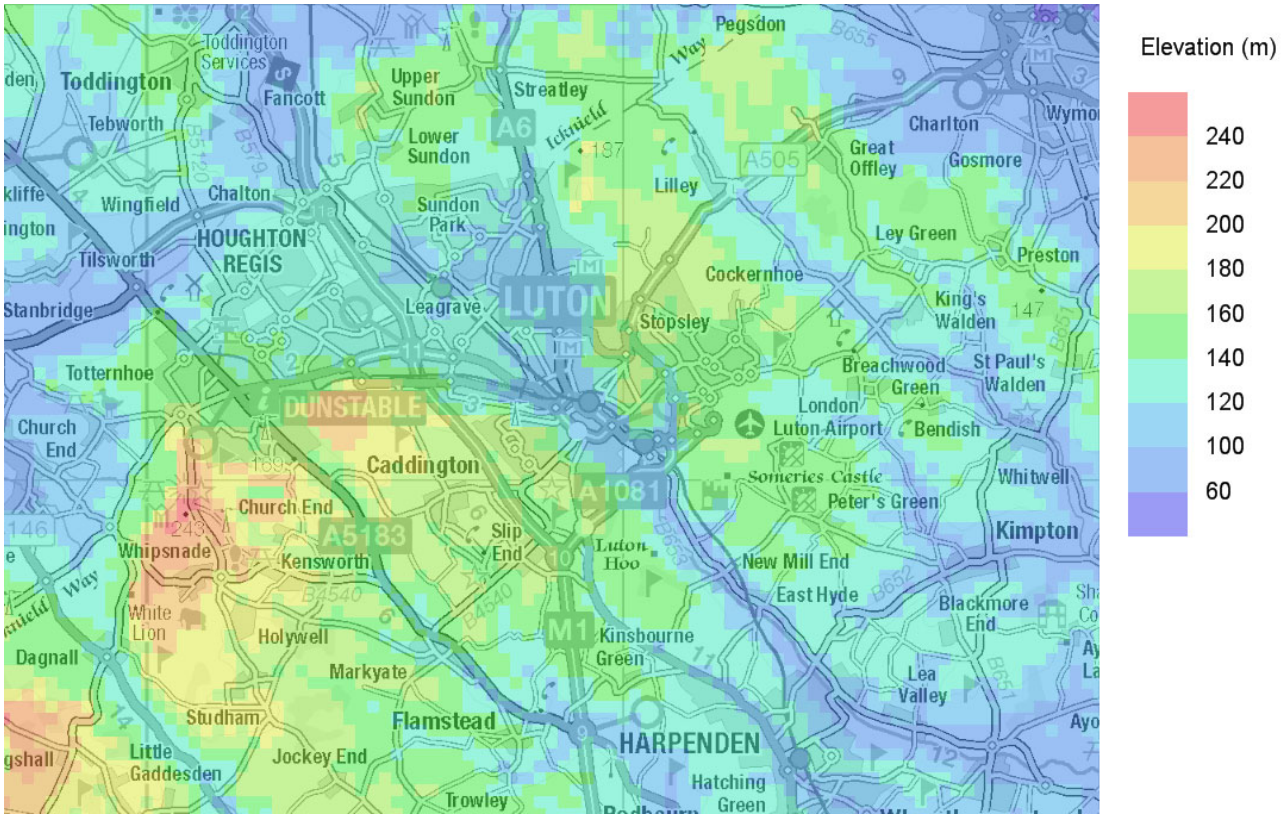
These effects are most pronounced when the terrain gradients exceed 1 in 10, i.e. a 100 m change in elevation per 1 km step in the horizontal plane.

The topography around LLA is rolling rather than hilly, with gradients approaching one in ten, although they do not generally exceed this. Overall, it is considered that the topography of the local area could have a significant effect on pollutant dispersion and consequently, the effects of terrain have been included in the dispersion modelling. Terrain data on a 50 m grid was obtained from the Ordnance Survey. Due to the extent of the receptors being modelled, this was reduced to a 250 m resolution grid (95 × 69 points) for input to ADMS; there is no benefit in inputting a higher resolution grid as ADMS by default reduces this to a 64 × 64 terrain grid internally.

A plot of the terrain files used is shown in **Figure 6D.4**.

[23] Hill et al (2005).

Figure 6D.4 Modelled terrain data




## Surface roughness length

Roughness length, $z_0$, represents the aerodynamic effects of surface friction and is defined as the height at which the extrapolated surface layer wind profile tends to zero. This value is an important parameter used by meteorological pre-processors to interpret the vertical profile of wind speed and estimate friction velocities which are, in turn, used to define heat and momentum fluxes and, consequently, the degree of turbulent mixing in the atmosphere.

The surface roughness length is related to the height of surface elements; typically, the surface roughness length is approximately 10% of the height of the main surface features. Thus, it follows that surface roughness is higher in urban and congested areas than in rural and open areas. Oke[24] and CERC[25] suggest typical roughness lengths for various land use categories (**Table 6D.6**).

Table 6D.6 Typical surface roughness lengths for various land use categories

| Type of surface | $z_0$ (m) |
|---|---|
| **Ice** | 0.00001 |
| **Smooth snow** | 0.00005 |
| **Smooth sea** | 0.0002 |
| **Lawn grass** | 0.01 |

[24] Oke, T.R. (1987). 'Boundary Layer Climates'. 2nd Edition, Methuen.
[25] CERC (2003). The Met Input Module. ADMS Technical Specification.

| Type of surface | $z_0$ (m) |
|---|---|
| **Pasture** | 0.2 |
| **Isolated settlement (farms, trees, hedges)** | 0.4 |
| **Parkland, woodlands, villages, open suburbia** | 0.5-1.0 |
| **Forests/cities/industrialised areas** | 1.0-1.5 |
| **Heavily industrialised areas** | 1.5-2.0 |

Increasing surface roughness increases turbulent mixing in the lower boundary layer. With respect to near-ground-level sources under neutral and stable conditions, increasing the roughness length can have complex effects on ground level concentrations, but generally tends to reduce ground-level concentrations:

- the increased mixing can transport portions of the low-level plume upwards, resulting in decreased ground level concentrations close to the emission source; and
- the increased mixing increases entrainment of ambient air into the plume and dilutes plume concentrations, resulting in reduced ground level concentrations further downwind from an emission source.

A surface roughness length of 1 m has been used to represent the airport and its vicinity. This value has been chosen to reflect the mix of low-roughness airfield, high-roughness buildings and intermediate-roughness car parks between the principal sources and the most sensitive receptors.

### Buildings

Any large object has an impact on atmospheric flow and air turbulence within the locality of the object. This can result in maximum ground level concentrations that are significantly different (generally higher) from those encountered in the absence of buildings. The building 'zone of influence' is generally regarded as extending a distance of 5*L* (where *L* is the lesser of the building height or width) from the foot of the building in the horizontal plane and three times the height of the building in the vertical plane.

Gaussian plume models are generally unable to model flows around complex arrangements of buildings; typically, this requires some form of computational fluid dynamics model, which presents other difficulties to the modeller. It is therefore common for air quality studies to model only simple arrangements of buildings close to the key emissions sources.

While numerous buildings are present on the Site, in general they are at a distance from the principal sources of emissions, especially from the runway. For this assessment, therefore, no attempt has been made to include buildings directly into the model. Instead, the effects of buildings are included by suitable choice of surface roughness length.

### Surface energy budget

One of the key factors governing the generation of convective turbulence is the magnitude of the surface sensible heat flux. This, in turn, is a factor of the incoming solar radiation. However, not all solar radiation arriving at the Earth's surface is available to be emitted back to atmosphere in the form of sensible heat. By adopting a surface energy budget approach, it can be identified that, for fixed values of incoming short and long wave solar radiation, the surface sensible heat flux is inversely proportional to the surface albedo and latent heat flux.

The surface albedo is a measure of the fraction of incoming short-wave solar radiation reflected by the Earth's surface. This parameter is dependent upon surface characteristics and varies throughout the year.

Oke[24] recommends average surface albedo values of 0.6 for snow covered ground and 0.23 for non-snow-covered ground.

The latent heat flux is dependent upon the amount of moisture present at the surface. Areas where moisture availability is greater will experience a greater proportion of incoming solar radiation released back to atmosphere in the form of latent heat, leaving less available in the form of sensible heat and, thus, decreasing convective turbulence. The modified Priestly-Taylor parameter (α) can be used to represent the amount of moisture available for evaporation. Holstag and van Ulden[26] suggest values of 0.45 and 1.0 for dry grassland and moist grassland, respectively.

A detailed analysis of the effects of surface characteristics on ground level concentrations by Auld et al[27] led them to conclude that, with respect to uncertainty in model predictions:

*"…the energy budget calculations had relatively little impact on the overall uncertainty".*

In this regard, it is not considered necessary to vary the surface energy budget parameters spatially or temporally, and annual averaged values have been adopted throughout the model domain for this assessment.

As snow covered ground is only likely to be present for a small fraction of the year, the surface albedo of 0.23 for non-snow-covered ground advocated by Oke[24] has been used whilst the model default α value of 1.0 has also been retained.

### Other treatments

Specialised model treatments, for short-term (puff) releases, coastal models, fluctuations, or photochemistry were not used in this assessment.

## Deposition

The predominant route by which emissions to air affect land is by deposition of atmospheric emissions. Ecological receptors can potentially be sensitive to the deposition of pollutants, particularly nitrogen and sulphur compounds, which can affect the character of the habitat through eutrophication and acidification.

Deposition processes in the form of dry and wet deposition remove material from a plume and alter the plume concentration. Dry deposition occurs when particles are brought to the surface by gravitational settling and turbulence. They are then removed from the atmosphere by deposition on the land surface. Wet deposition occurs due to rainout scavenging (within clouds) and washout scavenging (below clouds) of the material in the plume. These processes lead to a variation with downwind distance of the plume strength and may alter the shape of the vertical concentration profile as dry deposition only occurs at the surface.

Near to sources of pollutants (<2 km), dry deposition is generally the predominant removal mechanism[28,29] for pollutants such as $NO_x$, $SO_2$ and $NH_3$. Dry deposition may be quantified from the near-surface plume concentration and the deposition velocity[30]:

$$F_d = v_d\, C(x,y,0)$$

where:

[26] Holstag and van Ulden (1983). The Stability of the Atmospheric Surface Layer during Nighttime. American Met. Soc., 6th Symposium on Turbulence and Diffusion.
[27] Auld V, Hill R and Taylor T.J. (2002). Uncertainty in Deriving Dispersion Parameters from Meteorological Data. Atmospheric Dispersion Modelling Liaison Committee (ADMLC). Annual Report 2002-2003.
[28] Fangmeier A. et al. (1994). Effects of atmospheric ammonia on vegetation – a review. Environmental Pollution, 86, 43–82.
[29] Environment Agency (2014). Technical Guidance on Detailed Modelling Approach for an Appropriate Assessment for Emissions to Air.
[30] Chamberlin and Chadwick (1953). Deposition of Airborne Radioiodine Vapour. Nucleonics, 2, 22-25.

$F_d$ = dry deposition flux (µg $m^{-2}$ $s^{-1}$)

$v_d$ = deposition velocity (m $s^{-1}$)

$C(x,y,0)$ = ground level concentration in air (µg $m^{-3}$)

EA guidance AQTAG06[31] recommends deposition velocities for various pollutants dependent upon the habitat type, reproduced as **Table 6D.7**.

Table 6D.7 EA recommended deposition velocities

| Pollutant | Deposition velocity (m $s^{-1}$) | |
|---|---|---|
| | Grassland | Forest |
| $NO_2$ | 0.0015 | 0.003 |
| $SO_2$ | 0.012 | 0.024 |
| HCl | 0.025 | 0.06 |
| $NH_3$ | 0.02 | 0.03 |
| $HNO_3$ | 0.04 | 0.04 |
| $SO_4^{2-}$ (sulphate aerosol) | 0.01 | 0.01 |

For this assessment, the only ecological sites identified for assessment are ancient woodland, so the "forest" deposition velocities from **Table 6D.7** are used for all ecological receptors.

In order to assess the impacts of deposition, habitat-specific critical loads and critical levels have been created. These are generally defined similarly to:

*"…a quantitative estimate of exposure to one or more pollutants below which significant harmful effects on specified sensitive elements of the environment do not occur according to present knowledge."*[32]

It is important to distinguish between a critical load and a critical level. The critical load relates to the quantity of a material deposited from air to the ground, whilst critical levels refer to the concentration of a material in air. The UK APIS provides critical load data for designated ecological sites (SPAs, SACs and SSSIs) in the UK.

The critical loads used to assess the impact of compounds deposited to land which result in eutrophication and acidification are expressed in terms of kilograms of nitrogen deposited per hectare per year (kg N $ha^{-1}$ $y^{-1}$) and kilo-equivalents deposited per hectare per year (keq $ha^{-1}$ $y^{-1}$). The unit of 'equivalents' (eq) is used for the purposes of assessing acidification, rather than a unit of mass. The unit eq (1 keq = 1,000 eq) refers to molar equivalent of potential acidity resulting from (for example) sulphur and oxidised and reduced nitrogen, as well as base cations. Essentially, it means 'moles of charge' and is a measure of how acidifying a particular chemical species can be.

To convert the predicted concentration in air of $NO_2$, $SO_2$, $NH_3$, or $HNO_3$, the following formula is used:

$$DR_i = C_i \, v_{di} \, f_i$$

where:

$DR_i$ = annual deposition of N or S (kg N $ha^{-1}$ $y^{-1}$ or kg S $ha^{-1}$ $y^{-1}$)

[31] Fangmeier A. et al. (1994). Effects of atmospheric ammonia on vegetation – a review. Environmental Pollution, 86, 43–82.
[32] Nilsson J and Grennfelt P (Eds) (1988). Critical Loads for Sulphur and Nitrogen. Miljorapport 1988:15. Nordic Council of Ministers, Copenhagen.

$C_i$ = annual mean concentration of the $i$'th chemical species (µg m$^{-3}$)

$v_{di}$ = deposition velocity of $i$'th species (**Table 6D.7**)

$f_i$ = factor to convert from µg m$^{-2}$ s$^{-1}$ to kg ha$^{-1}$ y$^{-1}$ for the $i$'th species (**Table 6D.8**).

**Table 6D.8** provides the relevant fi conversion factors as extracted from AQTAG06[33].

Table 6D.8 EA factors for converting modelled deposition rates

| Pollutant | Conversion factor (µg m$^{-2}$ s$^{-1}$ to kg ha$^{-1}$ y$^{-1}$) | |
|---|---|---|
| | Element | Factor $f_i$ |
| $NO_2$ | N | 96 |
| $SO_2$ | S | 157.7 |
| $HNO_3$ | N | 70.1 |
| $NH_3$ | N | 259.7 |

In order to convert deposition of N or S to acid equivalents, the following relationships can be used:

1 keq ha$^{-1}$ y$^{-1}$ = 14 kg N ha$^{-1}$ y$^{-1}$; and

1 keq ha$^{-1}$ y$^{-1}$ = 16 kg S ha$^{-1}$ y$^{-1}$.

With respect to wet deposition, Environment Agency[34] states:

*"It is considered that wet deposition of $SO_2$, $NO_2$ and $NH_3$ is not significant within a short range."*

Therefore, the assessment only considers dry deposition of nutrifying and acidifying N and S compounds.

## Sensitivity analysis and uncertainty

### Sensitivity analysis

Wherever possible, this assessment has used worst-case scenarios, which will exaggerate the impact of the emissions on the surrounding area, including emissions, operational profile, ambient concentrations, meteorology, and surface roughness.

One of the key sources of uncertainty is weather conditions, and it is common practice for air quality assessments to model several years of meteorological ('met') data, with data reported from the year(s) predicting the highest ground-level concentrations at each receptor. Because airport operations, unlike most other sources of air pollution, are correlated with wind direction (since aircraft normally take off and land facing into the wind where possible), modelling multiple met years significantly increases the amount of work required of the modellers and the cost to the project.

Therefore, for this assessment, a more pragmatic and proportionate approach has been taken. A sensitivity study has been carried out using three met years of data, but with a simplified model of Luton Airport. The results of this sensitivity study are reported in **Section** Error! Reference source not found. of **Chapter 6** in

[33] Fangmeier A. et al. (1994). Effects of atmospheric ammonia on vegetation – a review. Environmental Pollution, 86, 43–82.
[34] Environment Agency (2016). Air emissions risk assessment for your environmental permit, [online]. Available at: https://www.gov.uk/guidance/air-emissions-risk-assessment-for-your-environmental-permit [Checked 22/03/2018].

**Volume 2: ES**, but the key conclusion is that, with suitable model adjustment, the 2017 met year produces consistently the highest concentrations at the key relevant receptors.

Therefore, it is considered sufficient to carry out the full modelling for the assessment using 2017 met data only, with the adjustment factor as indicated by the sensitivity study to ensure that uncertainty due to met variation is treated conservatively.

### Model uncertainty

Emissions have been modelled under expected operation using the standard steady state algorithms in ADMS to determine the impact on local receptors. In order to model atmospheric dispersion using standard Gaussian methods, the following assumptions and limitations have to be made:

- Conservation of mass: the entire mass of emitted pollutant remains in the atmosphere and no allowance is made for loss due to chemical reactions or deposition processes (although the standard Gaussian model can be modified to include such processes). Portions of the plume reaching the ground are assumed to be dispersed back away from the ground by turbulent eddies (eddy reflection);
- Steady state emissions: emission rates are assumed to be constant and continuous over the time averaging period of interest; and
- Steady state meteorology: no variations in wind speed, direction or turbulent profiles occur during transport from the source to the receptor. This assumption is reasonable within a few kilometres of a source but may not be valid for receptor distances in the order of tens of kilometres. For example, for a receptor 50 km from a source and with a wind speed of 5 m $s^{-3}$ it will take nearly three hours for the plume to travel this distance during which time many different processes may change (e.g., the sun may rise or set and clouds may form or dissipate affecting the turbulent profiles). For this reason, Gaussian models are practically limited to predicting concentrations within ~20 km of a source.

As a result of the above, and in combination with other factors, not least attempting to replicate stochastic processes (e.g., turbulence) by deterministic methods, dispersion modelling is inherently uncertain, but is nonetheless a useful tool in plume footprint visualisation and prediction of ground level concentrations. Dispersion models have been widely used in the UK for both regulatory and compliance purposes for a number of years and this is an accepted approach for this type of assessment.

This assessment has incorporated a number of worst-case assumptions, which will result in an overestimation of the predicted ground level concentrations from the operation. As a result of these worst-case assumptions, the predicted results should be considered the upper limit of model uncertainty for a scenario where the actual site impact is determined. Therefore, the actual predicted ground level concentrations would be expected to be lower than those reported in this assessment and, in some cases, significantly lower.

## Significance criteria

### Human receptors

Although no official procedure exists for classifying the magnitude and significance of air quality effects from a new development, guidance issued by the IAQM/EPUK[35] suggests ways to address the issue. In the EPUK guidance, the magnitude of impact due to an increase/decrease in annual mean $NO_2$ is described using the criteria in **Table 6D.9**. These criteria take into account both the change in concentration at a receptor

[35] EPUK and IAQM (2017). Land-use Planning and Development Control: Planning for Air Quality, v1.2, [online]. Available at: http://www.iaqm.co.uk/text/guidance/air-quality-planning-guidance.pdf [Checked 22/03/2018].

brought about by a new development as a percentage of the assessment level, and the actual concentration at that receptor.

The guidance makes clear that the purpose of these descriptors is to provide a common language for describing the impacts of a development. It says:

> *"The overall significance is determined using professional judgement. For example, a 'moderate' adverse impact at one receptor may not mean that the overall impact has a significant effect. Other factors need to be considered."*

Table 6D.9 Impact descriptors for increases in annual mean $NO_2$ concentration (assessment level = 40 µg $m^{-3}$)

| **Absolute concentration with scheme, relative to assessment level** | **Increase in concentration relative to assessment level** | | | | |
|---|---|---|---|---|---|
| | **0% (<0.2 µg $m^{-3}$)** | **1% (0.2-0.6 µg $m^{-3}$)** | **2–5% (0.6-2.2 µg $m^{-3}$)** | **6-10% (2.2-4.0 µg $m^{-3}$)** | **>10% (>4.0 µg $m^{-3}$)** |
| **75% or less (<30.2 µg $m^{-3}$)** | Negligible | Negligible | Negligible | Slight | Moderate |
| **76–94% (30.2–37.8 µg $m^{-3}$)** | Negligible | Negligible | Slight | Moderate | Moderate |
| **95–102% (37.8–41.0 µg $m^{-3}$)** | Negligible | Slight | Moderate | Moderate | Substantial |
| **103–109% (41.0–43.8 µg $m^{-3}$)** | Negligible | Moderate | Moderate | Substantial | Substantial |
| **110% or more (>43.8 µg $m^{-3}$)** | Negligible | Moderate | Substantial | Substantial | Substantial |

The table is intended to be used by calculating percentages relative to the assessment level and then rounding the percentages to whole numbers. For convenience, the above table gives equivalent absolute concentrations for the case where the assessment level is 40 µg $m^{-3}$ (e.g. for annual mean $NO_2$ or annual mean $PM_{10}$).

### Ecological receptors

EA guidance gives criteria for screening outsource contributions in the context of environmental permit applications. Although intended for use in evaluating permit applications for sources regulated by the EA, it is often used for planning applications where no better guidance is available (particularly for ecological receptors). This guidance suggests applicants first perform a screening assessment and, if the results of that do not meet the screening-out criteria, then perform a detailed modelling assessment.

This guidance also introduces the terms 'process contribution' (PC), meaning the concentration or deposition rate resulting from the development activities only, excluding other sources, and 'predicted environmental concentration' (PEC), meaning the total modelled concentration, equal to the PC plus the background contribution from all other sources. These terms are commonly used in air quality assessments, even where the term 'process' is not strictly accurate, and so are used in this assessment with 'process' referring to the Proposed Scheme. The term PEC is also used to describe total deposition rates.

For Special Protection Areas (SPAs), Special Areas of Conservation (SACs), Ramsar sites and Sites of Special Scientific Interest (SSSIs) (collectively referred to in this document as 'major ecological sites'), there is no need for further assessment if the screening calculation finds that:

- both the following are met:

- the short-term PC is less than 10% of the short-term AQAL; and
- the long-term PC is less than 1% of the long-term AQAL;

- or:
  - the long-term PEC is less than 70% of the long-term AQAL.

For local nature sites (ancient woodland, local wildlife sites and national and local nature reserves), emissions are insignificant if:

- the short-term PC is less than 100% of the short-term AQAL; and
- the long-term PC is less than 100% of the long-term AQAL.

Following detailed dispersion modelling, no further action is required if:

- the proposed emissions comply with Best Available Technique (BAT) associated emission levels (AELs) or the equivalent requirements where there is no BAT AEL; and
- the resulting PECs will not exceed AQALs.

IAQM guidance[36] provides further suggestions on circumstances where there is definitely an insignificant effect on a site in relation to the Habitats Directive. This guidance notes that the EA criteria above are commonly used in air quality assessments, but notes that:

> *"In the IAQM's opinion, the 1% and 10% screening criteria should not be used rigidly and, not to a numerical precision greater than the expression of the criteria themselves. Whilst it is straightforward to generate model results for the PC to any level of precision required, the accuracy of the result is much less certain and it is unwise to place too much emphasis on whether the PC is 0.9% or 1.1%, for example. In practice, because the magnitude of impacts attributable to new sources is often around 1% of the criterion, a regulator may require the results to be presented at greater resolution, i.e. having one (or more) decimal places. The distinction here is between the presentation of the model results and the weight given to fine differences around the criterion itself in making a judgement.*
>
> *"It is important to remember that a change of more than 1% does not necessarily indicate that a significant effect (or adverse effect on integrity) will occur; it simply means that the change in concentration or deposition rate cannot in itself be described as numerically inconsequential or imperceptible and therefore requires further consideration."*

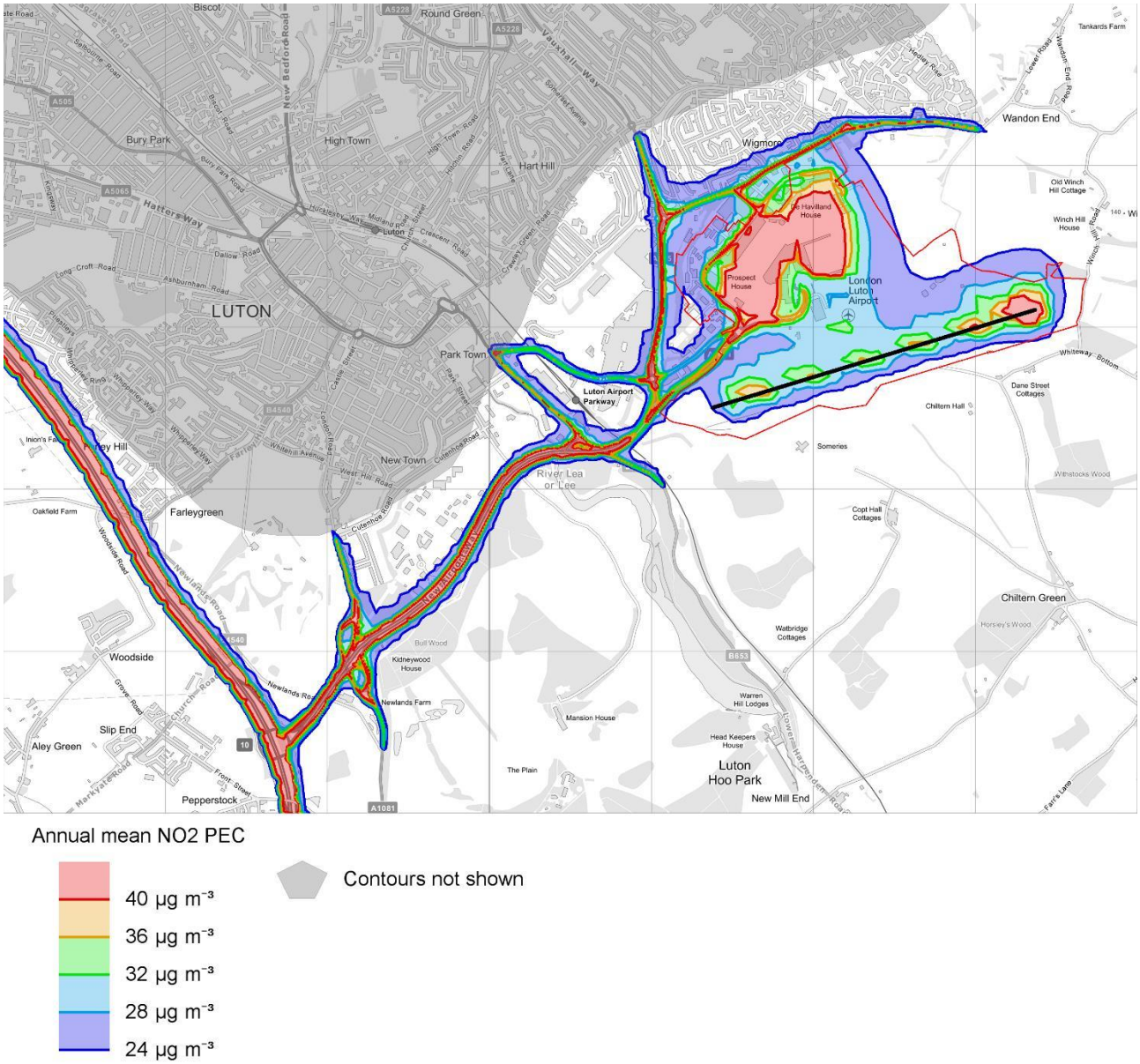
## 2017 model evaluation

This section sets out the results of the dispersion modelling for 2017 and compares predicted ground level concentrations against monitoring data. The purpose of this section is to evaluate the performance of the modelling, so only key results are presented.

A contour plot of modelled annual mean $NO_2$ concentrations is given in **Figure 6D.5**. The contour plot shows the contribution from the airfield and from the modelled roads clearly above the background, demonstrating that these contributions fall quickly with distance and reach background levels within a few hundred metres of the airfield and within a few tens of metres of roads. It also shows that concentrations above 40 µg $m^{-3}$ (the AQAL for annual mean $NO_2$) are confined to the airfield (where the AQAL does not apply as there is no long-term public exposure), close to the carriageway of the M1 motorway, and within the carriageways of certain major roads such as New Airport Way and Vauxhall Way (where again the AQAL does not apply).

[36] Institute of Air Quality Management (2019) A guide to the assessment of air quality impacts on designated nature conservation sites. Version 1.0, June 2019.

Figure 6D.5 Modelled annual mean $NO_2$, 2017



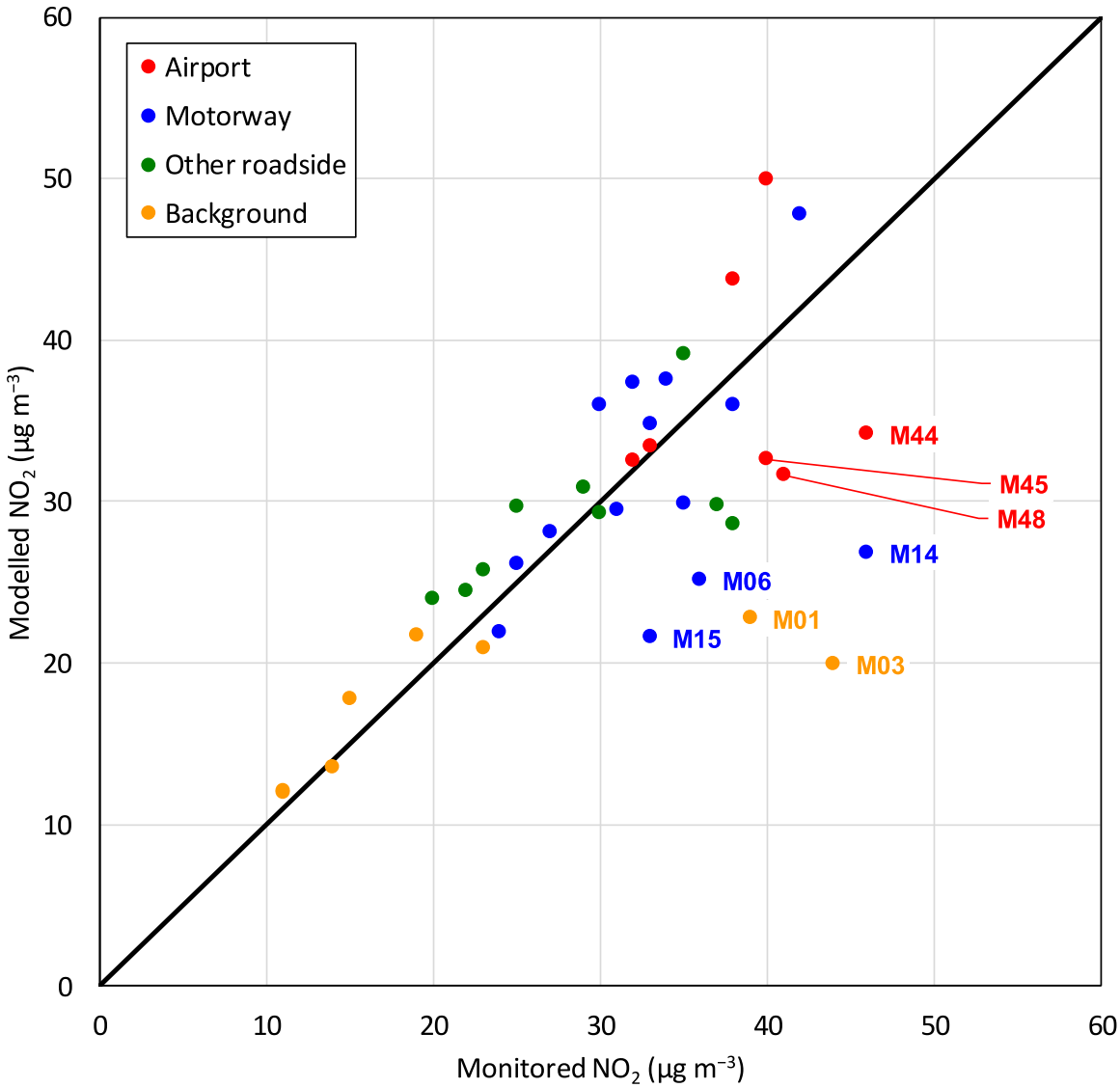

Modelled annual mean $NO_2$ concentrations are shown in **Table 6D.10** for those long-term human receptors and monitoring locations where the concentration is over 36 µg $m^{-3}$ (i.e. 10% below the assessment level). This threshold is commonly used as an indicator that there may be a risk of exceeding the AQAL.

Table 6D.10 Modelled annual mean $NO_2$ concentrations where greater than 36 µg $m^{-3}$, 2017 model evaluation case

| Receptor ID | Description | AQAL (µg $m^{-3}$) | PEC (µg $m^{-3}$) | PEC (% of AQAL) |
|---|---|---|---|---|
| **H83** | M1 North | 40 | 36.1 | 90.3% |
| **M16** | LN54 M1 Corner Bagshawe Court F.F. | 40 | 37.5 | 93.8% |
| **M20** | LN82 11 Withy Close | 40 | 37.3 | 93.3% |
| **M24** | LN86 Bradley Road (by M1 Bridge) | 40 | 47.8 | 119.4% |
| **M29** | LLA 5 (LA05) Adjacent to Stand 5 | 40 | 49.9 | 124.9% |
| **M30** | LLA 6 (LA06) President Way Jct | 40 | 39.1 | 97.6% |
| **M36** | LLA 12 (LA14) Adjacent to Stand 60 | 40 | 43.7 | 109.2% |
| **M41** | LLA 17 A1081 New Airport Way 1 | 40 | 37.2 | 93.1% |

Modelled annual mean $NO_2$ concentrations at the monitors are compared with measurements in **Table 6D.11** and in **Figure 6D.6**. In the figure, points on the diagonal line are receptors where the modelled concentration exactly agrees with the monitored concentration; points above the line are over-predicted, and those below the line are under-predicted. It should be noted that the model has been adjusted to give the best fit at the monitors close to the modelled roads (see **Appendix 6D** in **Volume 3: Figures and Appendices**), but this will make little difference at background or airport monitors.

Figure 6D.6 Modelled versus monitored annual mean $NO_2$, 2017




7.1.1 It should also be noted that the monitoring results, especially the diffusion tubes, are also subject to uncertainty. Uncertainty in annual mean $NO_2$ monitored by the continuous monitors is around 10–15%, and uncertainty in annual means from diffusion tubes is around 25%[37].

7.1.2 Overall, there is good agreement between modelled and monitored concentrations, with slightly more overpredicted sites than underpredicted, although there are some receptors where the underprediction is relatively large (discussed below). This is reflected by a regression line forced through the origin, which has a slope of 0.91, indicating a slight tendency to under predict, and a coefficient of determination ($R^2$) of 0.32.

7.1.3 Some sites show large underpredictions because they are close to roads which have little airport-related traffic, and which have therefore not been modelled. These are M01, which represents the Dunstable Road east (town centre) continuous monitoring station, and M03, which represents the

[37] AEA Energy & Environment (2008). Diffusion Tubes for Ambient NO2 Monitoring: Practical Guidance, AEA/ENV/R/2504 Issue 1a.

Defra continuous monitor next to the A505. Underprediction at these sites is therefore to be expected. Removing these two points increases the $R^2$ to 0.51.

7.1.4 Although the motorway sites are generally well predicted, there is some underprediction at a few locations. One is M14, which is a diffusion tube on a lamppost beside Luton Road where it passes under the motorway, and again the contribution from this road has not been modelled. Another is M06, which is close to the Junction 11 slip road. There is no obvious reason why M15 might be expected to be underpredicted.

7.1.5 The three most underpredicted receptors at the airport are M44, representing the LA07 Terminal Car Park diffusion tube, M45, representing the LA16 Set Down Area, and M48 representing the LA20 Short Term Car Park. This suggests that they are affected by local emissions sources which are unlikely to have a material contribution off the airport.

7.1.6 At other monitoring locations off the airport, including both roadside and background locations, the model gives good agreement with a slight tendency to overpredict, i.e. to be conservative.

7.1.7 It is therefore concluded that the model is suitable for forecasting the impacts from the Proposed Scheme and associated traffic at key receptors without further adjustment.

Table 6D.11 Modelled versus monitored annual mean $NO_2$, 2017

| Receptor ID | Description | Monitored $NO_2$ ($\mu g\ m^{-3}$) | Modelled $NO_2$ ($\mu g\ m^{-3}$) | Percentage difference |
|---|---|---|---|---|
| **M01** | LN60 (HB007) Dunstable Road East | 39 | 22.8 | -42% |
| **M02** | LA08 (HB006) London Luton Airport | N/A | 32.5 | N/A |
| **M03** | CM2 (LUTR; UKA00605) Luton A505 Roadside (AURN) | 44 | 19.9 | -55% |
| **M04** | LN15 Armitage Garden | 30 | 36.0 | 20% |
| **M05** | LN16 Belper Road | 35 | 29.9 | -15% |
| **M06** | LN17 Wyndham Road | 36 | 25.1 | -30% |
| **M07** | LN18 Copperfields | 24 | 21.9 | -9% |
| **M08** | LN22 1 Mistletoe Hill | 23 | 25.8 | 12% |
| **M09** | LN23 Eaton Green Road 1 | 37 | 29.7 | -20% |
| **M10** | LN24 19 Barnston Close | 22 | 24.4 | 11% |
| **M11** | LN25 Eaton Green Road 2 | 29 | 30.9 | 6% |
| **M12** | LN26 8 Keeble Close | 20 | 24.0 | 20% |
| **M13** | LN27 Eaton Green Road 3 | 30 | 29.3 | -2% |
| **M14** | LN28 Caddington Road | 46 | 26.8 | -42% |
| **M15** | LN53 3rd Floor Bagshawe Court F.F. | 33 | 21.6 | -35% |
| **M16** | LN54 M1 Corner Bagshawe Court F.F. | 34 | 37.5 | 10% |
| **M17** | LN55 M1 Corner Wyatt Court FF | 33 | 34.8 | 5% |

| Receptor ID | Description | Monitored $NO_2$ ($\mu g\ m^{-3}$) | Modelled $NO_2$ ($\mu g\ m^{-3}$) | Percentage difference |
|---|---|---|---|---|
| **M18** | LN56 20 Wyatt Court FF | 31 | 29.5 | -5% |
| **M19** | LN81 Bank Close | 38 | 35.9 | -6% |
| **M20** | LN82 11 Withy Close | 32 | 37.3 | 17% |
| **M21** | LN83 b/h 9 Copperfields | 25 | 26.1 | 4% |
| **M22** | LN84 97 Lime Avenue | 27 | 28.1 | 4% |
| **M23** | LN85 26 Belper Road | N/A | 34.4 | N/A |
| **M24** | LN86 Bradley Road (by M1 Bridge) | 42 | 47.8 | 14% |
| **M25** | LLA 1 Outside Zone 2 | N/A | 32.2 | N/A |
| **M26** | LLA 2 (LA02) Airport Approach Road | 38 | 28.6 | -25% |
| **M27** | LLA 3 (LA03) Runway Threshold Western | 23 | 20.9 | -9% |
| **M28** | LLA 4 (LA04) Runway Threshold Eastern | 19 | 21.7 | 14% |
| **M29** | LLA 5 (LA05) Adjacent to Stand 5 | 40 | 49.9 | 25% |
| **M30** | LLA 6 (LA06) President Way Jct | 35 | 39.1 | 12% |
| **M31** | LLA 7 Drop Off Zone | N/A | 27.4 | N/A |
| **M32** | LLA 8 (LA08) BAM Co-located | 32 | 32.5 | 2% |
| **M33** | LLA 9 (LA09) Stagenhoe Bottom Farm | 11 | 12.0 | 9% |
| **M34** | LLA 10 (LA10) Grove Farm Slip End | 11 | 12.0 | 9% |
| **M35** | LLA 11 (LA17) Dane End | 15 | 17.8 | 18% |
| **M36** | LLA 12 (LA14) Adjacent to Stand 60 | 38 | 43.7 | 15% |
| **M37** | LLA 13 (LA15) Eaton Green Road | 25 | 29.7 | 19% |
| **M38** | LLA 14 Undercroft Access Road | N/A | 33.9 | N/A |
| **M39** | LLA 15 Eaton Green Road – EasyJet CP | N/A | 32.2 | N/A |
| **M40** | LLA 16 Exit Road Plaza | N/A | 29.1 | N/A |
| **M41** | LLA 17 A1081 New Airport Way 1 | N/A | 37.2 | N/A |
| **M42** | LLA 18 A1081 New Airport Way 2 | N/A | 30.9 | N/A |
| **M43** | LA01 Terminal Patio | 33 | 33.3 | 1% |
| **M44** | LA07 Terminal Car Park | 46 | 34.2 | -26% |
| **M45** | LA16 Set Down Area | 40 | 32.6 | -19% |
| **M46** | LA18 Breachwood Green | 14 | 13.5 | -4% |
| **M47** | LA19 Kensworth | N/A | 11.1 | N/A |

| Receptor ID | Description | Monitored $NO_2$ ($\mu g\ m^{-3}$) | Modelled $NO_2$ ($\mu g\ m^{-3}$) | Percentage difference |
|---|---|---|---|---|
| **M48** | LA20 Short Term Car Park | 41 | 31.6 | -23% |
| **M49** | Supersite | N/A | 21.9 | N/A |

# Appendix 6E
# Air quality - Full results

This appendix provides calculated concentrations and deposition rates at all relevant modelled receptors for the operational phase. It presents tables of the following results:

- human receptors:
  - annual mean $NO_2$;
  - annual mean $PM_{10}$;
  - annual mean $PM_{2.5}$;
- ecological receptors:
  - annual mean $NO_x$;
  - nitrogen (N) deposition;
  - acid deposition; and
  - comparison with the acidity critical load function.

Results are given as Process Contribution (PC), i.e. the contribution to the concentration or deposition rate due to the Proposed Scheme, and as Predicted Environmental Concentration (PEC), i.e. the total concentration or deposition rate. Results are compared against the relevant Air Quality Assessment Level (AQAL; objective, standard, critical level, critical load etc.), which may be receptor-specific.

Please note that results are given to several decimal places. This is to enable comparison between receptors and between PC and PEC contributions. The number of decimal places should not be taken as providing any indication of the accuracy of the results.

Table 6E.1 PCs and PECs for annual mean $NO_2$

| Receptor | AQAL (µg m$^{-3}$) | PC (µg m$^{-3}$) | PEC (µg m$^{-3}$) | PC (% of AQAL) | PEC (% of AQAL) | Impact |
|---|---|---|---|---|---|---|
| **H01** | 40 | 0.11 | 13.55 | 0.3% | 33.9% | Negligible |
| **H02** | 40 | 0.06 | 17.83 | 0.1% | 44.6% | Negligible |
| **H03** | 40 | 0.07 | 15.72 | 0.2% | 39.3% | Negligible |
| **H04** | 40 | 0.07 | 15.58 | 0.2% | 39.0% | Negligible |
| **H05** | 40 | 0.08 | 15.98 | 0.2% | 40.0% | Negligible |
| **H06** | 40 | 0.10 | 19.66 | 0.3% | 49.2% | Negligible |
| **H07** | 40 | 0.15 | 22.01 | 0.4% | 55.0% | Negligible |
| **H08** | 40 | 0.14 | 19.94 | 0.4% | 49.9% | Negligible |
| **H09** | 40 | 0.15 | 23.87 | 0.4% | 59.7% | Negligible |

| Receptor | AQAL (µg m$^{-3}$) | PC (µg m$^{-3}$) | PEC (µg m$^{-3}$) | PC (% of AQAL) | PEC (% of AQAL) | Impact |
|---|---|---|---|---|---|---|
| **H10** | 40 | 0.16 | 22.58 | 0.4% | 56.5% | Negligible |
| **H11** | 40 | 0.19 | 22.19 | 0.5% | 55.5% | Negligible |
| **H12** | 40 | 0.18 | 22.08 | 0.4% | 55.2% | Negligible |
| **H13** | 40 | 0.19 | 22.04 | 0.5% | 55.1% | Negligible |
| **H14** | 40 | 0.19 | 21.89 | 0.5% | 54.7% | Negligible |
| **H15** | 40 | 0.20 | 22.15 | 0.5% | 55.4% | Negligible |
| **H16** | 40 | 0.20 | 22.78 | 0.5% | 57.0% | Negligible |
| **H17** | 40 | 0.21 | 22.75 | 0.5% | 56.9% | Negligible |
| **H18** | 40 | 0.22 | 23.23 | 0.5% | 58.1% | Negligible |
| **H19** | 40 | 0.22 | 24.07 | 0.5% | 60.2% | Negligible |
| **H20** | 40 | 0.22 | 23.53 | 0.6% | 58.8% | Negligible |
| **H21** | 40 | 0.24 | 25.88 | 0.6% | 64.7% | Negligible |
| **H22** | 40 | 0.24 | 27.05 | 0.6% | 67.6% | Negligible |
| **H23** | 40 | 0.25 | 26.54 | 0.6% | 66.4% | Negligible |
| **H24** | 40 | 0.25 | 25.62 | 0.6% | 64.1% | Negligible |
| **H25** | 40 | 0.25 | 24.76 | 0.6% | 61.9% | Negligible |
| **H26** | 40 | 0.25 | 24.63 | 0.6% | 61.6% | Negligible |
| **H27** | 40 | 0.26 | 24.59 | 0.7% | 61.5% | Negligible |
| **H28** | 40 | 0.26 | 24.80 | 0.7% | 62.0% | Negligible |
| **H29** | 40 | 0.28 | 21.85 | 0.7% | 54.6% | Negligible |
| **H30** | 40 | 0.28 | 23.01 | 0.7% | 57.5% | Negligible |
| **H31** | 40 | 0.29 | 24.55 | 0.7% | 61.4% | Negligible |
| **H32** | 40 | 0.32 | 22.53 | 0.8% | 56.3% | Negligible |
| **H33** | 40 | 0.31 | 21.32 | 0.8% | 53.3% | Negligible |
| **H34** | 40 | 0.32 | 21.17 | 0.8% | 52.9% | Negligible |
| **H35** | 40 | 0.32 | 21.67 | 0.8% | 54.2% | Negligible |
| **H36** | 40 | 0.35 | 24.59 | 0.9% | 61.5% | Negligible |
| **H37** | 40 | 0.35 | 24.61 | 0.9% | 61.5% | Negligible |
| **H38** | 40 | 0.35 | 21.83 | 0.9% | 54.6% | Negligible |
| **H39** | 40 | 0.35 | 23.93 | 0.9% | 59.8% | Negligible |

| Receptor | AQAL (µg m$^{-3}$) | PC (µg m$^{-3}$) | PEC (µg m$^{-3}$) | PC (% of AQAL) | PEC (% of AQAL) | Impact |
|---|---|---|---|---|---|---|
| **H40** | 40 | 0.35 | 21.99 | 0.9% | 55.0% | Negligible |
| **H41** | 40 | 0.36 | 22.26 | 0.9% | 55.7% | Negligible |
| **H42** | 40 | 0.35 | 23.17 | 0.9% | 57.9% | Negligible |
| **H43** | 40 | 0.34 | 20.12 | 0.9% | 50.3% | Negligible |
| **H44** | 40 | 0.35 | 22.23 | 0.9% | 55.6% | Negligible |
| **H45** | 40 | 0.33 | 20.17 | 0.8% | 50.4% | Negligible |
| **H46** | 40 | 0.29 | 19.89 | 0.7% | 49.7% | Negligible |
| **H47** | 40 | 0.28 | 20.29 | 0.7% | 50.7% | Negligible |
| **H48** | 40 | 0.28 | 21.17 | 0.7% | 52.9% | Negligible |
| **H49** | 40 | 0.27 | 19.23 | 0.7% | 48.1% | Negligible |
| **H50** | 40 | 0.27 | 19.42 | 0.7% | 48.6% | Negligible |
| **H51** | 40 | 0.26 | 19.43 | 0.6% | 48.6% | Negligible |
| **H52** | 40 | 0.25 | 19.02 | 0.6% | 47.6% | Negligible |
| **H53** | 40 | 0.23 | 19.61 | 0.6% | 49.0% | Negligible |
| **H54** | 40 | 0.23 | 19.78 | 0.6% | 49.5% | Negligible |
| **H55** | 40 | 0.22 | 17.99 | 0.5% | 45.0% | Negligible |
| **H56** | 40 | 0.22 | 18.21 | 0.6% | 45.5% | Negligible |
| **H57** | 40 | 0.21 | 18.07 | 0.5% | 45.2% | Negligible |
| **H58** | 40 | 0.21 | 17.47 | 0.5% | 43.7% | Negligible |
| **H59** | 40 | 0.34 | 17.92 | 0.9% | 44.8% | Negligible |
| **H60** | 40 | 0.27 | 17.16 | 0.7% | 42.9% | Negligible |
| **H61** | 40 | 0.17 | 14.69 | 0.4% | 36.7% | Negligible |
| **H62** | 40 | 0.19 | 16.03 | 0.5% | 40.1% | Negligible |
| **H63** | 40 | 0.13 | 19.08 | 0.3% | 47.7% | Negligible |
| **H64** | 40 | 0.08 | 11.21 | 0.2% | 28.0% | Negligible |
| **H65** | 40 | 0.08 | 11.11 | 0.2% | 27.8% | Negligible |
| **H66** | 40 | 0.07 | 10.78 | 0.2% | 27.0% | Negligible |
| **H67** | 40 | 0.09 | 11.09 | 0.2% | 27.7% | Negligible |
| **H68** | 40 | 0.29 | 15.49 | 0.7% | 38.7% | Negligible |
| **H69** | 40 | 0.38 | 16.48 | 0.9% | 41.2% | Negligible |

| Receptor | AQAL (µg m$^{-3}$) | PC (µg m$^{-3}$) | PEC (µg m$^{-3}$) | PC (% of AQAL) | PEC (% of AQAL) | Impact |
|---|---|---|---|---|---|---|
| **H70** | 40 | 0.09 | 11.11 | 0.2% | 27.8% | Negligible |
| **H71** | 40 | 0.08 | 10.40 | 0.2% | 26.0% | Negligible |
| **H72** | 40 | 0.06 | 10.08 | 0.2% | 25.2% | Negligible |
| **H73** | 40 | 0.05 | 9.64 | 0.1% | 24.1% | Negligible |
| **H74** | 40 | 0.07 | 10.04 | 0.2% | 25.1% | Negligible |
| **H75** | 40 | 0.09 | 10.64 | 0.2% | 26.6% | Negligible |
| **H76** | 40 | 0.42 | 15.97 | 1.1% | 39.9% | Negligible |
| **H77** | 40 | 0.38 | 15.65 | 1.0% | 39.1% | Negligible |
| **H78** | 40 | 0.24 | 15.22 | 0.6% | 38.1% | Negligible |
| **H79** | 40 | 0.10 | 11.82 | 0.2% | 29.6% | Negligible |
| **H80** | 40 | 0.19 | 15.26 | 0.5% | 38.2% | Negligible |
| **H81** | 40 | 0.24 | 15.95 | 0.6% | 39.9% | Negligible |
| **H82** | 40 | 0.11 | 12.84 | 0.3% | 32.1% | Negligible |
| **H83** | 40 | 0.66 | 21.99 | 1.7% | 55.0% | Negligible |
| **H84** | 40 | 0.29 | 15.86 | 0.7% | 39.7% | Negligible |
| **H85** | 40 | 0.32 | 16.31 | 0.8% | 40.8% | Negligible |
| **H86** | 40 | 0.20 | 15.05 | 0.5% | 37.6% | Negligible |
| **H87** | 40 | 0.40 | 18.06 | 1.0% | 45.2% | Negligible |
| **H88** | 40 | 0.27 | 14.80 | 0.7% | 37.0% | Negligible |
| **H89** | 40 | 0.43 | 17.35 | 1.1% | 43.4% | Negligible |
| **H90** | 40 | 0.21 | 14.80 | 0.5% | 37.0% | Negligible |
| **H91** | 40 | 0.08 | 10.62 | 0.2% | 26.6% | Negligible |
| **H92** | 40 | 0.11 | 10.21 | 0.3% | 25.5% | Negligible |
| **H93** | 40 | 0.28 | 12.18 | 0.7% | 30.5% | Negligible |
| **H94** | 40 | 0.10 | 17.02 | 0.2% | 42.6% | Negligible |
| **H95** | 40 | 0.12 | 16.73 | 0.3% | 41.8% | Negligible |
| **H96** | 40 | 0.12 | 20.34 | 0.3% | 50.9% | Negligible |
| **H97** | 40 | 0.10 | 18.02 | 0.2% | 45.1% | Negligible |
| **H98** | 40 | 0.47 | 18.96 | 1.2% | 47.4% | Negligible |
| **H99** | 40 | 0.05 | 21.31 | 0.1% | 53.3% | Negligible |

| Receptor | AQAL (µg m$^{-3}$) | PC (µg m$^{-3}$) | PEC (µg m$^{-3}$) | PC (% of AQAL) | PEC (% of AQAL) | Impact |
|---|---|---|---|---|---|---|
| **S01*** | N/A | 0.10 | 20.48 | N/A | N/A | N/A |
| **S02*** | N/A | 0.11 | 17.72 | N/A | N/A | N/A |
| **S03*** | N/A | 0.54 | 21.97 | N/A | N/A | N/A |
| **S04*** | N/A | 0.50 | 21.69 | N/A | N/A | N/A |
| **S05*** | N/A | 0.36 | 19.62 | N/A | N/A | N/A |
| **S06*** | N/A | 0.36 | 24.26 | N/A | N/A | N/A |
| **S07*** | N/A | 0.37 | 32.08 | N/A | N/A | N/A |
| **S08*** | N/A | 0.38 | 35.30 | N/A | N/A | N/A |
| **S09*** | N/A | 0.36 | 34.63 | N/A | N/A | N/A |
| **S10*** | N/A | 0.37 | 30.64 | N/A | N/A | N/A |
| **S11*** | N/A | 0.38 | 29.42 | N/A | N/A | N/A |
| **S12*** | N/A | 0.33 | 15.07 | N/A | N/A | N/A |
| **S13*** | N/A | 0.28 | 16.18 | N/A | N/A | N/A |

* Results for receptors S01–S13 are presented for comparison with the short-term (hourly) AQAL only. The annual mean AQAL does not apply at these receptors.

Table 6E.2 PCs and PECs for annual mean $PM_{10}$

| Receptor | AQAL (µg m$^{-3}$) | PC (µg m$^{-3}$) | PEC (µg m$^{-3}$) | PC (% of AQAL) | PEC (% of AQAL) | Impact |
|---|---|---|---|---|---|---|
| **H01** | 40 | 0.03 | 16.52 | 0.1% | 41.3% | Negligible |
| **H02** | 40 | 0.01 | 16.43 | 0.0% | 41.1% | Negligible |
| **H03** | 40 | 0.01 | 15.87 | 0.0% | 39.7% | Negligible |
| **H04** | 40 | 0.01 | 15.83 | 0.0% | 39.6% | Negligible |
| **H05** | 40 | 0.01 | 16.19 | 0.0% | 40.5% | Negligible |
| **H06** | 40 | 0.02 | 17.48 | 0.0% | 43.7% | Negligible |
| **H07** | 40 | 0.01 | 15.96 | 0.0% | 39.9% | Negligible |
| **H08** | 40 | 0.01 | 15.55 | 0.0% | 38.9% | Negligible |
| **H09** | 40 | 0.01 | 16.39 | 0.0% | 41.0% | Negligible |
| **H10** | 40 | 0.01 | 16.27 | 0.0% | 40.7% | Negligible |
| **H11** | 40 | 0.01 | 16.15 | 0.0% | 40.4% | Negligible |
| **H12** | 40 | 0.01 | 16.10 | 0.0% | 40.3% | Negligible |

| Receptor | AQAL (µg m$^{-3}$) | PC (µg m$^{-3}$) | PEC (µg m$^{-3}$) | PC (% of AQAL) | PEC (% of AQAL) | Impact |
|---|---|---|---|---|---|---|
| **H13** | 40 | 0.01 | 16.07 | 0.0% | 40.2% | Negligible |
| **H14** | 40 | 0.01 | 16.00 | 0.0% | 40.0% | Negligible |
| **H15** | 40 | 0.01 | 16.06 | 0.0% | 40.1% | Negligible |
| **H16** | 40 | 0.01 | 16.22 | 0.0% | 40.6% | Negligible |
| **H17** | 40 | 0.01 | 16.17 | 0.0% | 40.4% | Negligible |
| **H18** | 40 | 0.01 | 16.27 | 0.0% | 40.7% | Negligible |
| **H19** | 40 | 0.01 | 16.43 | 0.0% | 41.1% | Negligible |
| **H20** | 40 | 0.01 | 16.19 | 0.0% | 40.5% | Negligible |
| **H21** | 40 | 0.02 | 16.86 | 0.0% | 42.1% | Negligible |
| **H22** | 40 | 0.02 | 17.27 | 0.0% | 43.2% | Negligible |
| **H23** | 40 | 0.02 | 17.10 | 0.0% | 42.8% | Negligible |
| **H24** | 40 | 0.02 | 16.81 | 0.0% | 42.0% | Negligible |
| **H25** | 40 | 0.02 | 16.53 | 0.0% | 41.3% | Negligible |
| **H26** | 40 | 0.02 | 16.49 | 0.0% | 41.2% | Negligible |
| **H27** | 40 | 0.02 | 16.46 | 0.0% | 41.2% | Negligible |
| **H28** | 40 | 0.02 | 16.50 | 0.0% | 41.3% | Negligible |
| **H29** | 40 | 0.02 | 16.32 | 0.0% | 40.8% | Negligible |
| **H30** | 40 | 0.02 | 16.66 | 0.0% | 41.6% | Negligible |
| **H31** | 40 | 0.02 | 17.13 | 0.1% | 42.8% | Negligible |
| **H32** | 40 | 0.02 | 16.43 | 0.1% | 41.1% | Negligible |
| **H33** | 40 | 0.02 | 16.07 | 0.1% | 40.2% | Negligible |
| **H34** | 40 | 0.02 | 16.03 | 0.1% | 40.1% | Negligible |
| **H35** | 40 | 0.02 | 16.17 | 0.1% | 40.4% | Negligible |
| **H36** | 40 | 0.03 | 17.07 | 0.1% | 42.7% | Negligible |
| **H37** | 40 | 0.03 | 17.07 | 0.1% | 42.7% | Negligible |
| **H38** | 40 | 0.03 | 15.80 | 0.1% | 39.5% | Negligible |
| **H39** | 40 | 0.03 | 16.46 | 0.1% | 41.1% | Negligible |
| **H40** | 40 | 0.03 | 15.86 | 0.1% | 39.6% | Negligible |
| **H41** | 40 | 0.03 | 15.94 | 0.1% | 39.9% | Negligible |
| **H42** | 40 | 0.03 | 16.24 | 0.1% | 40.6% | Negligible |

| Receptor | AQAL (µg m$^{-3}$) | PC (µg m$^{-3}$) | PEC (µg m$^{-3}$) | PC (% of AQAL) | PEC (% of AQAL) | Impact |
|---|---|---|---|---|---|---|
| **H43** | 40 | 0.02 | 15.33 | 0.1% | 38.3% | Negligible |
| **H44** | 40 | 0.03 | 15.97 | 0.1% | 39.9% | Negligible |
| **H45** | 40 | 0.02 | 15.31 | 0.1% | 38.3% | Negligible |
| **H46** | 40 | 0.02 | 15.48 | 0.0% | 38.7% | Negligible |
| **H47** | 40 | 0.02 | 15.66 | 0.0% | 39.1% | Negligible |
| **H48** | 40 | 0.02 | 15.95 | 0.0% | 39.9% | Negligible |
| **H49** | 40 | 0.02 | 15.36 | 0.0% | 38.4% | Negligible |
| **H50** | 40 | 0.02 | 15.43 | 0.0% | 38.6% | Negligible |
| **H51** | 40 | 0.02 | 15.44 | 0.0% | 38.6% | Negligible |
| **H52** | 40 | 0.01 | 15.34 | 0.0% | 38.3% | Negligible |
| **H53** | 40 | 0.01 | 15.56 | 0.0% | 38.9% | Negligible |
| **H54** | 40 | 0.01 | 15.62 | 0.0% | 39.1% | Negligible |
| **H55** | 40 | 0.01 | 15.08 | 0.0% | 37.7% | Negligible |
| **H56** | 40 | 0.01 | 15.15 | 0.0% | 37.9% | Negligible |
| **H57** | 40 | 0.01 | 15.11 | 0.0% | 37.8% | Negligible |
| **H58** | 40 | 0.01 | 14.92 | 0.0% | 37.3% | Negligible |
| **H59** | 40 | 0.02 | 14.69 | 0.1% | 36.7% | Negligible |
| **H60** | 40 | 0.01 | 14.66 | 0.0% | 36.6% | Negligible |
| **H61** | 40 | 0.00 | 15.07 | 0.0% | 37.7% | Negligible |
| **H62** | 40 | 0.00 | 15.43 | 0.0% | 38.6% | Negligible |
| **H63** | 40 | 0.00 | 16.94 | 0.0% | 42.4% | Negligible |
| **H64** | 40 | 0.00 | 14.64 | 0.0% | 36.6% | Negligible |
| **H65** | 40 | 0.00 | 14.64 | 0.0% | 36.6% | Negligible |
| **H66** | 40 | 0.00 | 14.65 | 0.0% | 36.6% | Negligible |
| **H67** | 40 | 0.00 | 14.67 | 0.0% | 36.7% | Negligible |
| **H68** | 40 | 0.00 | 14.51 | 0.0% | 36.3% | Negligible |
| **H69** | 40 | 0.00 | 14.49 | 0.0% | 36.2% | Negligible |
| **H70** | 40 | 0.00 | 14.40 | 0.0% | 36.0% | Negligible |
| **H71** | 40 | 0.00 | 14.37 | 0.0% | 35.9% | Negligible |
| **H72** | 40 | 0.00 | 14.36 | 0.0% | 35.9% | Negligible |

| Receptor | AQAL (µg m$^{-3}$) | PC (µg m$^{-3}$) | PEC (µg m$^{-3}$) | PC (% of AQAL) | PEC (% of AQAL) | Impact |
|---|---|---|---|---|---|---|
| **H73** | 40 | 0.00 | 14.64 | 0.0% | 36.6% | Negligible |
| **H74** | 40 | 0.00 | 14.66 | 0.0% | 36.6% | Negligible |
| **H75** | 40 | 0.00 | 14.23 | 0.0% | 35.6% | Negligible |
| **H76** | 40 | 0.00 | 14.76 | 0.0% | 36.9% | Negligible |
| **H77** | 40 | 0.00 | 14.77 | 0.0% | 36.9% | Negligible |
| **H78** | 40 | 0.00 | 14.05 | 0.0% | 35.1% | Negligible |
| **H79** | 40 | 0.00 | 14.43 | 0.0% | 36.1% | Negligible |
| **H80** | 40 | 0.00 | 14.81 | 0.0% | 37.0% | Negligible |
| **H81** | 40 | 0.00 | 14.85 | 0.0% | 37.1% | Negligible |
| **H82** | 40 | 0.02 | 16.72 | 0.1% | 41.8% | Negligible |
| **H83** | 40 | 0.16 | 20.12 | 0.4% | 50.3% | Negligible |
| **H84** | 40 | 0.07 | 18.13 | 0.2% | 45.3% | Negligible |
| **H85** | 40 | 0.08 | 18.28 | 0.2% | 45.7% | Negligible |
| **H86** | 40 | 0.05 | 17.63 | 0.1% | 44.1% | Negligible |
| **H87** | 40 | 0.10 | 18.58 | 0.2% | 46.5% | Negligible |
| **H88** | 40 | 0.06 | 17.74 | 0.2% | 44.3% | Negligible |
| **H89** | 40 | 0.10 | 18.52 | 0.3% | 46.3% | Negligible |
| **H90** | 40 | 0.06 | 17.98 | 0.2% | 45.0% | Negligible |
| **H91** | 40 | 0.02 | 17.02 | 0.0% | 42.5% | Negligible |
| **H92** | 40 | 0.02 | 16.85 | 0.1% | 42.1% | Negligible |
| **H93** | 40 | 0.07 | 17.66 | 0.2% | 44.1% | Negligible |
| **H94** | 40 | 0.01 | 16.43 | 0.0% | 41.1% | Negligible |
| **H95** | 40 | 0.01 | 16.27 | 0.0% | 40.7% | Negligible |
| **H96** | 40 | 0.01 | 17.46 | 0.0% | 43.7% | Negligible |
| **H97** | 40 | 0.01 | 16.71 | 0.0% | 41.8% | Negligible |
| **H98** | 40 | 0.12 | 19.12 | 0.3% | 47.8% | Negligible |
| **H99** | 40 | 0.01 | 17.84 | 0.0% | 44.6% | Negligible |

Table 6E.3 PCs and PECs for annual mean $PM_{2.5}$

| Receptor | AQAL (µg m$^{-3}$) | PC (µg m$^{-3}$) | PEC (µg m$^{-3}$) | PC (% of AQAL) | PEC (% of AQAL) | Impact |
|---|---|---|---|---|---|---|
| **H01** | 25 | 0.01 | 10.22 | 0.1% | 40.9% | Negligible |
| **H02** | 25 | 0.01 | 10.63 | 0.0% | 42.5% | Negligible |
| **H03** | 25 | 0.01 | 10.31 | 0.0% | 41.2% | Negligible |
| **H04** | 25 | 0.01 | 10.29 | 0.0% | 41.2% | Negligible |
| **H05** | 25 | 0.01 | 10.81 | 0.0% | 43.2% | Negligible |
| **H06** | 25 | 0.01 | 11.52 | 0.0% | 46.1% | Negligible |
| **H07** | 25 | 0.01 | 10.57 | 0.0% | 42.3% | Negligible |
| **H08** | 25 | 0.01 | 10.33 | 0.0% | 41.3% | Negligible |
| **H09** | 25 | 0.01 | 10.82 | 0.0% | 43.3% | Negligible |
| **H10** | 25 | 0.01 | 10.75 | 0.0% | 43.0% | Negligible |
| **H11** | 25 | 0.01 | 10.69 | 0.0% | 42.8% | Negligible |
| **H12** | 25 | 0.01 | 10.67 | 0.0% | 42.7% | Negligible |
| **H13** | 25 | 0.01 | 10.65 | 0.0% | 42.6% | Negligible |
| **H14** | 25 | 0.01 | 10.62 | 0.0% | 42.5% | Negligible |
| **H15** | 25 | 0.01 | 10.65 | 0.0% | 42.6% | Negligible |
| **H16** | 25 | 0.01 | 10.75 | 0.0% | 43.0% | Negligible |
| **H17** | 25 | 0.01 | 10.72 | 0.0% | 42.9% | Negligible |
| **H18** | 25 | 0.01 | 10.78 | 0.0% | 43.1% | Negligible |
| **H19** | 25 | 0.01 | 10.88 | 0.0% | 43.5% | Negligible |
| **H20** | 25 | 0.01 | 10.75 | 0.0% | 43.0% | Negligible |
| **H21** | 25 | 0.01 | 11.14 | 0.0% | 44.6% | Negligible |
| **H22** | 25 | 0.01 | 11.38 | 0.0% | 45.5% | Negligible |
| **H23** | 25 | 0.01 | 11.28 | 0.0% | 45.1% | Negligible |
| **H24** | 25 | 0.01 | 11.12 | 0.0% | 44.5% | Negligible |
| **H25** | 25 | 0.01 | 10.96 | 0.0% | 43.8% | Negligible |
| **H26** | 25 | 0.01 | 10.94 | 0.0% | 43.8% | Negligible |
| **H27** | 25 | 0.01 | 10.93 | 0.0% | 43.7% | Negligible |
| **H28** | 25 | 0.01 | 10.95 | 0.1% | 43.8% | Negligible |
| **H29** | 25 | 0.01 | 11.05 | 0.1% | 44.2% | Negligible |

| Receptor | AQAL (µg m$^{-3}$) | PC (µg m$^{-3}$) | PEC (µg m$^{-3}$) | PC (% of AQAL) | PEC (% of AQAL) | Impact |
|---|---|---|---|---|---|---|
| **H30** | 25 | 0.01 | 11.24 | 0.1% | 45.0% | Negligible |
| **H31** | 25 | 0.01 | 11.51 | 0.1% | 46.0% | Negligible |
| **H32** | 25 | 0.02 | 11.13 | 0.1% | 44.5% | Negligible |
| **H33** | 25 | 0.02 | 10.92 | 0.1% | 43.7% | Negligible |
| **H34** | 25 | 0.02 | 10.90 | 0.1% | 43.6% | Negligible |
| **H35** | 25 | 0.02 | 10.98 | 0.1% | 43.9% | Negligible |
| **H36** | 25 | 0.02 | 11.49 | 0.1% | 45.9% | Negligible |
| **H37** | 25 | 0.02 | 11.49 | 0.1% | 46.0% | Negligible |
| **H38** | 25 | 0.02 | 10.64 | 0.1% | 42.5% | Negligible |
| **H39** | 25 | 0.02 | 11.01 | 0.1% | 44.0% | Negligible |
| **H40** | 25 | 0.02 | 10.67 | 0.1% | 42.7% | Negligible |
| **H41** | 25 | 0.02 | 10.71 | 0.1% | 42.9% | Negligible |
| **H42** | 25 | 0.02 | 10.88 | 0.1% | 43.5% | Negligible |
| **H43** | 25 | 0.02 | 10.36 | 0.1% | 41.4% | Negligible |
| **H44** | 25 | 0.02 | 10.72 | 0.1% | 42.9% | Negligible |
| **H45** | 25 | 0.02 | 10.35 | 0.1% | 41.4% | Negligible |
| **H46** | 25 | 0.01 | 10.41 | 0.1% | 41.6% | Negligible |
| **H47** | 25 | 0.01 | 10.50 | 0.1% | 42.0% | Negligible |
| **H48** | 25 | 0.01 | 10.66 | 0.1% | 42.6% | Negligible |
| **H49** | 25 | 0.01 | 10.32 | 0.0% | 41.3% | Negligible |
| **H50** | 25 | 0.01 | 10.36 | 0.0% | 41.4% | Negligible |
| **H51** | 25 | 0.01 | 10.36 | 0.0% | 41.5% | Negligible |
| **H52** | 25 | 0.01 | 10.30 | 0.0% | 41.2% | Negligible |
| **H53** | 25 | 0.01 | 10.42 | 0.0% | 41.7% | Negligible |
| **H54** | 25 | 0.01 | 10.45 | 0.0% | 41.8% | Negligible |
| **H55** | 25 | 0.01 | 10.14 | 0.0% | 40.6% | Negligible |
| **H56** | 25 | 0.01 | 10.18 | 0.0% | 40.7% | Negligible |
| **H57** | 25 | 0.01 | 10.15 | 0.0% | 40.6% | Negligible |
| **H58** | 25 | 0.00 | 10.05 | 0.0% | 40.2% | Negligible |
| **H59** | 25 | 0.02 | 9.98 | 0.1% | 39.9% | Negligible |

| Receptor | AQAL (µg m$^{-3}$) | PC (µg m$^{-3}$) | PEC (µg m$^{-3}$) | PC (% of AQAL) | PEC (% of AQAL) | Impact |
|---|---|---|---|---|---|---|
| **H60** | 25 | 0.01 | 9.93 | 0.0% | 39.7% | Negligible |
| **H61** | 25 | 0.00 | 9.51 | 0.0% | 38.0% | Negligible |
| **H62** | 25 | 0.00 | 9.71 | 0.0% | 38.8% | Negligible |
| **H63** | 25 | 0.00 | 10.37 | 0.0% | 41.5% | Negligible |
| **H64** | 25 | 0.00 | 9.08 | 0.0% | 36.3% | Negligible |
| **H65** | 25 | 0.00 | 9.08 | 0.0% | 36.3% | Negligible |
| **H66** | 25 | 0.00 | 9.02 | 0.0% | 36.1% | Negligible |
| **H67** | 25 | 0.00 | 9.03 | 0.0% | 36.1% | Negligible |
| **H68** | 25 | 0.00 | 9.19 | 0.0% | 36.7% | Negligible |
| **H69** | 25 | 0.00 | 9.18 | 0.0% | 36.7% | Negligible |
| **H70** | 25 | 0.00 | 8.93 | 0.0% | 35.7% | Negligible |
| **H71** | 25 | 0.00 | 8.91 | 0.0% | 35.6% | Negligible |
| **H72** | 25 | 0.00 | 8.90 | 0.0% | 35.6% | Negligible |
| **H73** | 25 | 0.00 | 8.99 | 0.0% | 36.0% | Negligible |
| **H74** | 25 | 0.00 | 9.00 | 0.0% | 36.0% | Negligible |
| **H75** | 25 | 0.00 | 8.95 | 0.0% | 35.8% | Negligible |
| **H76** | 25 | 0.00 | 9.19 | 0.0% | 36.8% | Negligible |
| **H77** | 25 | 0.00 | 9.19 | 0.0% | 36.8% | Negligible |
| **H78** | 25 | 0.00 | 9.10 | 0.0% | 36.4% | Negligible |
| **H79** | 25 | 0.00 | 9.11 | 0.0% | 36.4% | Negligible |
| **H80** | 25 | 0.00 | 9.59 | 0.0% | 38.4% | Negligible |
| **H81** | 25 | 0.00 | 9.62 | 0.0% | 38.5% | Negligible |
| **H82** | 25 | 0.01 | 10.89 | 0.1% | 43.6% | Negligible |
| **H83** | 25 | 0.09 | 12.76 | 0.4% | 51.0% | Negligible |
| **H84** | 25 | 0.04 | 11.66 | 0.2% | 46.7% | Negligible |
| **H85** | 25 | 0.04 | 11.74 | 0.2% | 47.0% | Negligible |
| **H86** | 25 | 0.03 | 11.35 | 0.1% | 45.4% | Negligible |
| **H87** | 25 | 0.05 | 11.87 | 0.2% | 47.5% | Negligible |
| **H88** | 25 | 0.04 | 11.24 | 0.1% | 44.9% | Negligible |
| **H89** | 25 | 0.06 | 11.67 | 0.2% | 46.7% | Negligible |

| Receptor | AQAL (µg m$^{-3}$) | PC (µg m$^{-3}$) | PEC (µg m$^{-3}$) | PC (% of AQAL) | PEC (% of AQAL) | Impact |
|---|---|---|---|---|---|---|
| **H90** | 25 | 0.04 | 11.26 | 0.1% | 45.1% | Negligible |
| **H91** | 25 | 0.01 | 10.51 | 0.0% | 42.1% | Negligible |
| **H92** | 25 | 0.01 | 10.34 | 0.1% | 41.3% | Negligible |
| **H93** | 25 | 0.04 | 10.65 | 0.1% | 42.6% | Negligible |
| **H94** | 25 | 0.00 | 10.95 | 0.0% | 43.8% | Negligible |
| **H95** | 25 | 0.00 | 10.86 | 0.0% | 43.4% | Negligible |
| **H96** | 25 | 0.00 | 11.52 | 0.0% | 46.1% | Negligible |
| **H97** | 25 | 0.00 | 11.11 | 0.0% | 44.4% | Negligible |
| **H98** | 25 | 0.06 | 12.21 | 0.3% | 48.8% | Negligible |
| **H99** | 25 | 0.00 | 11.77 | 0.0% | 47.1% | Negligible |

Table 6E.4 PCs and PECs for annual mean $NO_x$

| Receptor | AQAL (µg m$^{-3}$) | PC (µg m$^{-3}$) | PEC (µg m$^{-3}$) | PC (% of AQAL) | PEC (% of AQAL) | Impact |
|---|---|---|---|---|---|---|
| **E01** | 30 | 0.23 | 20.25 | 0.8% | 67.5% | Not significant |
| **E02** | 30 | 0.15 | 14.15 | 0.5% | 47.2% | Not significant |
| **E03** | 30 | 0.10 | 12.16 | 0.3% | 40.5% | Not significant |
| **E04** | 30 | 0.10 | 12.09 | 0.3% | 40.3% | Not significant |
| **E05** | 30 | 2.50 | 44.20 | 8.3% | 147.3% | Not significant |
| **E06** | 30 | 2.35 | 42.41 | 7.8% | 141.4% | Not significant |
| **E07** | 30 | 1.05 | 27.01 | 3.5% | 90.0% | Not significant |
| **E08** | 30 | 1.00 | 26.70 | 3.3% | 89.0% | Not significant |
| **E09** | 30 | 1.60 | 34.24 | 5.3% | 114.1% | Not significant |
| **E10** | 30 | 0.09 | 12.26 | 0.3% | 40.9% | Not significant |
| **E11** | 30 | 0.09 | 12.19 | 0.3% | 40.6% | Not significant |
| **E12** | 30 | 0.23 | 15.59 | 0.8% | 52.0% | Not significant |
| **E13** | 30 | 0.23 | 15.58 | 0.8% | 51.9% | Not significant |
| **E14** | 30 | 0.17 | 14.76 | 0.6% | 49.2% | Not significant |
| **E15** | 30 | 0.10 | 12.60 | 0.3% | 42.0% | Not significant |

| Receptor | AQAL (µg m$^{-3}$) | PC (µg m$^{-3}$) | PEC (µg m$^{-3}$) | PC (% of AQAL) | PEC (% of AQAL) | Impact |
|---|---|---|---|---|---|---|
| **E16** | 30 | 0.10 | 12.54 | 0.3% | 41.8% | Not significant |
| **E17** | 30 | 0.09 | 12.39 | 0.3% | 41.3% | Not significant |
| **E18** | 30 | 0.11 | 13.62 | 0.4% | 45.4% | Not significant |
| **E19** | 30 | 0.16 | 15.73 | 0.5% | 52.4% | Not significant |
| **E20** | 30 | 0.15 | 15.62 | 0.5% | 52.1% | Not significant |
| **E21** | 30 | 0.08 | 12.79 | 0.3% | 42.6% | Not significant |
| **E22** | 30 | 0.07 | 12.53 | 0.2% | 41.8% | Not significant |
| **E23** | 30 | 1.87 | 36.91 | 6.2% | 123.0% | Not significant |
| **E24** | 30 | 0.08 | 10.97 | 0.3% | 36.6% | Not significant |
| **E25** | 30 | 0.15 | 12.54 | 0.5% | 41.8% | Not significant |
| **E26** | 30 | 0.04 | 10.44 | 0.1% | 34.8% | Not significant |
| **E27** | 30 | 0.39 | 63.11 | 1.3% | 210.4% | Not significant |
| **E28** | 30 | 0.13 | 19.27 | 0.4% | 64.2% | Not significant |
| **E29** | 30 | 0.11 | 17.11 | 0.4% | 57.0% | Not significant |
| **E30** | 30 | 0.11 | 14.71 | 0.4% | 49.0% | Not significant |
| **E31** | 30 | 0.12 | 20.97 | 0.4% | 69.9% | Not significant |
| **E32** | 30 | 0.12 | 21.61 | 0.4% | 72.0% | Not significant |
| **E33** | 30 | 0.18 | 31.37 | 0.6% | 104.6% | Not significant |
| **E34** | 30 | 0.13 | 23.44 | 0.4% | 78.1% | Not significant |
| **E35** | 30 | 0.12 | 21.61 | 0.4% | 72.0% | Not significant |
| **E36** | 30 | 0.12 | 20.97 | 0.4% | 69.9% | Not significant |
| **E37** | 30 | 0.11 | 14.71 | 0.4% | 49.0% | Not significant |
| **E38** | 30 | 0.15 | 19.30 | 0.5% | 64.3% | Not significant |
| **E39** | 30 | 0.48 | 88.07 | 1.6% | 293.6% | Not significant |
| **E40** | 30 | 0.24 | 45.07 | 0.8% | 150.2% | Not significant |
| **E41** | 30 | 0.25 | 40.83 | 0.8% | 136.1% | Not significant |
| **E42** | 30 | 0.14 | 25.33 | 0.5% | 84.4% | Not significant |
| **E43** | 30 | 0.25 | 42.70 | 0.8% | 142.3% | Not significant |
| **E44** | 30 | 0.25 | 46.94 | 0.8% | 156.5% | Not significant |
| **E45** | 30 | 0.13 | 37.55 | 0.4% | 125.2% | Not significant |

| Receptor | AQAL (µg m$^{-3}$) | PC (µg m$^{-3}$) | PEC (µg m$^{-3}$) | PC (% of AQAL) | PEC (% of AQAL) | Impact |
|---|---|---|---|---|---|---|
| **E46** | 30 | 0.12 | 22.02 | 0.4% | 73.4% | Not significant |

Table 6E.5 PCs and PECs for nitrogen deposition

| Receptor | AQAL (kg N ha$^{-1}$ y$^{-1}$) | PC (kg N ha$^{-1}$ y$^{-1}$) | PEC (kg N ha$^{-1}$ y$^{-1}$) | PC (% of AQAL) | PEC (% of AQAL) | Impact |
|---|---|---|---|---|---|---|
| **E01** | 10.00 | 0.04 | 31.12 | 0.4% | 311.2% | Not significant |
| **E02** | 10.00 | 0.02 | 31.10 | 0.2% | 311.0% | Not significant |
| **E03** | 10.00 | 0.02 | 29.42 | 0.2% | 294.2% | Not significant |
| **E04** | 10.00 | 0.02 | 29.42 | 0.2% | 294.2% | Not significant |
| **E05** | 10.00 | 0.37 | 31.45 | 3.7% | 314.5% | Not significant |
| **E06** | 10.00 | 0.35 | 31.43 | 3.5% | 314.3% | Not significant |
| **E07** | 10.00 | 0.16 | 31.24 | 1.6% | 312.4% | Not significant |
| **E08** | 10.00 | 0.16 | 31.24 | 1.6% | 312.4% | Not significant |
| **E09** | 10.00 | 0.24 | 31.32 | 2.4% | 313.2% | Not significant |
| **E10** | 10.00 | 0.02 | 31.10 | 0.2% | 311.0% | Not significant |
| **E11** | 10.00 | 0.02 | 31.10 | 0.2% | 311.0% | Not significant |
| **E12** | 10.00 | 0.04 | 31.12 | 0.4% | 311.2% | Not significant |
| **E13** | 10.00 | 0.03 | 31.11 | 0.3% | 311.1% | Not significant |
| **E14** | 10.00 | 0.03 | 31.11 | 0.3% | 311.1% | Not significant |
| **E15** | 10.00 | 0.02 | 30.82 | 0.2% | 308.2% | Not significant |
| **E16** | 10.00 | 0.02 | 30.82 | 0.2% | 308.2% | Not significant |
| **E17** | 10.00 | 0.02 | 30.82 | 0.2% | 308.2% | Not significant |
| **E18** | 10.00 | 0.02 | 30.82 | 0.2% | 308.2% | Not significant |
| **E19** | 10.00 | 0.03 | 30.83 | 0.3% | 308.3% | Not significant |
| **E20** | 10.00 | 0.02 | 30.82 | 0.2% | 308.2% | Not significant |
| **E21** | 10.00 | 0.02 | 30.82 | 0.2% | 308.2% | Not significant |
| **E22** | 10.00 | 0.01 | 30.81 | 0.1% | 308.1% | Not significant |
| **E23** | 10.00 | 0.27 | 32.47 | 2.7% | 324.7% | Not significant |
| **E24** | 10.00 | 0.01 | 32.21 | 0.1% | 322.1% | Not significant |
| **E25** | 10.00 | 0.03 | 32.23 | 0.3% | 322.3% | Not significant |

| Receptor | AQAL (kg N ha$^{-1}$ y$^{-1}$) | PC (kg N ha$^{-1}$ y$^{-1}$) | PEC (kg N ha$^{-1}$ y$^{-1}$) | PC (% of AQAL) | PEC (% of AQAL) | Impact |
|---|---|---|---|---|---|---|
| **E26** | 10.00 | 0.01 | 32.21 | 0.1% | 322.1% | Not significant |
| **E27** | 10.00 | 0.05 | 32.25 | 0.5% | 322.5% | Not significant |
| **E28** | 10.00 | 0.02 | 30.82 | 0.2% | 308.2% | Not significant |
| **E29** | 10.00 | 0.02 | 30.82 | 0.2% | 308.2% | Not significant |
| **E30** | 10.00 | 0.02 | 32.22 | 0.2% | 322.2% | Not significant |
| **E31** | 10.00 | 0.02 | 32.22 | 0.2% | 322.2% | Not significant |
| **E32** | 10.00 | 0.02 | 32.22 | 0.2% | 322.2% | Not significant |
| **E33** | 10.00 | 0.03 | 32.23 | 0.3% | 322.3% | Not significant |
| **E34** | 10.00 | 0.02 | 32.22 | 0.2% | 322.2% | Not significant |
| **E35** | 10.00 | 0.02 | 32.22 | 0.2% | 322.2% | Not significant |
| **E36** | 10.00 | 0.02 | 32.22 | 0.2% | 322.2% | Not significant |
| **E37** | 10.00 | 0.02 | 32.22 | 0.2% | 322.2% | Not significant |
| **E38** | 10.00 | 0.03 | 32.23 | 0.3% | 322.3% | Not significant |
| **E39** | 10.00 | 0.05 | 32.25 | 0.5% | 322.5% | Not significant |
| **E40** | 10.00 | 0.03 | 32.23 | 0.3% | 322.3% | Not significant |
| **E41** | 10.00 | 0.03 | 32.23 | 0.3% | 322.3% | Not significant |
| **E42** | 10.00 | 0.02 | 32.22 | 0.2% | 322.2% | Not significant |
| **E43** | 10.00 | 0.03 | 32.23 | 0.3% | 322.3% | Not significant |
| **E44** | 10.00 | 0.03 | 32.23 | 0.3% | 322.3% | Not significant |
| **E45** | 10.00 | 0.02 | 32.22 | 0.2% | 322.2% | Not significant |
| **E46** | 10.00 | 0.02 | 32.22 | 0.2% | 322.2% | Not significant |

## Table 6E.6 Acid deposition rates

| Receptor | Sulphur PC (keq ha$^{-1}$ y$^{-1}$) | Nitrogen PC (keq ha$^{-1}$ y$^{-1}$) | Sulphur background (keq ha$^{-1}$ y$^{-1}$) | Nitrogen background (keq ha$^{-1}$ y$^{-1}$) |
|---|---|---|---|---|
| **E01** | 0 | 0.0027 | 0.22 | 2.22 |
| **E02** | 0 | 0.0016 | 0.22 | 2.22 |
| **E03** | 0 | 0.0016 | 0.18 | 2.10 |
| **E04** | 0 | 0.0016 | 0.18 | 2.10 |
| **E05** | 0 | 0.0265 | 0.22 | 2.22 |

| Receptor | Sulphur PC (keq ha$^{-1}$ y$^{-1}$) | Nitrogen PC (keq ha$^{-1}$ y$^{-1}$) | Sulphur background (keq ha$^{-1}$ y$^{-1}$) | Nitrogen background (keq ha$^{-1}$ y$^{-1}$) |
|---|---|---|---|---|
| **E06** | 0 | 0.0249 | 0.22 | 2.22 |
| **E07** | 0 | 0.0115 | 0.22 | 2.22 |
| **E08** | 0 | 0.0111 | 0.22 | 2.22 |
| **E09** | 0 | 0.0173 | 0.22 | 2.22 |
| **E10** | 0 | 0.0014 | 0.22 | 2.22 |
| **E11** | 0 | 0.0014 | 0.22 | 2.22 |
| **E12** | 0 | 0.0027 | 0.22 | 2.22 |
| **E13** | 0 | 0.0025 | 0.22 | 2.22 |
| **E14** | 0 | 0.0021 | 0.22 | 2.22 |
| **E15** | 0 | 0.0016 | 0.19 | 2.20 |
| **E16** | 0 | 0.0014 | 0.19 | 2.20 |
| **E17** | 0 | 0.0014 | 0.19 | 2.20 |
| **E18** | 0 | 0.0012 | 0.19 | 2.20 |
| **E19** | 0 | 0.0019 | 0.19 | 2.20 |
| **E20** | 0 | 0.0016 | 0.19 | 2.20 |
| **E21** | 0 | 0.0012 | 0.19 | 2.20 |
| **E22** | 0 | 0.0010 | 0.19 | 2.20 |
| **E23** | 0 | 0.0191 | 0.20 | 2.30 |
| **E24** | 0 | 0.0008 | 0.20 | 2.30 |
| **E25** | 0 | 0.0019 | 0.20 | 2.30 |
| **E26** | 0 | 0.0004 | 0.20 | 2.30 |
| **E27** | 0 | 0.0035 | 0.20 | 2.30 |
| **E28** | 0 | 0.0014 | 0.19 | 2.20 |
| **E29** | 0 | 0.0012 | 0.19 | 2.20 |
| **E30** | 0 | 0.0014 | 0.20 | 2.30 |
| **E31** | 0 | 0.0012 | 0.20 | 2.30 |
| **E32** | 0 | 0.0014 | 0.20 | 2.30 |
| **E33** | 0 | 0.0019 | 0.20 | 2.30 |
| **E34** | 0 | 0.0014 | 0.20 | 2.30 |

| Receptor | Sulphur PC (keq ha$^{-1}$ y$^{-1}$) | Nitrogen PC (keq ha$^{-1}$ y$^{-1}$) | Sulphur background (keq ha$^{-1}$ y$^{-1}$) | Nitrogen background (keq ha$^{-1}$ y$^{-1}$) |
|---|---|---|---|---|
| **E35** | 0 | 0.0014 | 0.20 | 2.30 |
| **E36** | 0 | 0.0012 | 0.20 | 2.30 |
| **E37** | 0 | 0.0014 | 0.20 | 2.30 |
| **E38** | 0 | 0.0019 | 0.20 | 2.30 |
| **E39** | 0 | 0.0039 | 0.20 | 2.30 |
| **E40** | 0 | 0.0023 | 0.20 | 2.30 |
| **E41** | 0 | 0.0025 | 0.20 | 2.30 |
| **E42** | 0 | 0.0014 | 0.20 | 2.30 |
| **E43** | 0 | 0.0025 | 0.20 | 2.30 |
| **E44** | 0 | 0.0023 | 0.20 | 2.30 |
| **E45** | 0 | 0.0014 | 0.20 | 2.30 |
| **E46** | 0 | 0.0014 | 0.20 | 2.30 |

Table 6E.8 Acid deposition: comparison with AQAL (critical load function)

| Receptor | Exceedance (keq ha$^{-1}$ y$^{-1}$) | | | Percent of AQAL | | | Impact |
|---|---|---|---|---|---|---|---|
| | PC | Background | PEC | PC | Background | PEC | |
| **E01** | No exceedance | 0.51 | 0.51 | 0.1 | 126.5 | 126.6 | Not significant |
| **E02** | No exceedance | 0.52 | 0.52 | 0.1 | 126.8 | 126.8 | Not significant |
| **E03** | No exceedance | No exceedance | No exceedance | 0.0 | 20.8 | 20.8 | Not significant |
| **E04** | No exceedance | No exceedance | No exceedance | 0.0 | 20.8 | 20.8 | Not significant |
| **E05** | No exceedance | 0.51 | 0.54 | 1.4 | 126.6 | 127.9 | Not significant |
| **E06** | No exceedance | 0.51 | 0.54 | 1.3 | 126.6 | 127.8 | Not significant |
| **E07** | No exceedance | 0.51 | 0.52 | 0.6 | 126.6 | 127.2 | Not significant |
| **E08** | No exceedance | 0.51 | 0.52 | 0.6 | 126.6 | 127.1 | Not significant |
| **E09** | No exceedance | 0.51 | 0.53 | 0.9 | 126.6 | 127.5 | Not significant |
| **E10** | No exceedance | 0.51 | 0.52 | 0.1 | 126.7 | 126.8 | Not significant |
| **E11** | No exceedance | 0.51 | 0.52 | 0.1 | 126.7 | 126.8 | Not significant |
| **E12** | No exceedance | 0.51 | 0.51 | 0.1 | 126.5 | 126.6 | Not significant |
| **E13** | No exceedance | 0.51 | 0.51 | 0.1 | 126.5 | 126.6 | Not significant |

| Receptor | Exceedance (keq ha$^{-1}$ y$^{-1}$) | | | Percent of AQAL | | | Impact |
|---|---|---|---|---|---|---|---|
| | PC | Background | PEC | PC | Background | PEC | |
| **E14** | No exceedance | 0.51 | 0.51 | 0.1 | 126.5 | 126.6 | Not significant |
| **E15** | No exceedance | 0.47 | 0.47 | 0.1 | 124.5 | 124.6 | Not significant |
| **E16** | No exceedance | 0.47 | 0.47 | 0.1 | 124.5 | 124.6 | Not significant |
| **E17** | No exceedance | 0.47 | 0.47 | 0.1 | 124.5 | 124.6 | Not significant |
| **E18** | No exceedance | 0.47 | 0.47 | 0.1 | 124.3 | 124.4 | Not significant |
| **E19** | No exceedance | 0.46 | 0.47 | 0.1 | 124.1 | 124.2 | Not significant |
| **E20** | No exceedance | 0.46 | 0.47 | 0.1 | 124.1 | 124.2 | Not significant |
| **E21** | No exceedance | 0.46 | 0.46 | 0.1 | 123.9 | 124.0 | Not significant |
| **E22** | No exceedance | 0.46 | 0.46 | 0.1 | 123.7 | 123.8 | Not significant |
| **E23** | No exceedance | 0.52 | 0.54 | 1.0 | 126.5 | 127.5 | Not significant |
| **E24** | No exceedance | 0.53 | 0.53 | 0.0 | 126.6 | 126.6 | Not significant |
| **E25** | No exceedance | 0.52 | 0.53 | 0.1 | 126.5 | 126.6 | Not significant |
| **E26** | No exceedance | 0.53 | 0.53 | 0.0 | 126.6 | 126.7 | Not significant |
| **E27** | No exceedance | 0.53 | 0.53 | 0.2 | 126.6 | 126.8 | Not significant |
| **E28** | No exceedance | 0.46 | 0.46 | 0.1 | 123.9 | 124.0 | Not significant |
| **E29** | No exceedance | 0.46 | 0.46 | 0.1 | 123.9 | 124.0 | Not significant |
| **E30** | No exceedance | 0.52 | 0.53 | 0.1 | 126.5 | 126.6 | Not significant |
| **E31** | No exceedance | 0.53 | 0.53 | 0.1 | 126.6 | 126.7 | Not significant |
| **E32** | No exceedance | 0.53 | 0.53 | 0.1 | 126.6 | 126.7 | Not significant |
| **E33** | No exceedance | 0.53 | 0.53 | 0.1 | 126.6 | 126.7 | Not significant |
| **E34** | No exceedance | 0.53 | 0.53 | 0.1 | 126.6 | 126.7 | Not significant |
| **E35** | No exceedance | 0.53 | 0.53 | 0.1 | 126.6 | 126.7 | Not significant |
| **E36** | No exceedance | 0.53 | 0.53 | 0.1 | 126.6 | 126.7 | Not significant |
| **E37** | No exceedance | 0.52 | 0.53 | 0.1 | 126.5 | 126.6 | Not significant |
| **E38** | No exceedance | 0.52 | 0.53 | 0.1 | 126.5 | 126.6 | Not significant |
| **E39** | No exceedance | 0.53 | 0.53 | 0.2 | 126.6 | 126.8 | Not significant |
| **E40** | No exceedance | 0.53 | 0.53 | 0.1 | 126.6 | 126.8 | Not significant |
| **E41** | No exceedance | 0.53 | 0.53 | 0.1 | 126.6 | 126.8 | Not significant |
| **E42** | No exceedance | 0.53 | 0.53 | 0.1 | 126.6 | 126.7 | Not significant |

| Receptor | Exceedance (keq $ha^{-1}$ $y^{-1}$) | | | Percent of AQAL | | | Impact |
|---|---|---|---|---|---|---|---|
| | PC | Background | PEC | PC | Background | PEC | |
| **E43** | No exceedance | 0.53 | 0.53 | 0.1 | 126.6 | 126.8 | Not significant |
| **E44** | No exceedance | 0.53 | 0.53 | 0.1 | 126.6 | 126.8 | Not significant |
| **E45** | No exceedance | 0.53 | 0.53 | 0.1 | 126.6 | 126.7 | Not significant |
| **E46** | No exceedance | 0.53 | 0.53 | 0.1 | 126.6 | 126.7 | Not significant |

# Appendix 7A
# Climate Supporting Data

## Introduction

This appendix should be read in conjunction with the **Chapter 7: Climate** of the Environmental Statement (ES).

This appendix sets out further detail of the methodology for quantifying Greenhouse Gases (GHGs) (**Section 7.2**) and the complete results of the assessment (**Section 7.3**).

This appendix provides the supporting data used to calculate greenhouse gas (GHG) emissions as part of the climate assessment (**Section 7.5).** It presents tables of the following data:

1) 2019 Airport building and ground operation electricity, gas use, diesel usage (for vehicles and heating / power) and refrigerant usage at LLA;
2) Vehicle movements, origins and modal splits for employee and passenger access to LLA; and
3) Aviation movements and destination information.

## Assessment methodology

### Emission Factors

Data on improvement factors under upper, central and lower emission scenarios have been collated from current government policy, CCC advice and industry reports. The trend for each improvement factor out to 2050 are shown in **Table 7A.1**.

Table 7A.1 Improvement factors (relative to the 2019 baseline data) used in the climate assessment for the upper, central and lower future emission scenarios.

| Improvement factor | Upper emission scenario | Central emission scenario | Lowe emission sceanrio |
|---|---|---|---|
| **Private vehicle splits by fuel type ł** | 33% petrol, 21% diesel, 46% electric (assumed to be plug-in hybrids) by 2050<br>*Source: Department for Transport (DfT) Forecasts*[1] | 2% petrol, 1% diesel, 97% battery electric vehicles by 2050<br>*Source: National Grid Future Energy Scenarios*[2]** Steady Progression* | 0% petrol, 0% diesel, 100% battery electric vehicles by 2050<br>*Source: National Grid Future Energy Scenarios*[2]** Leading the Way* |
| **Vehicle efficiency improvements ł** | Efficiency factor of 0.78 petrol, 0.86 diesel, 0.82 electric by 2050<br>*Source: DfT forecast*[1] | | |
| **Vehicle efficiency improvements (Public Service Vehicles including buses and coaches)** | Efficiency factor 0.71 diesel, 0.87 electric by 2050. Note the fleet mix is assumed to be all diesel<br>*Source: DfT forecast*[1] | | |

[1] Department for Transport (2020), TAG Data Book. Available at https://www.gov.uk/government/publications/tag-data-book [Accessed 21 October 2020].

[2] National Grid (2020), Future Energy Scenarios, FES 2020. Available at https://www.nationalgrideso.com/future-energy/future-energyscenarios/
fes-2020-documents [Accessed 21 October 2020].

| Improvement factor | Upper emission scenario | Central emission scenario | Lowe emission sceanrio |
|---|---|---|---|
| **Rail efficiency improvements (diesel)** | Efficiency factor of 0.87 by 2050<br>*Source: DfT forecast*[1] | Efficiency factor of 0.58 by 2050 (median value) | 3.82% annual improvement, equating to an efficiency factor of 0.29 by 2050<br>*Source: historical data from the Office of Rail and Road (ORR)*[3 #] |
| **Electricity generation efficiency improvements** | Efficiency factor of 0.54 by 2050<br>*Source: National Grid Future Energy Scenarios*[2] *Steady Progression* | Efficiency factor of 0.43 by 2050<br>*Source: Business, Energy and Industrial Strategy (BEIS) Energy and Emission Projections (EEP) 2019 projections*[4] *(assumed to flat line from 2040)* | Efficiency factor of -0.02 by 2050<br>*Source: National Grid Future Energy Scenarios*[2] *Leading the Way* |
| **Aircraft and engine efficiency** | 0.8%<br>(covers both aircraft and engine efficiency and air traffic management and operations**)<br>*Source: CCC*[5] | 1.01% (median value) | 1.22%<br>*Source: Sustainable Aviation*[6] |
| **Air traffic management and operations** | | 0.115% (median value) | 0.23%<br>*Source: Sustainable Aviation*[6] |
| **Sustainable aviation fuel**[##] | 5% implementation at 50% life-cycle emission reduction<br>*Source: DfT*[7] | 10% implementation at 30-47% life-cycle emission reduction<br>*Source: CCC*[5,8, , 9,10,11] | 18% implementation at 60% life-cycle emission reduction<br>*Source: Sustainable Aviation*[6] |

ǂPrivate vehicle splits are assumed to apply to cars and taxis
*Future energy scenarios provide data on electric vehicle percentage. Petrol/diesel percentages have been calculated based on the splits within the DfT forecasts (pessimistic scenario).
# carbon emissions ($gCO_2e$/pass-km) were obtained from the ORR for the period 2005-2020 for UK rail travel. These were used to extrapolate efficiencies into the future and provide an efficiency factor for carbon emissions per rail passenger to 2050 assuming a constant average annual improvement rate.
**CCC advice provides a combined annual improvement rate for aircraft and engine efficiencies and air traffic management and operations. To calculate median values for the central scenario and for use in the pessimistic scenario, air traffic management and operations has been assumed to result in no improvement (i.e. 0%) as the proportional improvement is unknown.

[3] ORR (2020), Table 6100 - Estimates of normalised passenger and freight carbon dioxide equivalent (CO2e) emissions. Available at https://dataportal.orr.gov.uk/statistics/infrastructure-and-emissions/rail-emissions/ [Accessed 12 November 2020].
[4] BEIS (2019), Updated energy and emissions projections: 2019 [online]. Available at https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/931215/Web_figures__EEP2019_.ods [Accessed 12 November 2020].
[5] Committee on Climate Change. (2009). Meeting the UK aviation target – options for reducing emissions to 2050. [online]. Available at: https://www.theccc.org.uk/wp-content/uploads/2009/12/CCC-Meeting-the-UK-Aviation-target-2009.pdf [Accessed 21 October 2020].
[6] Sustainable Aviation (2020). Sustainable Aviation Carbon Road-Map: A path to Net Zero. Available online at: https://www.sustainableaviation.co.uk/wp-content/uploads/2020/02/SustainableAviation_CarbonReport_20200203.pdf [Accessed 21 October 2020].
[7] Department for Transport (2017), UK Aviation Forecasts, Moving Britain Ahead (Oct 2017) [online]. Available at https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/878705/uk-aviation-forecasts-2017.pdf [Accessed 21 October 2020].
[8] Committee on Climate Change (2018), Biomass in a low-carbon economy, Committee on Climate Change Nov 2018. Available at https://d423d1558e1d71897434.b-cdn.net/wp-content/uploads/2018/11/Biomass-in-a-low-carbon-economy-CCC-2018.pdf
[9] Committee on Climate Change (2019), "Letter: Aviation 2050 – The future of UK aviation", [online]. Available at https://www.theccc.org.uk/wp-content/uploads/2019/02/Aviation-Letter-from-Lord-Deben-to-Chris-Grayling.pdf
[10] Committee on Climate Change (2012), Aviation – Fact Sheet. Available at https://www.theccc.org.uk/wpcontent/ uploads/2013/04/Aviation-factsheet.pdf
[11] Committee on Climate Change (2019), "Letter: International aviation and shipping and net zero", [online]. Available at: https://www.theccc.org.uk/wp-content/uploads/2019/09/Letter-from-Lord-Deben-to-Grant-Shapps-IAS.pdf [Accessed 21 October 2020].

## Sustainable aviation fuel uptake is dependent on fuel infrastructure being in place.

Emission factors for each time period used in the assessment are presented in Table 7A.2 to Table 7A.6.

Table 7A.2 Improvement factors (relative to 2019 data) used in the climate assessment for the pessimistic, central and optimistic scenario for the 2024 time period.

| Improvement factor | Pessimistic | Central | Optimistic |
|---|---|---|---|
| **Private vehicle splits by fuel type** | Petrol 50% / Diesel 46% / Electric 4% | Petrol 51% / Diesel 47% / Electric 2% | Petrol 49% / Diesel 45% / Electric 6% |
| **Vehicle efficiency improvements** | Petrol 0.89 / Diesel 0.93 / Electric 0.97 | | |
| **Vehicle efficiency improvements (Public Service Vehicles including buses and coaches)** | Bus / Coach (diesel) 0.88 | | |
| **Rail efficiency improvements** | 0.89 | 0.86 | 0.82 |
| **Electricity generation efficiency improvements** | 0.89 | 0.82 | 0.80 |
| **Air traffic management and operations** | 1.00 | 0.99 | 0.99 |

Table 7A.3 Improvement factors (relative to 2019 data) used in the climate assessment for the pessimistic, central and optimistic scenario for the 2028 time period.

| Improvement factor | Pessimistic | Central | Optimistic |
|---|---|---|---|
| **Private vehicle splits by fuel type** | Petrol 50% / Diesel 40% / Electric 10% | Petrol 52% / Diesel 42% / Electric 7% | Petrol 43% / Diesel 35% / Electric 22% |
| **Vehicle efficiency improvements** | Petrol 0.83 / Diesel 0.89 / Electric 0.93 | | |
| **Vehicle efficiency improvements (Public Service Vehicles including buses and coaches)** | Bus / Coach (diesel) 0.75 | | |
| **Rail efficiency improvements** | 0.87 | 0.79 | 0.70 |
| **Electricity generation efficiency improvements** | 0.84 | 0.58 | 0.70 |
| **Air traffic management and operations** | 1.00 | 0.99 | 0.98 |

Table 7A.4 Improvement factors (relative to 2019 data) used in the climate assessment for the pessimistic, central and optimistic scenario for the 2032 time period.

| Improvement factor | Pessimistic | Central | Optimistic |
|---|---|---|---|
| **Private vehicle splits by fuel type** | Petrol 47% / Diesel 34% / Electric 18% | Petrol 48% / Diesel 35% / Electric 17% | Petrol 263% / Diesel 19% / Electric 55% |

| Improvement factor | Pessimistic | Central | Optimistic |
|---|---|---|---|
| **Vehicle efficiency improvements** | Petrol 0.8 / Diesel 0.87 / Electric 0.88 | | |
| **Vehicle efficiency improvements (Public Service Vehicles including buses and coaches)** | Bus / Coach (diesel) 0.73 | | |
| **Rail efficiency improvements** | 0.87 | 0.74 | 0.60 |
| **Electricity generation efficiency improvements** | 0.80 | 0.54 | 0.54 |
| **Air traffic management and operations** | 1.00 | 0.99 | 0.97 |

Table 7A.5 Improvement factors (relative to 2019 data) used in the climate assessment for the pessimistic, central and optimistic scenario for the 2040 time period.

| Improvement factor | Pessimistic | Central | Optimistic |
|---|---|---|---|
| **Private vehicle splits by fuel type** | Petrol 40% / Diesel 27% / Electric 33% | Petrol 23% / Diesel 15% / Electric 62% | Petrol 1% / Diesel 1% / Electric 99% |
| **Vehicle efficiency improvements** | Petrol 0.78 / Diesel 0.86 / Electric 0.84 | | |
| **Vehicle efficiency improvements (Public Service Vehicles including buses and coaches)** | Bus / Coach (diesel) 0.72 | | |
| **Rail efficiency improvements** | 0.87 | 0.66 | 0.44 |
| **Electricity generation efficiency improvements** | 0.68 | 0.43 | 0.26 |
| **Air traffic management and operations** | 1.00 | 0.98 | 0.93 |

Table 7A.6 Improvement factors (relative to 2019 data) used in the climate assessment for the pessimistic, central and optimistic scenario for the 2050 time period.

| Improvement factor | Pessimistic | Central | Optimistic |
|---|---|---|---|
| **Private vehicle splits by fuel type** | Petrol 33% / Diesel 21% / Electric 46% | Petrol 2% / Diesel 1% / Electric 97% | Petrol 0% / Diesel 0% / Electric 100% |
| **Vehicle efficiency improvements** | Petrol 0.78 / Diesel 0.86 / Electric 0.82 | | |
| **Vehicle efficiency improvements (Public Service Vehicles including buses and coaches)** | Bus / Coach (diesel) 0.71 | | |
| **Rail efficiency improvements** | 0.87 | 0.59 | 0.30 |

| Improvement factor | Pessimistic | Central | Optimistic |
|---|---|---|---|
| **Electricity generation efficiency improvements** | 0.54 | 0.43 | -0.02 |
| **Air traffic management and operations** | 1.00 | 0.96 | 0.93 |
| **Aircraft and engine efficiency** | 0.92 | 0.90 | 0.88 |
| **Sustainable aviation fuel** | 0.98 | 0.94 | 0.93 |

Note: negative values represent a decrease in emissions between the 19 mppa scenario and the 2019 baseline

Additionally, a fourth emission scenario is used within the sensitivity assessment which represents further ambition based on latest recommendations from the CCC. This scenario is representative of the aviation sector improvements recommended in the CCC's 'Balanced Pathway' scenario for achieving net zero as presented in the report on setting the Sixth Carbon Budget[12].

This scenario has only been applied to aviation sector emissions and requires further aviation policy implementation to occur at a national level. Improvement factors used in the assessment are shown in Table 7A.7.

Table 7A.7 Improvement factors (relative to 2019 data) used in the sensitivity climate aviation assessment for the CCC Balanced Pathway scenario.

| Improvement factor | 2024 | 2028 | 2032 | 2040 | 2050 |
|---|---|---|---|---|---|
| **Average efficiency improvements*** | n/a | n/a | n/a | 0.89 | 0.78 |
| **Sustainable aviation fuel** | 1.00 | 1.00 | 0.98 | 0.94 | 0.88 |

*Note CCC projections for average efficiency improvement include airspace modernisation, operational optimisation, aircraft passenger loading, aircraft design, new engine efficiency improvements and introduction of hybrid electric aircraft from 2040. Individual modelling for these parameters is not conducted. Since aviation forecasts for LLA up to 2032 encompass some of these parameters through the updated fleet mixes, this improvement has not been included in the assessment until beyond 2032.

### *Methodology for quantifying aviation GHG emissions*

The majority of an airport's GHG emissions arise from the combustion of fuel by aircraft. Although research is being undertaken to introduce lower-carbon biofuels, it is likely that fuel will remain largely fossil-derived with only a small percentage of biofuel in the mix over the 2020s and 2030s and therefore this this factor is not considered until 2050.

Aviation emissions sources are broken down into:

- CCD phase (departure only to avoid double-counting with other airports); and
- The LTO cycle.

[12] Committee on Climate Change. (2020). The Sixth Carbon Budget – The UK's path to Net Zero [online]. Available at: https://www.theccc.org.uk/wp-content/uploads/2020/12/The-Sixth-Carbon-Budget-The-UKs-path-to-Net-Zero.pdf [Accessed 18 December 2020].

Aircraft movement forecasts were developed for both the 'with development' and 'without development' cases. Real aircraft movement data for the 2019 baseline was also provided.

Emissions factors (see **Table 7A.1**) for aircraft and engine efficiencies were applied to the aircraft movement forecasts from 2040 onwards. This is due to the substantial uncertainty over the emissions and technologies associated with 'next generation' aircraft beyond the current generation of Airbus NEOs and Boeing MAXs. The emissions factors incorporated are very likely to be conservative compared to the expected introduction of low carbon aircraft in the future (e.g. electric, hydrogen).

Both the 'with development' and 'without development' cases are presented for 2024, 2028, 2032, 2040 and 2050.

### Climb Cruise Descent (CCD) phase

The CCD phase of flights has only been considered for departing flights, following DfT guidance[7]. Arriving aircraft were not considered as part of the calculation of CCD emissions.

For the 'with development' and 'without development' cases, LLAOL provided forecast movements for a 92-day summer period. This was based on the same period for 2019, but with aircraft types and routes modified to reflect expected changes over the coming years. These forecasts were used to create an annual forecast by scaling emissions from passenger, cargo and general aviation movements by factor derived from actual 2017 data. The factors applied are 3.5, 4.9 and 3.9 for passenger, cargo and general aviation respectively.

The schedules provide destination airports for departures. The coordinates (latitude/longitude) of each destination airport were obtained from publicly available databases[13] and cross-checked[14,15]. The great circle distance[16] (GCD) from LLA to each airport was calculated from the coordinate pairs using standard trigonometric formulae.

To account for the fact that aircraft often do not fly exact great circle routes, it is usual practice to uplift the GCD by a certain amount to obtain the actual flight distance. Various procedures for uplifting the GCD have been proposed. For the Proposed Scheme, the procedure recommended by DfT was used**Error! Bookmark not defined.**, namely uplifting the GCD by 5% for short-haul "*to reflect the latest evidence in inherent inefficiencies in air traffic control, flight paths and airspace*".

Emission factors were derived from the EMEP/EEA guidebook[17]. The EEA and the United Nations (UN's) Long-Range Transboundary Air Pollution project (LRTAP) produce the guidebook to support the compilation of GHG inventories across Europe and across market sectors. The aviation chapter of the guidebook recommends methodologies for calculating GHG emissions from aviation, with various "tiers" or levels of accuracy. The Tier 3A approach has been used for this work, since it provides the best level of accuracy consistent with the availability of data. Specifically, it uses data on aircraft type and origin/destination.

The Tier 3A method takes into account that emission rates vary between phases of flight, and consequently that fuel burn is related to flight distance, but not in a simple way because different flight lengths entail different times in the various phases such as CCD.

EMEP/EEA provides two spreadsheets for calculating emissions, one for the LTO phase and one for the CCD phase. The underlying methodologies behind these spreadsheets are briefly described in the main guidebook

[13] GitHub (2018). JSON database of 28k+ airports with ICAO/IATA codes, names, cities, two-letter country identifiers, elevation, latitude & longitude, and a timezone identifier, [online]. Available at: https://github.com/mwgg/Airports [Accessed 21 October 2020].
[14] OpenFlights (2018). Airport database, [online]. Available at: https://openflights.org/data.html [Accessed 21 October 2020].
[15] Arash Partow (2018). The Global Airport Database, [online]. Available at: http://www.partow.net/miscellaneous/airportdatabase/ [Accessed 21 October 2020].
[16] Great Circle Distance is the shortest distance between two points on the surface of a sphere measured along the surface of the sphere.
[17] EMEP/EEA air pollutant emission inventory guidebook (2019). Chapter 1.A.3.a Aviation, [online]. Available at: https://www.eea.europa.eu/publications/emep-eea-guidebook-2019 [Accessed 21 October 2020].

document, with more detail available in a supporting document. The spreadsheet embodies a set of factors derived by using Eurocontrol's Advanced Emissions Model (AEM) tool. AEM uses a high level of four-dimensional trajectory information to calculate fuel burn — a level of detail which is not generally available to the public, and in particular is not available for future movements

Because aircraft types, engines, flight trajectories etc. evolve over time, Eurocontrol's AEM and the EMEP/EEA spreadsheets are updated periodically. For the climate assessment, the latest available version of the EMEP/EEA spreadsheets was used, from 2019. However, it should be noted that the 2019 version does not incorporate any substantive updates over the 2016 version. The EMEP/EEA spreadsheets are based on the current contemporary (2015) aircraft fleet characteristics, so it is only able to calculate emissions for many of the most common existing aircraft types. It does not include newer types such as the Airbus 320neo series or the Boeing 737Max series, both of which feature in the LLA schedules. For these newer types, the Small Emitters Tool (SET), published by Eurocontrol[18], was used as a supplementary source of information. SET is updated annually and includes emissions for these newer aircraft types, but it only provides whole-flight emissions, without separating out emissions from CCD and LTO. Therefore, for each of the newer aircraft types, a suitable surrogate aircraft type for which EMEP data is available was chosen, and an adjustment factor was calculated equal to the ratio of the whole-flight emissions for a typical 1500 km flight as calculated by SET. Surrogates and adjustment factors are given in **Table 7A.8.**

Table 7A.8 Surrogate and adjustment factors for SET calculation

| Aircraft type | Surrogate | Adjustment factor |
|---|---|---|
| A320neo | A320ceo | 0.804 |
| A321neo | A321ceo | 0.786 |
| B737 Max 8 | B737-800 | 0.834 |

### Landing and Take Off (LTO) cycle

The LTO cycle is considered for all Air Traffic Movements (ATM)s that occur as a result of the Proposed Scheme. As is common practice, emissions are calculated for all parts of the LTO at LLA, including the arrival elements (approach, landing roll and taxi-in). This is a minor deviation from the formal recommendation to present emissions for departing flights only, as this would entail calculating the arrival LTOs at a large number of remote airports for which data collection would be extremely onerous. This is therefore a conservative approach and represents a reasonable worst-case for assessment.

As noted in paragraph 7.9.18, EMEP/EEA provides a generic spreadsheet for calculating emissions for the LTO phase, but this was not used for this assessment. This is because it was possible to compile a detailed emissions inventory using data specific to LLA, including detailed taxi-in and taxi-out times as described in **Chapter 6: Air Quality** of the ES. This inventory included fuel consumption as an integral part of the calculation. LTO emissions of $CO_2$ were calculated by multiplying the fuel consumption by a factor of 3.15**Error! Bookmark not defined.** (or a reduced factor where efficiencies were added). This approach is considered to be more accurate than using a more generic approach such as the EMEP/EEA spreadsheet.

## Methodology for quantifying surface access GHG emissions

Surface access emissions have been calculated using employee and passenger numbers and by estimating the number of total kilometres travelled for each mode of transport, based on information from the Traffic Assessment and Travel Plan and provided in Appendix A.

[18] Eurocontrol (2019). Small Emitters Tool. Available at: https://www.eurocontrol.int/tool/small-emitters-tool

Passenger data for the 2019 baseline modal splits has been sourced from raw data provided to LLAOL from the 2019 CAA Passenger Survey[19] at LLA. The modal splits in the 'without development' case are based on targets within the 2019 ASAS re-issue[20] for passenger bus/coach and rail travel. For the 'with development' case, modal splits are based on targets within the Travel Plan for bus/coach and rail. Although there is an additional target for non-electric cars this has not been incorporated into the assessment as no target data is available for electric cars and the assumptions are therefore too great. Uptake of electric vehicles are included in future projections (see **Table 7A.1**). Average car occupancy from the National Travel Survey 2019[21] has been applied to private car and taxi travel, it is assumed to remain constant in future time periods.

Details of passenger origin locations has been sourced from the public report of the CAA Passenger Survey 2019 for LLA. Origin is assumed constant in the 'with development' and 'without development' cases and all future time periods.

No data is available on the last mode of transport for rail passengers in the 2019 baseline, although it is assumed that the majority of passengers' onward travel would be by shuttle bus or taxi. Since passenger split details are unknown, the baseline assessment therefore only considers rail passengers' journey to Luton Airport Parkway and not their journey by the last mode of transport to LLA. In the future scenarios a last mode of transport assessment has been included. It has been assumed that all rail passengers will travel by DART, and this has been incorporated into the assessment for future assessment years once operational.

Baseline employee modal split data has been taken from the 2019 Staff Travel Survey (see **Chapter 10: Transport**). The modal splits in the 'without development' case are based on targets within the 2019 ASAS re-issue[22] for staff rail travel (note the targets for single occupancy vehicle and bus/coach have been achieved already in 2019 and no further improvements are assumed). For the 'with development' case, modal splits are based on targets within the Travel Plan for bus/coach, rail and cycling. As with the passenger data, there is an additional target for non-electric cars but this has not been incorporated into the assessment as no target data is available for electric cars and the assumptions are therefore too great. Uptake of electric vehicles are includes in future projections (see **Table 7A.1**).

Employee numbers for the 2019 baseline and 'with development' case are noted in the Transport Assessment (document reference **41431MP17V1).** 2019 baseline is assumed to be representative of an 18 mppa airport and is therefore used for the 'without development' case. Peak employee numbers are assumed be reached in the year the planning capacity is forecast to be reached and then remain constant.

Employee commuting distance has been sourced from the DfT National Travel Survey 2019[21] average commuting length of 14.7 km. This is in line with the data from the Staff Travel Survey where the median commute length of respondents was 14.5 km (representative of approximately 8.4% of staff).

Data on passenger and employee journeys have been multiplied by emissions factors from the 2019 conversion factors published by BEIS[4]. The emissions factors used for the surface access assessment are:

- Passenger vehicle (average sized car petrol): 0.18084 $kgCO_{2e}$/km;
- Passenger vehicle (average sized car diesel): 0.17336 $kgCO_{2e}$/km

[19] CAA. (2020). 2019 Passenger survey report [online]. Available at: https://www.caa.co.uk/Data-and-analysis/UK-aviation-market/Consumer-research/Departing-passenger-survey/2019-Passenger-survey-report/
[20] London Luton Airport (2019). LLAOL Airport Surface Access Strategy 2019 Reissue [online]. Available at: https://www.london-luton.co.uk/CMSPages/GetFile.aspx?guid=a31129aa-284b-4b4c-aae0-ed0208d70fec [Accessed 04 November 2020].
[21] Department for Transport, (2018), "National Travel Survey: 2019", [online]. Available at: https://www.gov.uk/government/statistics/national-travel-survey-2019
[22] London Luton Airport (2019). LLAOL Airport Surface Access Strategy 2019 Reissue [online]. Available at: https://www.london-luton.co.uk/CMSPages/GetFile.aspx?guid=a31129aa-284b-4b4c-aae0-ed0208d70fec [Accessed 04 November 2020].

- Passenger vehicle (average sized car plug in hybrid electric vehicle, including UK Electivity for EV usage): 0.11182 $kgCO_{2e}$/km
- Passenger vehicle (average sized car battery electric vehicle, including UK Electivity for EV usage): 0.05549 $kgCO_{2e}$/km
- Motorbike (average sized): 0.11551 $kgCO_{2e}$/km;
- Taxis (black cab): 0.31764 $kgCO_{2e}$/km;
- Taxis (regular taxi): 0.21024 $kgCO_{2e}$/km;
- Local Bus (average): 0.10471 $kgCO_{2e}$/passenger/km;
- Coach (average): 0.02779 $kgCO_{2e}$/passenger/km;
- National rail: 0.04115 $kgCO_{2e}$/passenger/km; and
- Light rail and tram: 0.03508 $kgCO_{2e}$/passenger/km.

All journeys are assumed two-way journeys. Well-to-tank emissions have not been considered.

Surface access emissions have been calculated for pessimistic, central and optimistic scenarios based on governmental policy and projections, CCC advice and industry projections (**Table 7A.1**). Data has been collated for all sources for 2024, 2028, 2032, 2040 and 2050.

Both the 'with development' and 'without development' cases are presented for 2024, 2028, 2032, 2040 and 2050.

### Methodology for quantifying airport buildings and operations GHG emissions

Raw data on airport building and ground operations at LLA have been provided for 2019. These have been multiplied by emissions factors from the 2019 conversion factors published by BEIS[4] unless otherwise specified. The emission factors used are:

- Electricity generation 2019 UK grid mix: 0.2556 $kgCO_{2e}$/kWh;
- Transmission and distribution (T&D) of UK grid electricity: 0.0217 $kgCO_{2e}$/kWh
- Natural gas: 0.18385 $kgCO_{2e}$/kWh;
- Diesel (heating and power): 2.75821 $kgCO_{2e}$ /litre;
- Diesel (vehicles): 2.59411 $kgCO_{2e}$/litre;
- Refrigerants (R410A): 2088 kg $CO2_e$/kg
- Refrigerants (HFC-134a): 1430 kg $CO2_e$/kg
- Refrigerants (R407C): 1774 kg $CO2_e$/kg

An increase in airport building and ground operations requirements has been calculated based on a linear increase proportionate to passenger numbers, relative to the 2019 baseline. Once the passenger capacity is reached, emissions are assumed to remain constant due to uncertainties in projections.

Where data is available information on tenant emissions have also been included. Presently this data is available for diesel for third party vehicle usage only. Future endeavours on carbon reporting in line with the ACA process will result in more detailed analysis being possible.

LLA have committed to securing electricity generated from renewable sources by the end of 2021. In line with guidance from the GHG Protocol[23], a market-based Scope 2 electricity factor has been calculated to reflect the renewable energy tariff which will be supported by a Renewables Obligation Certificate (ROC). The emission factor used in the market-based method is 0.0125 $kgCO_2e/kWh$[24]. This is reported in addition to the location-based emission for Scope 2 electricity, representative of the average emission of the UK Electricity grid including T&D emissions, as reported in paragraph 7.9.33.

Data on engine testing is not available for LLA and has not been included in the climate assessment. Based on the results of other airports the emissions associated with engine testing are likely to be negligible.

Improvement factors for three scenarios as stated in Table 7A.2 have been incorporated into the assessment for UK grid electricity generation. There is not sufficient information available to quantify anticipated changes in gas use, fleet vehicles or refrigerants for the future scenarios. These are therefore assumed to be constant, although expected changes such as improved building management processes, further boiler upgrades and fleet upgrades to electric or alternative fuel technologies are anticipated.

Both the 'with development' and 'without development' (i.e. Future Baseline) cases are presented for 2024, 2028, 2032, 2040 and 2050.

## Quantification of GHGs

This section sets out further quantifications of GHG emissions that are not presented in **Section 7.10** of **Chapter 7** of the ES.

## Total emissions

A breakdown of total projected GHG emissions by source for the upper emission scenario is shown in **Figure 7A.1**. The lower emission scenario is presented in **Figure 7A.2** (note the central emission scenario is shown in Chapter 8).

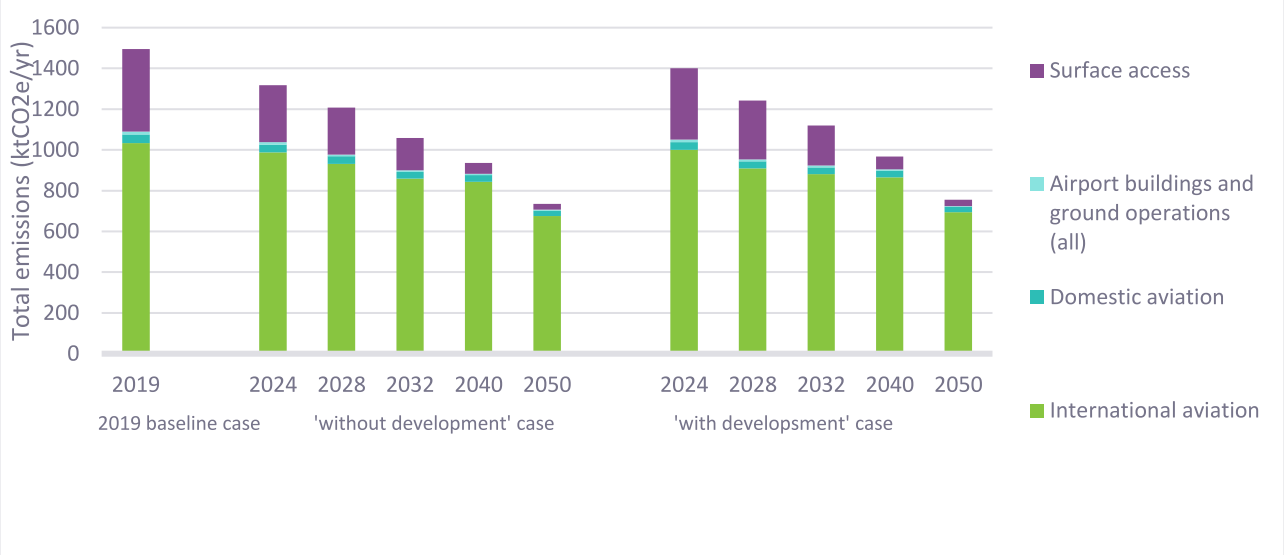
[23] Greenhouse Gas Protocol. (2015). GHG Protocol Scope 2 Guidance. An amendment to the GHG Protocol Corporate Standard [online]. Available at https://www.ghgprotocol.org/sites/default/files/ghgp/standards/Scope%202%20Guidance_Final_0.pdf [Accessed 21 October 2020].

[24] Pehl et al (2017). Understanding future emissions form low-carbon power systems by integration of life-cycle assessment and integrated energy modelling. Naturel energy, Volume 2 December 2017 939-945.

Figure 7A.1 Total GHG emissions for the 2017 baseline, and 'without development' and 'with development' cases for the upper emission scenario

Note: location-based approach is used to calculate all emissions

Figure 7A.2 Total GHG emissions for the 2017 baseline, and 'without development' and 'with development' cases for the upper emission scenario using a location-based approach




Note: location-based approach is used to calculate all emissions

## Aviation emissions

Total projected aviation GHG emissions from LLA for the baseline, 'without development' and 'with development' cases for the assessment years 2024, 2028, 2032, 2040 and 2050 in three future improvement scenarios (upper, central and lower emissions scenarios) are shown in **Table 7A.9**.

Table 7A9 Aviation GHG emissions ($ktCO_2/yr$) for domestic and international sources in the 2019 baseline, 'without development' and 'with development' cases in the upper, central and lower emission scenarios.

| | | 2024 | | 2028 | | 2032 | | 2040 | | 2050 | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | 2019 baseline | Without development | With development | Without development | With development | Without development | With development | Without development | With development | Without development | With development |
| **Upper emissions scenario** | | | | | | | | | | | |
| **Domestic** | 41.86 | 38.73 | 38.33 | 37.96 | 35.67 | 35.13 | 34.82 | 35.13 | 34.82 | 31.61 | 31.33 |
| **International** | 1033.83 | 998.69 | 1011.84 | 950.79 | 928.30 | 884.49 | 907.75 | 884.49 | 907.75 | 795.82 | 816.74 |
| **Pessimistic scenario total** | 1075.69 | 1037.42 | 1050.17 | 988.76 | 963.98 | 919.62 | 942.56 | 919.62 | 942.56 | 827.43 | 848.07 |
| **Central emissions scenario** | | | | | | | | | | | |
| **Domestic** | 41.86 | 38.51 | 38.11 | 37.57 | 35.30 | 34.61 | 34.30 | 34.29 | 33.99 | 28.74 | 28.49 |
| **International** | 1033.83 | 992.96 | 1006.03 | 941.00 | 918.74 | 871.36 | 894.27 | 863.38 | 886.07 | 723.69 | 742.71 |
| **Central scenario total** | 1075.69 | 1031.46 | 1044.15 | 978.57 | 954.04 | 905.97 | 928.57 | 897.66 | 920.06 | 752.43 | 771.20 |
| **Lower emissions scenario** | | | | | | | | | | | |
| **Domestic** | 41.86 | 38.29 | 37.89 | 37.19 | 34.94 | 34.09 | 33.79 | 33.47 | 33.17 | 26.85 | 26.61 |
| **International** | 1033.83 | 987.26 | 1000.26 | 931.29 | 909.26 | 858.41 | 880.97 | 842.74 | 864.89 | 675.98 | 693.75 |
| **Optimistic scenario total** | 1075.69 | 1025.54 | 1038.15 | 968.48 | 944.20 | 892.50 | 914.76 | 876.21 | 898.07 | 702.82 | 720.36 |

*2019 baseline is based on actual data and therefore no future scenarios were applied to the data, the same data is repeated in this table.

## Surface access emissions

Projected surface access GHG emissions for the 2019 baseline, 'without development' and 'with development' cases for the assessment years 2024, 2028, 2032, 2040 and 2050 in three future improvement scenarios (upper emission, central emission and lower emission scenarios) are shown in **Table 7A.10**.

Table 7A.10 Surface access GHG emissions ($ktCO_2e/yr$) associated with LLA.

| | | 2024 | | 2028 | | 2032 | | 2040 | | 2050 | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | 2019 baseline | Without development | With development | Without development | With development | Without development | With development | Without development | With development | Without development | With development |
| **Upper emission Scenario** | | | | | | | | | | | |
| **Passengers** | 396.06 | 281.22 | 352.80 | 258.49 | 324.49 | 243.46 | 305.46 | 223.96 | 280.60 | 207.02 | 258.83 |
| **Employees** | 9.69 | 8.61 | 9.17 | 7.90 | 8.43 | 7.47 | 7.97 | 6.91 | 7.39 | 6.41 | 6.87 |
| **Upper emission total** | 405.75 | 289.83 | 361.97 | 266.39 | 332.92 | 250.93 | 313.44 | 230.87 | 287.99 | 213.42 | 265.70 |
| **Central emission scenario** | | | | | | | | | | | |
| **Passengers** | 396.06 | 279.55 | 350.85 | 251.80 | 316.31 | 224.69 | 281.91 | 137.78 | 169.94 | 71.21 | 84.19 |
| **Employees** | 9.69 | 8.57 | 9.13 | 7.73 | 8.25 | 6.95 | 7.42 | 4.30 | 4.67 | 2.28 | 2.56 |
| **Central emission total** | 405.75 | 288.13 | 359.98 | 259.53 | 324.56 | 231.64 | 289.33 | 142.07 | 174.61 | 73.49 | 86.75 |
| **Lower emission scenario** | | | | | | | | | | | |
| **Passengers** | 396.06 | 271.49 | 340.76 | 223.69 | 280.77 | 153.87 | 191.37 | 52.75 | 61.29 | 27.44 | 29.28 |
| **Employees** | 9.69 | 8.36 | 8.91 | 6.95 | 7.44 | 4.87 | 5.27 | 1.80 | 2.06 | 1.07 | 1.29 |
| **Lower emission total** | 405.75 | 279.85 | 349.67 | 230.64 | 288.20 | 158.74 | 196.64 | 54.55 | 63.35 | 28.51 | 30.57 |

## Airport buildings and ground operations

In line with the GHG protocol guidance[23], both location-based and market-based carbon reporting methods have been used to calculate emissions associated with Scope 2 electricity.

Future efficiencies are applied to the UK grid electricity and there is therefore variation in the location-based results for the upper, central and lower emission scenarios. Data is presented for the both approach for all three emission scenarios in **Table 7A.11.**

Table 7A.11: Airport building and ground operation emissions ($ktCO_2e/yr$)

| | | 2024 | | 2028 | | 2032 | | 2040 | | 2050 | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | 2019 baseline* | Without development | With development | Without development | With development | Without development | With development | Without development | With development | Without development | With development |
| **Upper emission scenario** | | | | | | | | | | | |
| **Electricity (location-based)** | 10.10 | 9.40 | 6.64 | 6.30 | 5.41 | 4.25 | 10.10 | 9.40 | 6.64 | 6.30 | 5.41 |
| **Electricity (market-based)** | 10.10 | 0.48 | 0.36 | 0.36 | 0.36 | 0.36 | 10.10 | 0.48 | 0.36 | 0.36 | 0.36 |
| **Gas** | 1.50 | 1.58 | 1.58 | 1.58 | 1.58 | 1.58 | 1.50 | 1.58 | 1.58 | 1.58 | 1.58 |
| **Diesel – Heating** | 0.10 | 0.11 | 0.11 | 0.11 | 0.11 | 0.11 | 0.10 | 0.11 | 0.11 | 0.11 | 0.11 |
| **Diesel – Power** | 0.10 | 0.11 | 0.11 | 0.11 | 0.11 | 0.11 | 0.10 | 0.11 | 0.11 | 0.11 | 0.11 |
| **Diesel – Vehicles LLAOL** | 1.08 | 1.14 | 1.14 | 1.14 | 1.14 | 1.14 | 1.08 | 1.14 | 1.14 | 1.14 | 1.14 |
| **Diesel – Vehicles 3rd Part** | 0.67 | 0.71 | 0.71 | 0.71 | 0.71 | 0.71 | 0.67 | 0.71 | 0.71 | 0.71 | 0.71 |
| **Refrigerants (total)** | 0.27 | 0.28 | 0.28 | 0.28 | 0.28 | 0.28 | 0.27 | 0.28 | 0.28 | 0.28 | 0.28 |
| **TOTAL (location-based)** | 13.82 | 13.33 | 10.57 | 10.23 | 9.34 | 8.18 | 13.82 | 13.33 | 10.57 | 10.23 | 9.34 |
| **TOTAL (market-based)** | 13.82 | 4.40 | 4.28 | 4.28 | 4.28 | 4.28 | 13.82 | 4.40 | 4.28 | 4.28 | 4.28 |
| **Central emission scenario** | | | | | | | | | | | |
| **Electricity (location-based)** | 10.10 | 8.68 | 4.62 | 4.24 | 3.39 | 3.39 | 10.10 | 8.68 | 4.62 | 4.24 | 3.39 |
| **Electricity (market-based)** | 10.10 | 0.48 | 0.36 | 0.36 | 0.36 | 0.36 | 10.10 | 0.48 | 0.36 | 0.36 | 0.36 |
| **Gas** | 1.50 | 1.58 | 1.58 | 1.58 | 1.58 | 1.58 | 1.50 | 1.58 | 1.58 | 1.58 | 1.58 |
| **Diesel – Heating** | 0.10 | 0.11 | 0.11 | 0.11 | 0.11 | 0.11 | 0.10 | 0.11 | 0.11 | 0.11 | 0.11 |
| **Diesel – Power** | 0.10 | 0.11 | 0.11 | 0.11 | 0.11 | 0.11 | 0.10 | 0.11 | 0.11 | 0.11 | 0.11 |
| **Diesel – Vehicles LLAOL** | 1.08 | 1.14 | 1.14 | 1.14 | 1.14 | 1.14 | 1.08 | 1.14 | 1.14 | 1.14 | 1.14 |
| **Diesel – Vehicles 3rd Part** | 0.67 | 0.71 | 0.71 | 0.71 | 0.71 | 0.71 | 0.67 | 0.71 | 0.71 | 0.71 | 0.71 |
| **Refrigerants (total)** | 0.27 | 0.28 | 0.28 | 0.28 | 0.28 | 0.28 | 0.27 | 0.28 | 0.28 | 0.28 | 0.28 |
| **TOTAL (location-based)** | 13.82 | 12.60 | 8.55 | 8.16 | 7.31 | 7.31 | 13.82 | 12.60 | 8.55 | 8.16 | 7.31 |
| **TOTAL (market-based)** | 13.82 | 4.40 | 4.28 | 4.28 | 4.28 | 4.28 | 13.82 | 4.40 | 4.28 | 4.28 | 4.28 |
| **Upper emission scenario** | | | | | | | | | | | |
| **Electricity (location-based)** | 10.10 | 8.47 | 5.52 | 4.26 | 2.05 | -0.16 | 10.10 | 8.47 | 5.52 | 4.26 | 2.05 |
| **Electricity (market-based)** | 10.10 | 0.48 | 0.36 | 0.36 | 0.36 | 0.36 | 10.10 | 0.48 | 0.36 | 0.36 | 0.36 |
| **Gas** | 1.50 | 1.58 | 1.58 | 1.58 | 1.58 | 1.58 | 1.50 | 1.58 | 1.58 | 1.58 | 1.58 |

| | | 2024 | | 2028 | | 2032 | | 2040 | | 2050 | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | 2019 baseline* | Without development | With development | Without development | With development | Without development | With development | Without development | With development | Without development | With development |
| **Diesel – Heating** | 0.10 | 0.11 | 0.11 | 0.11 | 0.11 | 0.11 | 0.10 | 0.11 | 0.11 | 0.11 | 0.11 |
| **Diesel – Power** | 0.10 | 0.11 | 0.11 | 0.11 | 0.11 | 0.11 | 0.10 | 0.11 | 0.11 | 0.11 | 0.11 |
| **Diesel – Vehicles LLAOL** | 1.08 | 1.14 | 1.14 | 1.14 | 1.14 | 1.14 | 1.08 | 1.14 | 1.14 | 1.14 | 1.14 |
| **Diesel – Vehicles 3rd Part** | 0.67 | 0.71 | 0.71 | 0.71 | 0.71 | 0.71 | 0.67 | 0.71 | 0.71 | 0.71 | 0.71 |
| **Refrigerants (total)** | 0.27 | 0.28 | 0.28 | 0.28 | 0.28 | 0.28 | 0.27 | 0.28 | 0.28 | 0.28 | 0.28 |
| **TOTAL (location-based)** | 13.82 | 12.40 | 9.45 | 8.19 | 5.98 | 3.77 | 13.82 | 12.40 | 9.45 | 8.19 | 5.98 |
| **TOTAL (market-based)** | 13.82 | 4.40 | 4.28 | 4.28 | 4.28 | 4.28 | 13.82 | 4.40 | 4.28 | 4.28 | 4.28 |

Note negative values represent reductions in emissions. The direction of magnitude for these emission sources is beneficial in terms of impact on the global climate.
*2019 baseline is based on actual data and therefore no future scenarios were applied to the data, the same data is repeated in this table.

## Assessment of effects: the global climate

This section sets out further information considered in the assessment of effects, and should therefore be read in conjunction with the **Chapter 7, Section 7.11**.

## International aviation

International aviation GHG emissions for the Proposed Scheme and the 'with development' case as a percentage of the 37.5 $MtCO_2$/yr planning assumption are shown graphically in Chapter 8. These results are presented in **Table 7A.12** and **Table 7A.13**.

Table 7A.12 International aviation GHG emissions from the expansion of LLA (i.e. the Proposed Scheme) as a proportion of 37.5 $MtCO_2$/yr

| | 2024 | | 2028 | | 2032 | | 2040 | | 2050 | |
|---|---|---|---|---|---|---|---|---|---|---|
| | $MtCO_2$/yr | % | $MtCO_2$/yr | % | $MtCO_2$/yr | % | $MtCO_2$/yr | % | $MtCO_2$/yr | % |
| **Upper emission scenario** | 0.01 | 0.04% | -0.02 | -0.06% | 0.02 | 0.06% | 0.02 | 0.06% | 0.02 | 0.06% |
| **Central emission scenario** | 0.01 | 0.03% | -0.02 | -0.06% | 0.02 | 0.06% | 0.02 | 0.06% | 0.02 | 0.05% |
| **Lower emission scenario** | 0.01 | 0.03% | -0.02 | -0.06% | 0.02 | 0.06% | 0.02 | 0.06% | 0.02 | 0.05% |

Table 7A.13 International aviation GHG emissions from the 'with development' case as a proportion of the 37.5 $MtCO_2$/yr planning assumption

| | 2024 | | 2028 | | 2032 | | 2040 | | 2050 | |
|---|---|---|---|---|---|---|---|---|---|---|
| | **$MtCO_2$/yr** | **%** | **$MtCO_2$/yr** | **%** | **$MtCO_2$/yr** | **%** | **$MtCO_2$/yr** | **%** | **$MtCO_2$/yr** | **%** |
| **Upper emission scenario** | 1.01 | 2.70% | 0.93 | 2.48% | 0.91 | 2.42% | 0.91 | 2.42% | 0.82 | 2.18% |
| **Central emission scenario** | 1.01 | 2.68% | 0.92 | 2.45% | 0.89 | 2.38% | 0.89 | 2.36% | 0.74 | 1.98% |
| **Lower emission scenario** | 1.00 | 2.67% | 0.91 | 2.42% | 0.88 | 2.35% | 0.86 | 2.31% | 0.69 | 1.85% |

## Sensitivity analysis

Aviation GHG emissions for the Proposed Scheme and the 'with development' case as a percentage of the 23 $MtCO_2$/yr planning suggestion are shown graphically in Chapter 8. These results are presented in **Table 7A.14** and **Table 7A.15**.

Table 7A.14 Aviation GHG emissions from the expansion of LLA (i.e. the Proposed Scheme only) as a proportion of 23 $MtCO_2$/yr

| | 2024 | | 2028 | | 2032 | | 2040 | | 2050 | |
|---|---|---|---|---|---|---|---|---|---|---|
| | **MtCO2/yr** | **%** | **MtCO2/yr** | **%** | **MtCO2/yr** | **%** | **MtCO2/yr** | **%** | **MtCO2/yr** | **%** |
| **Upper emission scenario** | 0.01 | 0.06% | -0.02 | -0.11% | 0.02 | 0.10% | 0.02 | 0.10% | 0.02 | 0.09% |
| **Central emission scenario** | 0.01 | 0.06% | -0.02 | -0.11% | 0.02 | 0.10% | 0.02 | 0.10% | 0.02 | 0.08% |
| **Lower emission scenario** | 0.01 | 0.05% | -0.02 | -0.11% | 0.02 | 0.10% | 0.02 | 0.10% | 0.02 | 0.08% |
| **CCC Balanced Pathway scenario** | 0.01 | 0.06% | -0.02 | -0.11% | 0.02 | 0.10% | 0.02 | 0.08% | 0.02 | 0.07% |

Table 7A.15 Aviation GHG emissions from the 'with development' case (i.e. all aviation emissions including the Proposed Scheme) as a proportion of the 23 $MtCO_2$/yr planning suggestion

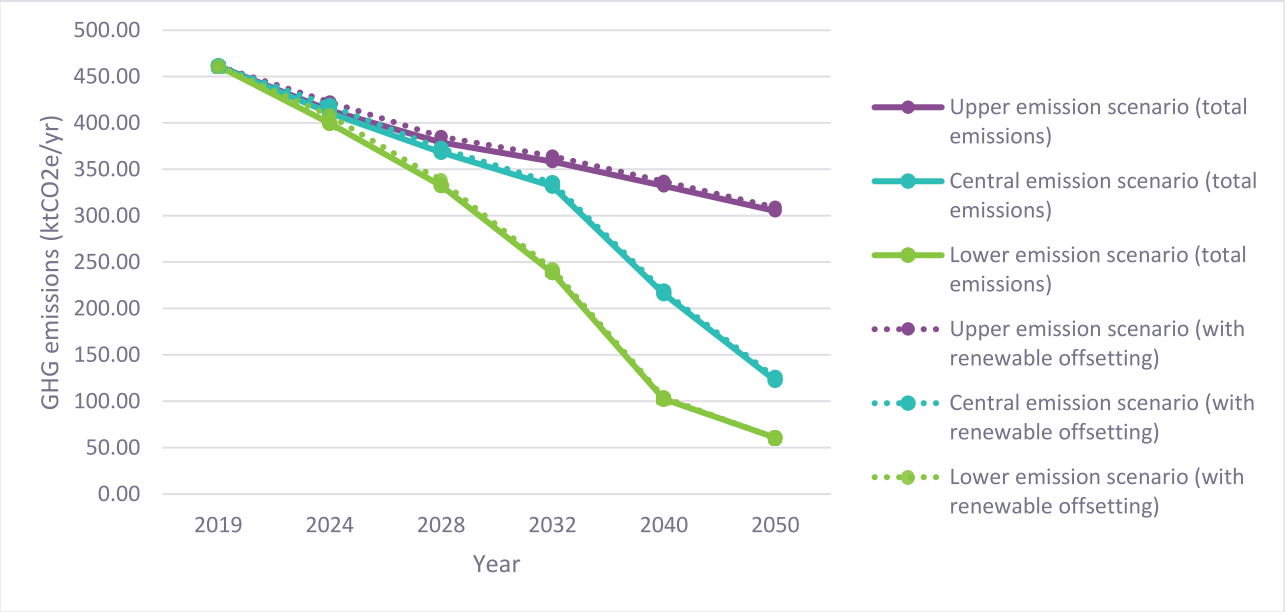
| | 2024 | | 2028 | | 2032 | | 2040 | | 2050 | |
|---|---|---|---|---|---|---|---|---|---|---|
| | **$MtCO_2$/yr** | **%** | **$MtCO_2$/yr** | **%** | **$MtCO_2$/yr** | **%** | **$MtCO_2$/yr** | **%** | **$MtCO_2$/yr** | **%** |
| **Upper emission scenario** | 1.05 | 4.57% | 0.96 | 4.19% | 0.94 | 4.10% | 0.94 | 4.10% | 0.85 | 3.69% |
| **Central emission scenario** | 1.04 | 4.54% | 0.95 | 4.15% | 0.93 | 4.04% | 0.92 | 4.00% | 0.77 | 3.35% |
| **Lower emission scenario** | 1.04 | 4.51% | 0.94 | 4.11% | 0.91 | 3.98% | 0.90 | 3.90% | 0.72 | 3.13% |
| **CCC Balanced Pathway scenario** | 1.05 | 4.57% | 0.96 | 4.17% | 0.92 | 4.00% | 0.79 | 3.43% | 0.64 | 2.78% |

## UK Carbon Target for 2050 and UK Carbon Budgets (non-international aviation)

**Figure 7A.3** shows the GHG emissions associated with the 'with development' case that are considered in the UK Carbon Budget[25] and Net Zero Target[26]. This represents all activities at LLA that are considered in the UK Carbon Budget and Net Zero Target, including emissions from the Proposed Scheme. Both the total emissions and residual emissions following offsetting commitments are shown.

[25] The UK Government. (2016). Carbon Budgets. [online]. Available at: https://www.gov.uk/guidance/carbon-budgets [Accessed 21 October 2020].
[26] The UK Government. (2008). Climate Change Act 2008. [online]. Available at: http://www.legislation.gov.uk/ukpga/2008/27/contents [Accessed 21 October 2020].

Figure 7A.3 Total GHG emissions (solid line) and residual GHG emissions once offsetting commitments (renewable energy procurement) are considered (dashed line) which contribute to the UK Carbon Target and UK Carbon Budgets from the 'with development' case.



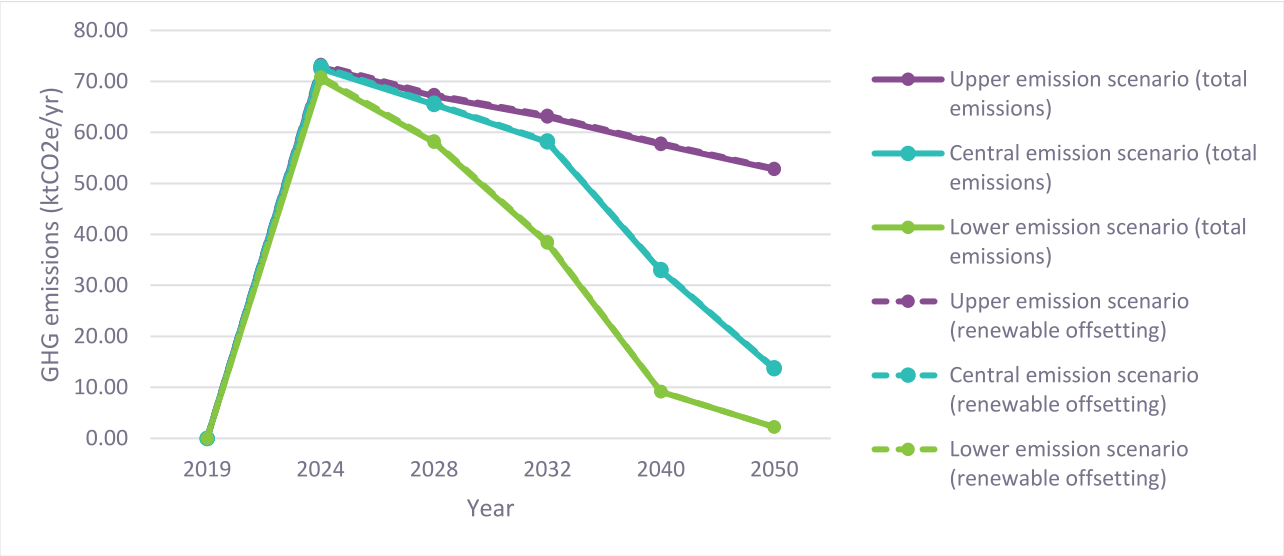

In 2050, GHG emissions from the 'with development' case that are considered in the UK Net Zero 2050 Target are 60.9 – 305.2 $ktCO_{2e}$/yr, dependent on the future improvement scenario used. Residual GHG emissions once offsetting commitments have been considered reduce to 60.4 – 309.1 $ktCO_{2e}$/yr, dependent on the scenario used.

The Luton Borough Council Climate Change Action Plan[27] aims for a carbon neutral borough by 2040. To date, this is an aim rather than a policy and the scope of this aim has not yet been defined. To provide an indication, GHG emissions from surface access, and airport building and operations GHG emissions from the Proposed Development case have been considered in line with the target year of this aim.

GHG emissions that are assumed to be indicative of the scope of the Luton Borough Council Climate Change Action Plan[27] aim are shown for the Proposed Development in **Figure 7A.4**. Both the total emissions and residual emissions following offsetting commitments are shown.

[27] Luton Borough Council [2019] Climate Change Action Plan [online]. Available at: https://www.luton.gov.uk/Environment/Lists/LutonDocuments/PDF/Climate%20change/Climate-change-action-plan.pdf [Accessed 01 December 2020].

Figure 7A.4 Total GHG emissions (solid line) and residual GHG emissions once offsetting commitments are considered (dashed line) which are assumed to be indicative of the scope of the Luton Borough Council Climate Change Action Plan aim from the Proposed Scheme only.




GHG emissions that are assumed to be indicative of the scope of the Luton Borough Council Climate Change Action Plan aim are shown for the 'with development' case in **Figure 7A.5**. This represents all activities at LLA that are considered indicative of the scope of the Luton Borough Council Climate Change Action Plan[27] aim, including emissions form the Proposed Scheme. Both the total emissions and residual emissions following offsetting commitments are shown.

Figure 7A.5 Total GHG emissions (solid line) and residual GHG emissions once offsetting commitments are considered (dashed line) which are assumed to be indicative of the scope of the North Somerset Climate Emergency Strategy aim from the 'with development' case.

In 2040, GHG emissions from the 'with development' case that are considered indicative of the scope of the Luton Borough Council Climate Change Action Plan aim are 69.3 – 297.3 $ktCO_{2e}$/yr, dependent on the future improvement scenario used. Residual GHG emissions once offsetting commitments have been considered reduce to 71.0 – 302.4 $ktCO_{2e}$/yr, dependent on the scenario used. GHG emissions then fall in all future scenarios, primarily due to a decrease in surface access emissions due to the increased uptake of electric vehicles and shift in modal splits.

## Supporting Data

The section sets out details of supporting data that has been used to quantify GHG emissions in **Chapter 8** of the ES.

### Airport building and ground operations

Table 7A.16 Raw data on electricity, gas, diesel and refrigerant usage in 2019 for baseline calculations

| Component | Unit | Usage in 2019 |
|---|---|---|
| **Electricity** | kWh | 36,408,146.5 |
| **Gas** | kWh | 8,140,035 |
| **Diesel (heating)** | Litres | 36,278 |
| **Diesel (power)** | Litres | 37,440 |
| **Diesel (LLAOL vehicles)** | Litres | 417,067 |
| **Diesel (third party vehicles)** | Litres | 258,730 |
| **Refrigerant – R407C** | Kg | 8.70 |
| **Refrigerant – R410A** | Kg | 31.1 |
| **Refrigerant – R134A** | Kg | 131 |
| **Refrigerant – R32** | kg | 0 |

## Surface access

Table 7A.17 Passenger origins for LLA and representative distances travelled used in surface access assessment

| Region | % of passengers (CAA Passenger survey results) | Representative distance (road journeys) (km) | Representative distance (rail journeys) (km) |
|---|---|---|---|
| **East Midlands** | 6.95% | 146.34 | 142.92 |
| **East of England** | 32.62% | 77.83 | 107.33 |
| **North East** | 0.13% | 388.25 | 389.98 |
| **North West** | 0.43% | 312.61 | 309.16 |
| **Scotland** | 0.12% | 674.31 | 678.93 |
| **South East** | 53.73% | 127.02 | 130.31 |
| **South West** | 2.05% | 258.07 | 273.33 |
| **Wales** | 0.40% | 279.49 | 290.00 |
| **West Midlands** | 2.84% | 144.28 | 165.94 |

| Region | % of passengers (CAA Passenger survey results) | Representative distance (road journeys) (km) | Representative distance (rail journeys) (km) |
|---|---|---|---|
| **Yorkshire and the Humber** | 0.73% | 267.47 | 266.62 |
| **Northern Ireland & Eire** | 0.00% | 146.34 | 142.92 |

## Table 7A.18 Modal splits for passenger journeys

| Mode | 2019 Baseline | 'without development' case* | 'with development' case** |
|---|---|---|---|
| **Bus / Coach** | 16.9% | 17.0% | 17.0% |
| **Rail** | 20.7% | 24.0% | 25.0% |
| **Taxi / Minicab** | 17.9% | 13.3% | 13.6% |
| **Walk / Cycle** | 0.2% | 0.1% | 0.1% |
| **Private car (drop off / pick up)** | 26.8% | 19.8% | 26.8% |
| **Private car (on-site / off-site parking and rental car)** | 17.5% | 12.9% | 17.5% |
| **Other** | 0.1% | 0.0% | 0.0% |

*Based on ASAS re-issue targets for passengers travelling by bus/coach and rail. The remaining passenger journeys have been assigned modal splits based on the same distribution as in the 2019 Baseline data.
**Based on Travel Plan targets for passengers travelling by bus/coach and rail, and assuming the same number of private car journeys. The remaining passenger journeys have been assigned modal splits based on the same distribution as in the 2019 Baseline data.

## Table 7A.19 Employee numbers and journeys

| | Baseline (2019) and 'without development' case | 'with development' case |
|---|---|---|
| **Employee numbers (total)** | 10,935 | 11,285 |
| **Equivalent number of employee working days per year*** | 2,384,221 | 2,460,533 |

*It is assumed that one journeys is made to LLA by employees on each working day, and one return journey.

## Table 7A.20 Modal splits for staff journeys

| Mode | 2019 Baseline | 'without development' case* | 'with development' case** |
|---|---|---|---|
| **Private car (single occupancy vehicles)** | 59.4% | 58.5% | 59.4% |
| **Private car (as a driver with additional passengers)** | 4.1% | 4.0% | 4.1% |
| **Private car (as an additional passenger)** | 3.8% | 3.7% | 3.8% |
| **Bus** | 16.0% | 15.8% | 17.0% |

| Mode | 2019 Baseline | 'without development' case* | 'with development' case** |
|---|---|---|---|
| **Rail** | 7.6% | 9.0% | 10.0% |
| **Walk** | 5.8% | 5.71% | 2.1% |
| **Cycle** | 1.7% | 1.67% | 3.0% |
| **Motorcycle** | 0.8% | 0.8% | 0.3% |
| **Taxi** | 0.8% | 0.8% | 0.3% |

*Based on ASAS re-issue targets for staff travelling by rail. The remaining staff journeys have been assigned modal splits based on the same distribution as in the 2019 baseline data.
**Based on Travel Plan targets for staff travelling by bus, rail and cycling, and assuming the same number of private car journeys as in the 2019 baseline. The remaining staff journeys have been assigned modal splits based on the same distribution as in the 2019 baseline data.

## Aviation emissions

### Table 7A.21: Aviation movements and destination information

| Aircraft type code | Destination | without development' 2024 | with development' 2024 | without development' 2028 | with development' 2028 | without development' 2032 | with development' 2032 |
|---|---|---|---|---|---|---|---|
| C68A | C68A | 4.35 | 4.35 | 4.35 | 4.35 | 4.26 | 4.28 |
| GLEX | BGSF | 4.35 | 4.35 | 4.35 | 4.35 | 4.26 | 4.28 |
| CL35 | BIAR | 4.35 | 4.35 | 4.35 | 4.35 | 4.26 | 4.28 |
| H25B, GLF6, GLF5, GLF4, GLEX, E135, CRJ2, CL60, CL35, CL30, B738, A321, A320, A319, A21N, A20N | BIKF | 667.11 | 667.12 | 684.27 | 667.12 | 665.65 | 665.88 |
| H25B, GLF5, E35L, CRJ2, CL60 | BIRK | 30.47 | 30.47 | 30.47 | 30.47 | 29.83 | 29.93 |
| C56X, A320, A21N, A20N | BKPR | 189.53 | 189.53 | 194.85 | 189.53 | 189.44 | 189.46 |
| GLF4, CL30 | CYFB | 8.71 | 8.71 | 8.71 | 8.71 | 8.52 | 8.55 |
| GLEX | CYHU | 4.35 | 4.35 | 4.35 | 4.35 | 4.26 | 4.28 |
| GLF5 | CYHZ | 4.35 | 4.35 | 4.35 | 4.35 | 4.26 | 4.28 |
| F2TH | CYPQ | 4.35 | 4.35 | 4.35 | 4.35 | 4.26 | 4.28 |
| GALX, E135, CL35, CL30 | CYQX | 21.76 | 21.76 | 21.76 | 21.76 | 21.31 | 21.38 |

| Aircraft type code | Destination | without development' 2024 | with development' 2024 | without development' 2028 | with development' 2028 | without development' 2032 | with development' 2032 |
|---|---|---|---|---|---|---|---|
| GLEX, CL60, CL35, CL30 | CYUL | 21.76 | 21.76 | 21.76 | 21.76 | 21.31 | 21.38 |
| GLF4 | CYWG | 4.35 | 4.35 | 4.35 | 4.35 | 4.26 | 4.28 |
| GLF5 | CYYC | 4.35 | 4.35 | 4.35 | 4.35 | 4.26 | 4.28 |
| F2TH, CL35 | CYYR | 8.71 | 8.71 | 8.71 | 8.71 | 8.52 | 8.55 |
| CL30 | CYYT | 4.35 | 4.35 | 4.35 | 4.35 | 4.26 | 4.28 |
| GLEX, CL60 | CYYZ | 13.06 | 13.06 | 13.06 | 13.06 | 12.78 | 12.83 |
| LJ40 | DAAG | 4.35 | 4.35 | 4.35 | 4.35 | 4.26 | 4.28 |
| GLF5, CL60, A318 | DGAA | 17.41 | 17.41 | 17.41 | 17.41 | 17.05 | 17.10 |
| GLF6, GALX, FA7X, CL60 | DNAA | 21.76 | 21.76 | 21.76 | 21.76 | 21.31 | 21.38 |
| GLF5, GLF4, GLEX, FA7X, E135 | DNMM | 43.53 | 43.53 | 43.53 | 43.53 | 42.61 | 42.76 |
| E135 | DNPO | 4.35 | 4.35 | 4.35 | 4.35 | 4.26 | 4.28 |
| B7M8, B738 | DTNH | 45.42 | 45.42 | 46.73 | 45.42 | 45.42 | 45.42 |
| CRJ2, CL35, C750 | DTTA | 13.06 | 13.06 | 13.06 | 13.06 | 12.78 | 12.83 |
| TBM7, PC12, G280, FA8X, E135, C680, C650, C56X, C25A | EBAW | 43.53 | 43.53 | 43.53 | 43.53 | 42.61 | 42.76 |
| PRM1, GLF6, GLF5, GLF4, GLEX, FA8X, FA7X, E55P, CRJ2, CN35, CL60, C510, C25A, BET, B738 | EBBR | 87.05 | 82.71 | 87.05 | 82.71 | 85.23 | 81.24 |
| FA7X, C56X | EBCI | 17.41 | 17.41 | 17.41 | 17.41 | 17.05 | 17.10 |
| P180, G280, G150, C500, C25C, C25A | EBKT | 30.47 | 30.47 | 30.47 | 30.47 | 29.83 | 29.93 |
| CRJ2, CL60, CL30, C25A | EBLG | 21.76 | 21.76 | 21.76 | 21.76 | 21.31 | 21.38 |
| E145 | EBMB | 4.35 | 4.35 | 4.35 | 4.35 | 4.26 | 4.28 |

| Aircraft type code | Destination | without development' 2024 | with development' 2024 | without development' 2028 | with development' 2028 | without development' 2032 | with development' 2032 |
|---|---|---|---|---|---|---|---|
| CL35, C500 | EBOS | 8.71 | 8.71 | 8.71 | 8.71 | 8.52 | 8.55 |
| A109 | ED28 | 3.17 | 3.17 | 3.17 | 3.17 | 3.17 | 3.17 |
| C56X | EDAC | 4.35 | 4.35 | 4.35 | 4.35 | 4.26 | 4.28 |
| GLF6, GLEX, GL5T, FA7X, F900, F2TH, E50P, E135, CRJ2, CL35, CL30, C680, C56X, C510, C500, A320, A319, A20N | EDDB | 648.60 | 648.61 | 663.85 | 648.61 | 646.14 | 646.53 |
| B752 | EDDC | 4.35 | 4.35 | 4.35 | 4.35 | 4.26 | 4.28 |
| GLF6 | EDDE | 4.35 | 4.35 | 4.35 | 4.35 | 4.26 | 4.28 |
| LJ55, GLF6, GLF5, GLF4, GLEX, F2TH, E135, CRJ2, CL60, CL35, C680, C56X, BE2, A306 | EDDF | 227.39 | 227.39 | 220.14 | 227.39 | 225.65 | 225.93 |
| GLEX, C56X | EDDG | 8.71 | 8.71 | 8.71 | 8.71 | 8.52 | 8.55 |
| H25B, GLF5, GLEX, F2TH, E55P, C750, C56X, C25C, BET, BE2 | EDDH | 56.58 | 56.59 | 56.58 | 56.59 | 55.40 | 55.59 |
| LJ55, LJ40, LJ28, GLF5, GLEX, F2TH, E55P, E50P, CRJ2, CL60, C56X, C550, B752 | EDDK | 69.67 | 69.68 | 69.45 | 69.68 | 68.30 | 68.52 |
| GLF5, GLEX, E550, E135, CL60, C750, C680, C56X, | EDDL | 82.70 | 78.35 | 82.70 | 78.35 | 80.96 | 76.96 |

| Aircraft type code | Destination | without development' 2024 | with development' 2024 | without development' 2028 | with development' 2028 | without development' 2032 | with development' 2032 |
|---|---|---|---|---|---|---|---|
| C55B, C550, C500, B738, B735 | | | | | | | |
| LJ55, LJ40, H25B, GLF5, GLEX, F900, E55P, E190, E135, CL35, C750, C680, C56X, A320, A319, A20N | EDDM | 361.36 | 361.36 | 369.49 | 361.36 | 359.72 | 359.98 |
| LJ75, LJ55, LJ40, GLEX, DA42, CL30, C68A, C56X | EDDN | 52.23 | 52.24 | 52.23 | 52.24 | 51.14 | 51.31 |
| CL60, B752, B734, A306 | EDDP | 197.27 | 197.27 | 366.70 | 197.27 | 385.71 | 197.19 |
| E50P, C750, C56X, C25C | EDDS | 17.41 | 17.41 | 17.41 | 17.41 | 17.05 | 17.10 |
| H25B, E35L, CL35 | EDDT | 13.06 | 13.06 | 13.06 | 13.06 | 12.78 | 12.83 |
| F900, CRJ2, CL60, C56X, C55B | EDDV | 34.82 | 34.82 | 34.82 | 34.82 | 34.09 | 34.21 |
| C56X, C550 | EDDW | 8.71 | 8.71 | 8.71 | 8.71 | 8.52 | 8.55 |
| E50P, E135, BE2 | EDFH | 13.06 | 13.06 | 13.06 | 13.06 | 12.78 | 12.83 |
| E50P, C680, C500 | EDHL | 17.41 | 17.41 | 17.41 | 17.41 | 17.05 | 17.10 |
| C650, C56X | EDLN | 8.71 | 8.71 | 8.71 | 8.71 | 8.52 | 8.55 |
| C550 | EDLP | 4.35 | 4.35 | 4.35 | 4.35 | 4.26 | 4.28 |
| E55P, C550, A320, A319, A20N | EDLW | 308.27 | 308.27 | 316.50 | 308.27 | 307.81 | 307.89 |
| GLEX, C56X | EDMO | 17.41 | 17.41 | 17.41 | 17.41 | 17.05 | 17.10 |
| GLEX, E55P | EDNY | 8.71 | 8.71 | 8.71 | 8.71 | 8.52 | 8.55 |
| C25C | EDQG | 4.35 | 4.35 | 4.35 | 4.35 | 4.26 | 4.28 |
| C25A | EDQM | 4.35 | 4.35 | 4.35 | 4.35 | 4.26 | 4.28 |
| C500 | EDRY | 4.35 | 4.35 | 4.35 | 4.35 | 4.26 | 4.28 |
| E50P, D228 | EDRZ | 17.41 | 17.41 | 17.41 | 17.41 | 17.05 | 17.10 |
| LJ28, E55P, E135, | EDSB | 39.17 | 39.18 | 39.17 | 39.18 | 38.35 | 38.48 |

| Aircraft type code | Destination | without development' 2024 | with development' 2024 | without development' 2028 | with development' 2028 | without development' 2032 | with development' 2032 |
|---|---|---|---|---|---|---|---|
| CL35, C25A | | | | | | | |
| E55P, C56X | EDTL | 8.71 | 8.71 | 8.71 | 8.71 | 8.52 | 8.55 |
| E55P | EDTM | 8.71 | 8.71 | 8.71 | 8.71 | 8.52 | 8.55 |
| C56X | EDTY | 4.35 | 4.35 | 4.35 | 4.35 | 4.26 | 4.28 |
| FA7X | EDVE | 4.35 | 4.35 | 4.35 | 4.35 | 4.26 | 4.28 |
| E55P, CL35, C680, C550, BE2 | EDXW | 34.82 | 34.82 | 34.82 | 34.82 | 34.09 | 34.21 |
| H25B, A321, A21N, A20N | EETN | 102.18 | 102.18 | 104.99 | 102.18 | 102.09 | 102.11 |
| GLF4, GLEX, FA7X, E190, E135, CL60, C680, C550 | EFHK | 39.17 | 39.18 | 39.17 | 39.18 | 38.35 | 38.48 |
| CL60 | EFKU | 4.35 | 4.35 | 4.35 | 4.35 | 4.26 | 4.28 |
| CL60, A321, A320, A21N, A20N | EFTU | 119.65 | 140.62 | 122.96 | 140.62 | 119.56 | 140.54 |
| PC12 | EG0B | 4.35 | 4.35 | 4.35 | 4.35 | 4.26 | 4.28 |
| H25B, E55P, E135, BE2, B7M8, A320, A319, A20N | EGAA | 1138.06 | 1138.06 | 1169.86 | 1138.06 | 1137.42 | 1137.52 |
| H25B, E55P, C56X | EGAC | 26.12 | 26.12 | 26.12 | 26.12 | 25.57 | 25.65 |
| F2TH, CL35, C680 | EGAE | 13.06 | 13.06 | 13.06 | 13.06 | 12.78 | 12.83 |
| LJ28, GLF5, GLF4, E55P, E550, E195, CRJ2, C56X, BE40, B7M8 | EGBB | 81.84 | 78.35 | 81.94 | 78.35 | 80.20 | 76.96 |
| A109 | EGBE | 9.52 | 9.52 | 9.52 | 9.52 | 9.52 | 9.52 |
| C510 | EGBJ | 4.35 | 4.35 | 4.35 | 4.35 | 4.26 | 4.28 |
| HELI | EGBV | 3.17 | 3.17 | 3.17 | 3.17 | 3.17 | 3.17 |
| RJ85, LJ40, H25B, GLF5, GLEX, E55P, E550, E35L, E135, CRJ2, CL60, C650, C56X, C55B, | EGCC | 189.06 | 154.13 | 190.36 | 154.13 | 186.04 | 151.58 |

| Aircraft type code | Destination | without development' 2024 | with development' 2024 | without development' 2028 | with development' 2028 | without development' 2032 | with development' 2032 |
|---|---|---|---|---|---|---|---|
| C550, C510, C25C, B7M8, B788, B738, A320, A20N | | | | | | | |
| GALX, C750 | EGCM | 8.71 | 8.71 | 8.71 | 8.71 | 8.52 | 8.55 |
| GLF4, CL35, CL30, C750, C680, C500, B350 | EGCN | 30.47 | 30.47 | 30.47 | 30.47 | 29.83 | 29.93 |
| A109 | EGDD | 3.17 | 3.17 | 3.17 | 3.17 | 3.17 | 3.17 |
| BET | EGFE | 4.35 | 4.35 | 4.35 | 4.35 | 4.26 | 4.28 |
| LJ40, GLEX, E35L, CL35, C56X, BET, BE40, BE2 | EGFF | 69.64 | 69.65 | 69.64 | 69.65 | 68.18 | 68.41 |
| GLF6, GLF5, E55P, E550, E135, CL35, C25A, A319, A20N | EGGD | 50.51 | 50.52 | 50.71 | 50.52 | 49.60 | 49.75 |
| RJ1H, LJ55, FA7X, F900, F2TH, E55P, E145, E135, C56X, C25A, BE40, BE2, A320, A319, A20N | EGGP | 101.03 | 101.03 | 101.43 | 101.03 | 99.20 | 99.49 |
| GLF6, GLF5, C56X | EGGW | 26.12 | 26.12 | 26.12 | 26.12 | 25.57 | 25.65 |
| AS55 | EGHC | 3.17 | 3.17 | 3.17 | 3.17 | 3.17 | 3.17 |
| PC12, H25B, F900, F2TH, E550, E135, CL60, C56X, C55B | EGHH | 69.64 | 69.65 | 69.64 | 69.65 | 68.18 | 68.41 |
| GLF5, E55P, C680, C56X, C55B, C550, C510, | EGHI | 59.76 | 59.76 | 59.76 | 59.76 | 58.57 | 58.76 |

| Aircraft type code | Destination | without development' 2024 | with development' 2024 | without development' 2028 | with development' 2028 | without development' 2032 | with development' 2032 |
|---|---|---|---|---|---|---|---|
| C500, B462, A169 | | | | | | | |
| B752, B737, AS55, A109 | EGHL | 35.28 | 35.28 | 35.28 | 35.28 | 35.00 | 35.05 |
| H25B, FA7X, E55P, E50P, DA42, C56X | EGHQ | 39.17 | 39.18 | 39.17 | 39.18 | 38.35 | 38.48 |
| LJ75, E55P, E550, E135, CL60, CL30, C550, C510 | EGJB | 104.46 | 104.47 | 104.46 | 104.47 | 102.27 | 102.62 |
| PC12, H25B, GLEX, G280, E50P, CRJ2, CL60, CL35, C56X, C550, C510, C500, BET, A320, A319, A20N | EGJJ | 425.05 | 425.06 | 434.38 | 425.06 | 422.95 | 423.28 |
| LJ75, LJ40, GLF5, GLF4, GLEX, FA7X, F900, E55P, E550, E135, CRJ2, CL60, CL35, C680, C56X, C550, C510, BET, BE40, A109 | EGKB | 257.62 | 257.64 | 257.62 | 257.64 | 252.42 | 253.24 |
| GLEX, E55P, B7M8, B788, B738, A320, A319, A20N | EGKK | 75.09 | 64.61 | 77.00 | 64.61 | 74.91 | 64.46 |
| GLEX, G280, E55P, E35L, C680, C56X, C55B, C510 | EGLC | 56.58 | 56.59 | 56.58 | 56.59 | 55.40 | 55.59 |

| Aircraft type code | Destination | without development' 2024 | with development' 2024 | without development' 2028 | with development' 2028 | without development' 2032 | with development' 2032 |
|---|---|---|---|---|---|---|---|
| PC12, B06, A109 | EGLD | 19.41 | 19.41 | 19.41 | 19.41 | 19.13 | 19.18 |
| PC24, LJ40, H25B, GLF6, GLF5, GLF4, GLEX, GALX, G280, FA7X, F900, F2TH, E55P, E50P, E35L, E135, DFL, CRJ2, CL60, CL35, C680, C56X, C550, C25A, B738, B737, B06 | EGLF | 455.84 | 455.88 | 455.84 | 455.88 | 446.35 | 447.86 |
| C510, BET | EGLK | 8.71 | 8.71 | 8.71 | 8.71 | 8.52 | 8.55 |
| GLF6, GLF5, B752, A306 | EGLL | 105.16 | 105.16 | 100.33 | 105.16 | 104.98 | 105.01 |
| S76, B06, AS55, A139, A109 | EGLW | 101.94 | 101.94 | 101.94 | 101.94 | 101.66 | 101.70 |
| RJ1H, LJ40, GLF5, GLEX, FA7X, F900, CL60, C680, C550, B462 | EGMC | 69.64 | 69.65 | 69.64 | 69.65 | 68.18 | 68.41 |
| C55B, B350 | EGMD | 8.71 | 8.71 | 8.71 | 8.71 | 8.52 | 8.55 |
| GLF6 | EGNC | 4.35 | 4.35 | 4.35 | 4.35 | 4.26 | 4.28 |
| LJ40, CL35, C56X, C55B, BET | EGNH | 21.76 | 21.76 | 21.76 | 21.76 | 21.31 | 21.38 |
| E145, C56X | EGNJ | 13.06 | 13.06 | 13.06 | 13.06 | 12.78 | 12.83 |
| GLF6, CRJ2, C550 | EGNM | 13.06 | 13.06 | 13.06 | 13.06 | 12.78 | 12.83 |
| FA8X, CL60, C56X, C550, C510 | EGNR | 21.76 | 21.76 | 21.76 | 21.76 | 21.31 | 21.38 |
| LJ75, LJ40, E55P, E50P, E35L, E135, CL60, C56X, A320, | EGNS | 254.58 | 254.59 | 257.89 | 254.59 | 251.66 | 252.13 |

| Aircraft type code | Destination | without development' 2024 | with development' 2024 | without development' 2028 | with development' 2028 | without development' 2032 | with development' 2032 |
|---|---|---|---|---|---|---|---|
| A319, A20N | | | | | | | |
| RJ1H, H25B, GLF5, GLF4, GLEX, FA7X, E55P, E50P, E145, C56X, C550, BET, BE2, B06, A320, A319, A20N | EGNT | 106.78 | 106.79 | 106.88 | 106.79 | 104.68 | 105.01 |
| E55P, CL30, C56X, C55B, C550, BET, BE2 | EGNV | 47.88 | 47.88 | 47.88 | 47.88 | 46.87 | 47.03 |
| H25B, E135, CL35, C750, C56X, B752, B735, B734, B733, A306 | EGNX | 394.32 | 394.32 | 376.53 | 394.32 | 393.50 | 393.63 |
| H25B, F2TH, F100, E55P, CL35, C56X, A320, A319, A20N | EGPD | 276.76 | 276.77 | 283.59 | 276.77 | 275.94 | 276.07 |
| RJ85, LJ75, H25B, GLF5, GLF4, G280, E55P, E50P, CL60, C56X, C550, C25A, A320, A319, A20N | EGPE | 602.38 | 602.39 | 616.93 | 602.39 | 600.38 | 600.70 |
| GLF4, GLEX, FA7X, E50P, E135, CL60, C56X, C510, C500, BET, | EGPF | 805.95 | 798.97 | 826.72 | 798.97 | 804.22 | 797.51 |

| Aircraft type code | Destination | without development' 2024 | with development' 2024 | without development' 2028 | with development' 2028 | without development' 2032 | with development' 2032 |
|---|---|---|---|---|---|---|---|
| B7M8, B788, A320, A319, A20N | | | | | | | |
| RJ1H, H25B, GLF6, GLF5, GLF4, GLEX, FA7X, F2TH, E55P, E35L, CL60, CL30, C680, C56X, C55B, C550, C500, C25A, BET, BE40, BE2, A320, A319, A20N | EGPH | 1140.34 | 1140.35 | 1169.33 | 1140.35 | 1137.60 | 1138.03 |
| C680 | EGPI | 8.71 | 8.71 | 8.71 | 8.71 | 8.52 | 8.55 |
| GLF4, GLEX, E550, C550 | EGPK | 21.76 | 21.76 | 21.76 | 21.76 | 21.31 | 21.38 |
| FA7X, CL60, C680, B350 | EGPN | 21.76 | 21.76 | 21.76 | 21.76 | 21.31 | 21.38 |
| E55P | EGPU | 4.35 | 4.35 | 4.35 | 4.35 | 4.26 | 4.28 |
| GLF6, GLEX | EGQL | 13.06 | 13.06 | 13.06 | 13.06 | 12.78 | 12.83 |
| H25B, GLF4, E190, C56X, C55B | EGSC | 30.47 | 30.47 | 30.47 | 30.47 | 29.83 | 29.93 |
| C56X | EGSH | 4.35 | 4.35 | 4.35 | 4.35 | 4.26 | 4.28 |
| LJ75, HELI, H25B, GLF6, GLF5, GLF4, GLEX, G280, E55P, E550, E35L, E135, CL35, C56X, BET, B7M8, B752, B738, B737, A320, A20N, A109 | EGSS | 190.13 | 190.15 | 183.85 | 190.15 | 179.95 | 187.45 |
| CL60 | EGTC | 4.35 | 4.35 | 4.35 | 4.35 | 4.26 | 4.28 |

| Aircraft type code | Destination | without development' 2024 | with development' 2024 | without development' 2028 | with development' 2028 | without development' 2032 | with development' 2032 |
|---|---|---|---|---|---|---|---|
| A109 | EGTD | 3.17 | 3.17 | 3.17 | 3.17 | 3.17 | 3.17 |
| PC12, LJ40, H25B, GLF5, GLF4, E50P, CL60, B350 | EGTE | 56.58 | 56.59 | 56.58 | 56.59 | 55.40 | 55.59 |
| S76, EC55, BET, B06, A139 | EGTF | 26.57 | 26.57 | 26.57 | 26.57 | 26.48 | 26.50 |
| HELI, GLEX, E55P, CL60, C680, C55B, C550, C510 | EGTK | 41.17 | 41.17 | 41.17 | 41.17 | 40.44 | 40.55 |
| AS55 | EGTR | 3.17 | 3.17 | 3.17 | 3.17 | 3.17 | 3.17 |
| GLF6 | EGVN | 4.35 | 4.35 | 4.35 | 4.35 | 4.26 | 4.28 |
| C56X | EGYM | 4.35 | 4.35 | 4.35 | 4.35 | 4.26 | 4.28 |
| PRM1, P180, LJ40, H25B, GLF6, GLF5, GLF4, GLEX, FA7X, F2TH, E55P, E50P, E35L, E135, CL60, CL35, C750, C680, C650, C56X, C550, C510, B763, B738, A332, A321, A320, A319, A306, A21N, A20N | EHAM | 2491.69 | 2446.29 | 2546.61 | 2268.09 | 2483.73 | 2264.32 |
| PRM1, E135, CRJ2, C680, C56X, C55B, C550, C510 | EHBK | 39.17 | 39.18 | 39.17 | 39.18 | 38.35 | 38.48 |
| E55P, E135, CL60, C750, C680 | EHEH | 30.47 | 30.47 | 30.47 | 30.47 | 29.83 | 29.93 |
| C510 | EHGG | 4.35 | 4.35 | 4.35 | 4.35 | 4.26 | 4.28 |
| PRM1, E55P, E135, | EHRD | 39.17 | 39.18 | 39.17 | 39.18 | 38.35 | 38.48 |

| Aircraft type code | Destination | without development' 2024 | with development' 2024 | without development' 2028 | with development' 2028 | without development' 2032 | with development' 2032 |
|---|---|---|---|---|---|---|---|
| CL35, C510, C500, C25A | | | | | | | |
| LJ40, FA7X, CN35, C56X, B7M8, B738 | EICK | 338.86 | 338.86 | 348.09 | 338.86 | 338.49 | 338.55 |
| LJ40, LJ28, H25B, GLEX, GL5T, E55P, E550, E50P, E35L, E135, CRJ2, CL60, CL35, C56X, C550, C500, B7M8 | EIDW | 1180.55 | 1180.56 | 1210.95 | 1180.56 | 1177.99 | 1178.40 |
| GLF4, GLEX, E50P, B7M8, B738 | EIKN | 433.19 | 433.20 | 445.13 | 433.20 | 432.83 | 432.89 |
| PRM1, GLF6, GLF4, GLEX, GALX, E55P, E50P, E135, CL35, C55B, C550, BET, B7M8 | EIKY | 378.03 | 378.03 | 387.26 | 378.03 | 376.84 | 377.03 |
| CN35 | EIME | 13.06 | 13.06 | 13.06 | 13.06 | 12.78 | 12.83 |
| LJ28, GLF6, GLF4, GLEX, GL5T, F2TH, CL60, CL35, CL30, C68A, C56X, C550, BET, B752 | EINN | 69.67 | 69.68 | 69.45 | 69.68 | 68.30 | 68.52 |
| PC12 | EKAE | 4.35 | 4.35 | 4.35 | 4.35 | 4.26 | 4.28 |
| C56X, C55B | EKAH | 8.71 | 8.71 | 8.71 | 8.71 | 8.52 | 8.55 |
| J328, FA7X, F2TH, CL35 | EKBI | 17.41 | 17.41 | 17.41 | 17.41 | 17.05 | 17.10 |
| GLF5, GLF4, FA7X, F2TH, CL60, | EKCH | 314.34 | 314.34 | 322.36 | 314.34 | 313.61 | 313.73 |

| Aircraft type code | Destination | without development' 2024 | with development' 2024 | without development' 2028 | with development' 2028 | without development' 2032 | with development' 2032 |
|---|---|---|---|---|---|---|---|
| C680, C56X, B7M8, B738, B737, A320, A20N | | | | | | | |
| E55P, C55B | EKOD | 8.71 | 8.71 | 8.71 | 8.71 | 8.52 | 8.55 |
| FA7X | EKSB | 4.35 | 4.35 | 4.35 | 4.35 | 4.26 | 4.28 |
| C680 | EKVG | 4.35 | 4.35 | 4.35 | 4.35 | 4.26 | 4.28 |
| C550 | EKYT | 4.35 | 4.35 | 4.35 | 4.35 | 4.26 | 4.28 |
| SF34, PC24, LJ55, LJ40, H25B, GLF6, GLF5, GLEX, F2TH, CL35, C750, C56X, C550 | ELLX | 100.11 | 100.12 | 100.11 | 100.12 | 98.01 | 98.34 |
| E135, CL60 | ENAL | 8.71 | 8.71 | 8.71 | 8.71 | 8.52 | 8.55 |
| C650 | ENAT | 4.35 | 4.35 | 4.35 | 4.35 | 4.26 | 4.28 |
| CRJ2, C680, C25A, A321, A21N, A20N | ENBR | 166.79 | 198.24 | 171.21 | 198.24 | 166.52 | 198.01 |
| LJ40, H25B, E135, C56X | ENCN | 30.47 | 30.47 | 30.47 | 30.47 | 29.83 | 29.93 |
| GLEX, F900, F2TH, E545, E35L, CRJ2, CL60, C680, C56X | ENGM | 43.53 | 43.53 | 43.53 | 43.53 | 42.61 | 42.76 |
| C680 | ENRO | 4.35 | 4.35 | 4.35 | 4.35 | 4.26 | 4.28 |
| E50P, C56X | ENZV | 8.71 | 8.71 | 8.71 | 8.71 | 8.52 | 8.55 |
| B7M8, B738 | EPBY | 139.76 | 139.76 | 143.77 | 139.76 | 139.76 | 139.76 |
| E35L, A320, A21N, A20N | EPGD | 811.46 | 811.46 | 834.64 | 811.46 | 811.37 | 811.39 |
| GLF4, C680, A321, A320, A319, A21N, A20N | EPKK | 829.79 | 829.79 | 853.37 | 829.79 | 829.61 | 829.64 |
| A21N, A20N | EPKT | 817.59 | 817.59 | 841.07 | 817.59 | 817.59 | 817.59 |

| Aircraft type code | Destination | without development' 2024 | with development' 2024 | without development' 2028 | with development' 2028 | without development' 2032 | with development' 2032 |
|---|---|---|---|---|---|---|---|
| A321, A320, A21N, A20N | EPLB | 380.84 | 380.84 | 391.78 | 380.84 | 380.84 | 380.84 |
| LJ55, G280 | EPMO | 8.71 | 8.71 | 8.71 | 8.71 | 8.52 | 8.55 |
| GLF5, C550, A321, A320, A21N, A20N | EPPO | 333.65 | 330.15 | 317.82 | 330.15 | 309.00 | 330.00 |
| B7M8, B738 | EPRZ | 132.77 | 132.77 | 136.58 | 132.77 | 132.77 | 132.77 |
| A321, A320, A21N, A20N | EPSY | 136.27 | 136.27 | 140.18 | 136.27 | 136.27 | 136.27 |
| GLF5, C55B, C25A, A21N, A20N | EPWA | 1059.48 | 1059.48 | 1089.27 | 1059.48 | 1059.02 | 1059.09 |
| A21N, A20N | EPWR | 454.22 | 454.22 | 467.26 | 454.22 | 454.22 | 454.22 |
| GLF5, E55P, E35L, C680 | ESGG | 17.41 | 17.41 | 17.41 | 17.41 | 17.05 | 17.10 |
| C56X | ESGT | 4.35 | 4.35 | 4.35 | 4.35 | 4.26 | 4.28 |
| E35L, CL35 | ESMS | 8.71 | 8.71 | 8.71 | 8.71 | 8.52 | 8.55 |
| LJ75 | ESNN | 4.35 | 4.35 | 4.35 | 4.35 | 4.26 | 4.28 |
| GLF4 | ESNQ | 4.35 | 4.35 | 4.35 | 4.35 | 4.26 | 4.28 |
| E55P, C56X | ESNZ | 8.71 | 8.71 | 8.71 | 8.71 | 8.52 | 8.55 |
| FA7X | ESOW | 4.35 | 4.35 | 4.35 | 4.35 | 4.26 | 4.28 |
| GLF6, GLF5, GLEX, GALX, E550, E35L, CL35, C55B, C25A, A320, A319, A306, A20N | ESSA | 300.92 | 300.92 | 295.62 | 300.92 | 299.82 | 300.00 |
| P180, GLEX, FA7X, E55P, CL60, CL35, C750, C56X, C550, C500, C25A | ESSB | 69.64 | 69.65 | 69.64 | 69.65 | 68.18 | 68.41 |
| GLEX, C500 | ESTA | 8.71 | 8.71 | 8.71 | 8.71 | 8.52 | 8.55 |

| Aircraft type code | Destination | without development' 2024 | with development' 2024 | without development' 2028 | with development' 2028 | without development' 2032 | with development' 2032 |
|---|---|---|---|---|---|---|---|
| LJ55, E55P, CL60, CL35, C750, C56X, A320, A21N, A20N | EVRA | 658.53 | 658.53 | 676.68 | 658.53 | 657.98 | 658.07 |
| B7M8, B738, A321, A21N, A20N | EYKA | 538.07 | 538.07 | 553.52 | 538.07 | 538.07 | 538.07 |
| A320, A21N, A20N | EYPA | 185.18 | 185.18 | 190.50 | 185.18 | 185.18 | 185.18 |
| CL35, B7M8, B738, A321, A320, A21N, A20N | EYVI | 787.86 | 787.86 | 810.23 | 787.86 | 787.68 | 787.71 |
| GLF5 | FCOB | 4.35 | 4.35 | 4.35 | 4.35 | 4.26 | 4.28 |
| GLF6, GLF5, CL60 | FGSL | 13.06 | 13.06 | 13.06 | 13.06 | 12.78 | 12.83 |
| GLEX | FLLS | 4.35 | 4.35 | 4.35 | 4.35 | 4.26 | 4.28 |
| GLEX | FMNA | 4.35 | 4.35 | 4.35 | 4.35 | 4.26 | 4.28 |
| GLEX | FNLU | 4.35 | 4.35 | 4.35 | 4.35 | 4.26 | 4.28 |
| CL60 | FOOL | 8.71 | 8.71 | 8.71 | 8.71 | 8.52 | 8.55 |
| F900 | GBYD | 4.35 | 4.35 | 4.35 | 4.35 | 4.26 | 4.28 |
| B7M8 | GCFV | 90.84 | 90.84 | 93.45 | 90.84 | 90.84 | 90.84 |
| B7M8 | GCLP | 136.27 | 136.27 | 140.18 | 136.27 | 136.27 | 136.27 |
| B7M8, B738, A320, A319, A20N | GCRR | 279.52 | 279.52 | 287.54 | 279.52 | 279.52 | 279.52 |
| B7M8, B738, A320, A319, A20N | GCTS | 300.48 | 300.48 | 215.66 | 300.48 | 209.64 | 300.48 |
| CRJ2 | GMAD | 4.35 | 4.35 | 4.35 | 4.35 | 4.26 | 4.28 |
| CRJ2, C56X | GMME | 8.71 | 8.71 | 8.71 | 8.71 | 8.52 | 8.55 |
| C56X | GMMI | 4.35 | 4.35 | 4.35 | 4.35 | 4.26 | 4.28 |
| H25B | GMMN | 4.35 | 4.35 | 4.35 | 4.35 | 4.26 | 4.28 |
| LJ40, H25B, GLEX, CRJ2, B7M8, B738 | GMMX | 199.10 | 199.10 | 204.31 | 199.10 | 198.73 | 198.79 |
| GLF6 | HEAL | 4.35 | 4.35 | 4.35 | 4.35 | 4.26 | 4.28 |
| GLF6, E35L | HECA | 13.06 | 13.06 | 13.06 | 13.06 | 12.78 | 12.83 |
| GLF6, CL60 | HEGN | 13.06 | 13.06 | 13.06 | 13.06 | 12.78 | 12.83 |

| Aircraft type code | Destination | without development' 2024 | with development' 2024 | without development' 2028 | with development' 2028 | without development' 2032 | with development' 2032 |
|---|---|---|---|---|---|---|---|
| GLF6, GLF5, FA7X | HKJK | 13.06 | 13.06 | 13.06 | 13.06 | 12.78 | 12.83 |
| GLF6, GLF5 | HRYR | 17.41 | 17.41 | 17.41 | 17.41 | 17.05 | 17.10 |
| GLF5 | HTDA | 4.35 | 4.35 | 4.35 | 4.35 | 4.26 | 4.28 |
| GLEX | HTKJ | 4.35 | 4.35 | 4.35 | 4.35 | 4.26 | 4.28 |
| GLF4 | KADW | 4.35 | 4.35 | 4.35 | 4.35 | 4.26 | 4.28 |
| GLF4, GLEX, FA7X | KBDL | 17.41 | 17.41 | 17.41 | 17.41 | 17.05 | 17.10 |
| GLF6, GLEX, F2TH, CL60 | KBED | 34.82 | 34.82 | 34.82 | 34.82 | 34.09 | 34.21 |
| GLF6 | KBFI | 4.35 | 4.35 | 4.35 | 4.35 | 4.26 | 4.28 |
| GLF6, GLF5, GLF4, GLEX, G280, F900, F2TH, F28, CL60, CL35 | KBGR | 121.87 | 121.88 | 121.87 | 121.88 | 119.32 | 119.72 |
| GLEX | KBJC | 8.71 | 8.71 | 8.71 | 8.71 | 8.52 | 8.55 |
| GLF5, GLEX, FA7X, F2TH, CL60 | KBOS | 47.88 | 47.88 | 47.88 | 47.88 | 46.87 | 47.03 |
| GLF5 | KBRY | 4.35 | 4.35 | 4.35 | 4.35 | 4.26 | 4.28 |
| GLF5, GLEX, CL60 | KBUF | 13.06 | 13.06 | 13.06 | 13.06 | 12.78 | 12.83 |
| F900 | KBVY | 8.71 | 8.71 | 8.71 | 8.71 | 8.52 | 8.55 |
| GLF5, GLF4 | KBWI | 8.71 | 8.71 | 8.71 | 8.71 | 8.52 | 8.55 |
| CL60 | KCGI | 4.35 | 4.35 | 4.35 | 4.35 | 4.26 | 4.28 |
| GLF6 | KCLT | 4.35 | 4.35 | 4.35 | 4.35 | 4.26 | 4.28 |
| GLEX | KCMH | 4.35 | 4.35 | 4.35 | 4.35 | 4.26 | 4.28 |
| GLF6 | KCRQ | 4.35 | 4.35 | 4.35 | 4.35 | 4.26 | 4.28 |
| GLF6, FA7X | KDAL | 21.76 | 21.76 | 21.76 | 21.76 | 21.31 | 21.38 |
| GLEX | KDAY | 4.35 | 4.35 | 4.35 | 4.35 | 4.26 | 4.28 |
| GLF5, FA7X | KEGE | 8.71 | 8.71 | 8.71 | 8.71 | 8.52 | 8.55 |
| GLF5 | KETB | 4.35 | 4.35 | 4.35 | 4.35 | 4.26 | 4.28 |
| GLF6, GLF5, GLF4, GLEX, GL5T, FA7X | KEWR | 39.17 | 39.18 | 39.17 | 39.18 | 38.35 | 38.48 |
| GLEX | KFAR | 4.35 | 4.35 | 4.35 | 4.35 | 4.26 | 4.28 |
| GLEX | KFLL | 4.35 | 4.35 | 4.35 | 4.35 | 4.26 | 4.28 |
| GLF5, GLF4, GLEX, FA7X | KFOK | 56.58 | 56.59 | 56.58 | 56.59 | 55.40 | 55.59 |
| GLEX | KFRG | 4.35 | 4.35 | 4.35 | 4.35 | 4.26 | 4.28 |
| GLF5 | KFTY | 4.35 | 4.35 | 4.35 | 4.35 | 4.26 | 4.28 |
| GLF6 | KGEG | 4.35 | 4.35 | 4.35 | 4.35 | 4.26 | 4.28 |

| Aircraft type code | Destination | without development' 2024 | with development' 2024 | without development' 2028 | with development' 2028 | without development' 2032 | with development' 2032 |
|---|---|---|---|---|---|---|---|
| B737 | KGTF | 4.35 | 4.35 | 4.35 | 4.35 | 4.26 | 4.28 |
| GLF4 | KGYY | 4.35 | 4.35 | 4.35 | 4.35 | 4.26 | 4.28 |
| GLF5, GLEX | KHOU | 13.06 | 13.06 | 13.06 | 13.06 | 12.78 | 12.83 |
| GLF6, GLF5, GLF4, GLEX, F900 | KHPN | 87.05 | 87.06 | 87.05 | 87.06 | 85.23 | 85.52 |
| FA7X | KHYA | 4.35 | 4.35 | 4.35 | 4.35 | 4.26 | 4.28 |
| GLF6, GLF5, GLF4, GLEX, FA7X, F900 | KIAD | 47.88 | 47.88 | 47.88 | 47.88 | 46.87 | 47.03 |
| GLF4 | KINL | 4.35 | 4.35 | 4.35 | 4.35 | 4.26 | 4.28 |
| CL30 | KISL | 4.35 | 4.35 | 4.35 | 4.35 | 4.26 | 4.28 |
| GLF6 | KISP | 4.35 | 4.35 | 4.35 | 4.35 | 4.26 | 4.28 |
| GLF6, GLF5 | KLAS | 8.71 | 8.71 | 8.71 | 8.71 | 8.52 | 8.55 |
| GLF6, GLF5, GLEX, FA7X | KLAX | 39.17 | 39.18 | 39.17 | 39.18 | 38.35 | 38.48 |
| GLF5 | KLEX | 4.35 | 4.35 | 4.35 | 4.35 | 4.26 | 4.28 |
| GLEX, F900 | KLGA | 8.71 | 8.71 | 8.71 | 8.71 | 8.52 | 8.55 |
| GLF6 | KLIT | 4.35 | 4.35 | 4.35 | 4.35 | 4.26 | 4.28 |
| GLF6, GLF4, GLEX | KMDW | 13.06 | 13.06 | 13.06 | 13.06 | 12.78 | 12.83 |
| GLEX | KMEM | 4.35 | 4.35 | 4.35 | 4.35 | 4.26 | 4.28 |
| GLF5, GLEX | KMMU | 8.71 | 8.71 | 8.71 | 8.71 | 8.52 | 8.55 |
| F900 | KMTN | 4.35 | 4.35 | 4.35 | 4.35 | 4.26 | 4.28 |
| GLF5 | KNEW | 4.35 | 4.35 | 4.35 | 4.35 | 4.26 | 4.28 |
| GLEX | KOAK | 4.35 | 4.35 | 4.35 | 4.35 | 4.26 | 4.28 |
| GLEX | KOPF | 8.71 | 8.71 | 8.71 | 8.71 | 8.52 | 8.55 |
| GLEX | KPDK | 4.35 | 4.35 | 4.35 | 4.35 | 4.26 | 4.28 |
| GLF5, GLF4, GLEX | KPHL | 17.41 | 17.41 | 17.41 | 17.41 | 17.05 | 17.10 |
| GLF4, GLEX | KPIT | 8.71 | 8.71 | 8.71 | 8.71 | 8.52 | 8.55 |
| GLF4, F900 | KPSM | 17.41 | 17.41 | 17.41 | 17.41 | 17.05 | 17.10 |
| GLF4, GLEX, F2TH | KPTK | 21.76 | 21.76 | 21.76 | 21.76 | 21.31 | 21.38 |
| GLEX, FA7X | KPWM | 8.71 | 8.71 | 8.71 | 8.71 | 8.52 | 8.55 |
| GLF5, GLF4 | KRDU | 8.71 | 8.71 | 8.71 | 8.71 | 8.52 | 8.55 |
| GLF6 | KROG | 4.35 | 4.35 | 4.35 | 4.35 | 4.26 | 4.28 |
| F2TH | KRST | 4.35 | 4.35 | 4.35 | 4.35 | 4.26 | 4.28 |
| GLF6 | KSAT | 4.35 | 4.35 | 4.35 | 4.35 | 4.26 | 4.28 |
| GLF6, GLF5 | KSAV | 13.06 | 13.06 | 13.06 | 13.06 | 12.78 | 12.83 |
| GLF6, GLF5 | KSFO | 17.41 | 17.41 | 17.41 | 17.41 | 17.05 | 17.10 |
| GLF6, GLF5 | KSJC | 8.71 | 8.71 | 8.71 | 8.71 | 8.52 | 8.55 |
| GLF4 | KSTP | 4.35 | 4.35 | 4.35 | 4.35 | 4.26 | 4.28 |
| GLEX | KSUS | 4.35 | 4.35 | 4.35 | 4.35 | 4.26 | 4.28 |

| Aircraft type code | Destination | without development' 2024 | with development' 2024 | without development' 2028 | with development' 2028 | without development' 2032 | with development' 2032 |
|---|---|---|---|---|---|---|---|
| GLF5 | KSWF | 4.35 | 4.35 | 4.35 | 4.35 | 4.26 | 4.28 |
| GLF6, GLF5, GLF4, GLEX, GL7T, GL5T, FA8X, FA7X, F900, F2TH, CL60 | KTEB | 278.57 | 278.59 | 278.57 | 278.59 | 272.72 | 273.65 |
| GLF5, GLEX, DFL | KVNY | 34.82 | 34.82 | 34.82 | 34.82 | 34.09 | 34.21 |
| C55B, A321, A320, A21N, A20N | LATI | 304.83 | 304.84 | 313.46 | 304.84 | 304.74 | 304.76 |
| A321, A320, A21N, A20N | LBBG | 457.71 | 457.71 | 442.10 | 457.71 | 429.76 | 457.71 |
| B733, A321, A21N, A20N | LBSF | 773.03 | 773.03 | 795.10 | 773.03 | 772.94 | 772.95 |
| A320, A20N | LBWN | 412.29 | 412.29 | 424.13 | 412.29 | 412.29 | 412.29 |
| CL35, B7M8, B738, A321, A319, A21N, A20N | LCLK | 801.84 | 801.84 | 824.61 | 801.84 | 801.66 | 801.69 |
| B7M8, B738, A320, A319, A20N | LCPH | 303.98 | 303.98 | 312.70 | 303.98 | 303.98 | 303.98 |
| GLF6, GLF4, GLEX, E135, CL35, C680, C56X, A320, A319, A20N | LDDU | 180.65 | 180.65 | 184.46 | 180.65 | 179.65 | 179.81 |
| GL5T, E550, E135, CRJ2, C680, BE2, B737, A319 | LDPL | 43.53 | 43.53 | 43.53 | 43.53 | 42.61 | 42.76 |
| LJ40, GLEX, CRJ2, CL60, C680, C56X, C500, | LDSP | 669.81 | 624.39 | 615.78 | 624.39 | 598.92 | 623.54 |

| Aircraft type code | Destination | without development' 2024 | with development' 2024 | without development' 2028 | with development' 2028 | without development' 2032 | with development' 2032 |
|---|---|---|---|---|---|---|---|
| A321, A320, A319, A21N, A20N | | | | | | | |
| C650, C56X | LDZA | 8.71 | 8.71 | 8.71 | 8.71 | 8.52 | 8.55 |
| GLF4, GLEX, CL60, C56X, C550, A320, A319, A20N | LDZD | 116.96 | 116.96 | 62.06 | 116.96 | 60.51 | 116.50 |
| LJ40, CL35, B7M8, B738, A320, A319, A20N | LEAL | 1021.96 | 1021.96 | 1047.46 | 1021.96 | 1018.28 | 1021.81 |
| LJ75, LJ40, H25B, GLF6, GLF5, GLEX, F900, E55P, CRJ2, CL60, CL35, CL30, C750, C56X, C55B, C510, B7M8, B738, A320, A319, A20N | LEBL | 1377.19 | 1377.20 | 1414.11 | 1373.70 | 1375.27 | 1372.08 |
| E135 | LEDA | 4.35 | 4.35 | 4.35 | 4.35 | 4.26 | 4.28 |
| PC24, H25B, GLF6, GLF4, CL60, C680, C56X, C550, C510, BET, B7M8, B738 | LEGE | 179.79 | 179.79 | 183.70 | 179.79 | 178.88 | 179.02 |
| C55B | LEGT | 8.71 | 8.71 | 8.71 | 8.71 | 8.52 | 8.55 |
| LJ75, LJ40, H25B, GLF6, GLF5, GLEX, GL5T, FA7X, E55P, E550, | LEIB | 795.67 | 795.70 | 763.80 | 795.70 | 744.41 | 790.76 |

| Aircraft type code | Destination | without development' 2024 | with development' 2024 | without development' 2028 | with development' 2028 | without development' 2032 | with development' 2032 |
|---|---|---|---|---|---|---|---|
| E35L, E135, CRJ2, CL60, CL35, CL30, C750, C56X, C55B, C550, C500, C25C, BE40, B7M8, B738, A320, A319, A20N | | | | | | | |
| C56X | LEJR | 4.35 | 4.35 | 4.35 | 4.35 | 4.26 | 4.28 |
| H25B, GLF6, GLF5, GLEX, F2TH, E55P, CRJ2, CL60, CL35, C56X, C55B, C550, C500, C25A, BET, BE40, B735, A320, A319, A20N | LEMD | 455.58 | 455.59 | 465.41 | 455.59 | 453.20 | 453.58 |
| LJ75, LJ40, GLF6, GLF5, GLF4, GLEX, FA8X, FA7X, F2TH, E55P, E550, E135, CRJ2, CL35, C680, C650, C56X, C55B, C550, C25A, B7M8, B738, A320, A319, A20N | LEMG | 1515.67 | 1375.93 | 1409.42 | 1375.93 | 1371.53 | 1372.23 |
| PRM1, GLF4, GLEX, | LEMH | 436.63 | 433.14 | 448.17 | 433.14 | 435.90 | 432.52 |

| Aircraft type code | Destination | without development' 2024 | with development' 2024 | without development' 2028 | with development' 2028 | without development' 2032 | with development' 2032 |
|---|---|---|---|---|---|---|---|
| E35L, E135, CL35, C56X, BET, B7M8, B738, A320, A319, A20N | | | | | | | |
| E55P, C680, B7M8, B738 | LEMI | 326.66 | 326.66 | 335.79 | 326.66 | 326.47 | 326.50 |
| LJ40, H25B, GLF5, GLF4, GLEX, FA7X, E55P, E550, E35L, E135, CRJ2, CL60, CL35, C750, C680, C56X, C55B, C550, BET, BE40, B7M8, B738, A320, A319, A20N | LEPA | 1339.08 | 1339.10 | 1363.09 | 1014.16 | 1326.80 | 1009.69 |
| GLEX, B7M8, B738, A320, A319, A20N | LERS | 119.65 | 119.65 | 122.96 | 119.65 | 119.56 | 119.58 |
| CRJ2, CL35, C500 | LESO | 13.06 | 13.06 | 13.06 | 13.06 | 12.78 | 12.83 |
| GLF6 | LEST | 21.76 | 21.76 | 21.76 | 21.76 | 21.31 | 21.38 |
| E190 | LETO | 4.35 | 4.35 | 4.35 | 4.35 | 4.26 | 4.28 |
| GLF5, F2TH, C56X, A320, A20N | LEVC | 152.82 | 152.82 | 156.83 | 152.82 | 152.54 | 152.59 |
| CRJ2 | LEVT | 4.35 | 4.35 | 4.35 | 4.35 | 4.26 | 4.28 |
| GLEX | LEVX | 4.35 | 4.35 | 4.35 | 4.35 | 4.26 | 4.28 |
| E550 | LEXJ | 4.35 | 4.35 | 4.35 | 4.35 | 4.26 | 4.28 |
| H25B, C56X, C550, B737, A320, A319, A20N | LEZL | 192.11 | 192.11 | 186.34 | 192.11 | 181.26 | 191.80 |
| E50P | LFAQ | 4.35 | 4.35 | 4.35 | 4.35 | 4.26 | 4.28 |

| Aircraft type code | Destination | without development' 2024 | with development' 2024 | without development' 2028 | with development' 2028 | without development' 2032 | with development' 2032 |
|---|---|---|---|---|---|---|---|
| LJ75, JET, GLF6, GLF4, GLEX, E55P, C680, C56X, C510, C500, A320, A319, A20N | LFBD | 406.84 | 406.84 | 416.77 | 406.84 | 405.56 | 405.77 |
| E50P, ASTR | LFBE | 8.71 | 8.71 | 8.71 | 8.71 | 8.52 | 8.55 |
| GLF4, C68A, C500 | LFBH | 13.06 | 13.06 | 13.06 | 13.06 | 12.78 | 12.83 |
| F2TH | LFBL | 4.35 | 4.35 | 4.35 | 4.35 | 4.26 | 4.28 |
| FA7X, C550, BET, BE2, A320, A20N | LFBO | 224.41 | 224.42 | 230.23 | 224.42 | 223.96 | 224.03 |
| CL60, A20N | LFBP | 7.85 | 7.85 | 7.95 | 7.85 | 7.76 | 7.77 |
| FA7X, C56X | LFBT | 8.71 | 8.71 | 8.71 | 8.71 | 8.52 | 8.55 |
| GLF5, E55P, CL35, C750, C680, C56X, BE2, A320, A319, A20N | LFBZ | 104.70 | 104.70 | 106.71 | 104.70 | 103.97 | 104.09 |
| CL60 | LFGA | 4.35 | 4.35 | 4.35 | 4.35 | 4.26 | 4.28 |
| F2TH | LFGJ | 4.35 | 4.35 | 4.35 | 4.35 | 4.26 | 4.28 |
| C56X | LFJL | 4.35 | 4.35 | 4.35 | 4.35 | 4.26 | 4.28 |
| BET | LFKB | 4.35 | 4.35 | 4.35 | 4.35 | 4.26 | 4.28 |
| CL35, C680 | LFKC | 8.71 | 8.71 | 8.71 | 8.71 | 8.52 | 8.55 |
| GLF5, FA8X, E50P, CL60 | LFKF | 17.41 | 17.41 | 17.41 | 17.41 | 17.05 | 17.10 |
| GLEX, E550, C750, C56X | LFKJ | 21.76 | 21.76 | 21.76 | 21.76 | 21.31 | 21.38 |
| C56X, BE40 | LFLC | 8.71 | 8.71 | 8.71 | 8.71 | 8.52 | 8.55 |
| GLF5, GL5T, E55P, C56X, BET, BE2, A320, A319, A20N | LFLL | 315.20 | 315.20 | 323.12 | 315.20 | 314.38 | 314.51 |
| G280 | LFLP | 13.06 | 13.06 | 13.06 | 13.06 | 12.78 | 12.83 |
| C680 | LFLS | 4.35 | 4.35 | 4.35 | 4.35 | 4.26 | 4.28 |
| LJ75, FA10, E55P, | LFLY | 30.47 | 30.47 | 30.47 | 30.47 | 29.83 | 29.93 |

| Aircraft type code | Destination | without development' 2024 | with development' 2024 | without development' 2028 | with development' 2028 | without development' 2032 | with development' 2032 |
|---|---|---|---|---|---|---|---|
| C56X, C55B, C25A | | | | | | | |
| LJ75, H25B, GLF4, G280, F900, F2TH, E55P, E50P, E135, CRJ2, CL60, CL35, CL30, C68A, C680, C56X, C510, C500, C25A | LFMD | 261.16 | 261.18 | 261.16 | 261.18 | 255.68 | 256.55 |
| E55P | LFMK | 4.35 | 4.35 | 4.35 | 4.35 | 4.26 | 4.28 |
| GLF6, GLF4, F2TH, C56X, C25A, A320, A319, A20N | LFML | 206.94 | 206.95 | 212.26 | 206.95 | 206.49 | 206.56 |
| PRM1, PC24, P180, LJ75, H25B, GLF6, GLF5, GLF4, GLEX, GL5T, GALX, G280, FA8X, FA7X, FA50, F900, F2TH, E55P, E550, E50P, E35L, E135, CRJ2, CL60, CL35, CL30, C750, C680, C56X, C550, C25C, C25A, BE40, B752, B737, A320, | LFMN | 1763.52 | 1763.60 | 1784.29 | 1763.60 | 1741.70 | 1745.18 |

| Aircraft type code | Destination | without development' 2024 | with development' 2024 | without development' 2028 | with development' 2028 | without development' 2032 | with development' 2032 |
|---|---|---|---|---|---|---|---|
| A319, A20N | | | | | | | |
| E135, C25A | LFMP | 8.71 | 8.71 | 8.71 | 8.71 | 8.52 | 8.55 |
| CL60, A320, A20N | LFMT | 140.62 | 140.62 | 144.53 | 140.62 | 140.53 | 140.54 |
| B7M8, B738 | LFMU | 136.27 | 136.27 | 140.18 | 136.27 | 136.27 | 136.27 |
| GLF5, GLEX, E55P, E550, C56X, C550, C25C, C25A | LFMV | 39.17 | 39.18 | 39.17 | 39.18 | 38.35 | 38.48 |
| C500, C25C | LFOH | 8.71 | 8.71 | 8.71 | 8.71 | 8.52 | 8.55 |
| PC24, H25C, H25B, GLF6, GLF5, GLF4, GLEX, GL5T, GALX, G280, FA7X, F900, F2TH, E55P, E550, E50P, E35L, E135, CRJ2, CL60, CL35, C750, C68A, C680, C56X, C550, C500, C25A, BET, BE40, B737, B735, A320, A319, A318 | LFPB | 696.41 | 696.47 | 696.41 | 696.47 | 681.81 | 684.13 |
| B737, A320, A319, A20N | LFPG | 797.49 | 797.49 | 820.26 | 783.51 | 797.39 | 783.43 |
| A320, A20N | LFPO | 3.49 | 3.49 | 3.59 | 0.00 | 3.49 | 0.00 |
| CRJ2, C56X | LFPT | 8.71 | 8.71 | 8.71 | 8.71 | 8.52 | 8.55 |
| F900, C56X | LFQB | 8.71 | 8.71 | 8.71 | 8.71 | 8.52 | 8.55 |

| Aircraft type code | Destination | without development' 2024 | with development' 2024 | without development' 2028 | with development' 2028 | without development' 2032 | with development' 2032 |
|---|---|---|---|---|---|---|---|
| E50P, C55B, C550 | LFQQ | 13.06 | 13.06 | 13.06 | 13.06 | 12.78 | 12.83 |
| GLEX | LFRD | 4.35 | 4.35 | 4.35 | 4.35 | 4.26 | 4.28 |
| H25B, FA7X, E50P, E135, CL35, C680, C56X, C55B, C550, C510 | LFRG | 47.88 | 47.88 | 47.88 | 47.88 | 46.87 | 47.03 |
| GLEX | LFRK | 4.35 | 4.35 | 4.35 | 4.35 | 4.26 | 4.28 |
| RJ85, C500 | LFRM | 8.71 | 8.71 | 8.71 | 8.71 | 8.52 | 8.55 |
| E35L, BE2 | LFRN | 8.71 | 8.71 | 8.71 | 8.71 | 8.52 | 8.55 |
| C550, C500, BET, A320, A319, A20N | LFRS | 191.25 | 191.25 | 196.37 | 191.25 | 190.98 | 191.02 |
| C55B | LFRT | 4.35 | 4.35 | 4.35 | 4.35 | 4.26 | 4.28 |
| GLF6, GLF4, GLEX, FA7X, F2TH, CL30, C56X, BET, A320, A319, A20N | LFSB | 356.27 | 356.27 | 365.50 | 356.27 | 355.54 | 355.65 |
| GLF4, F2TH, C680, C56X | LFSD | 21.76 | 21.76 | 21.76 | 21.76 | 21.31 | 21.38 |
| C56X | LFST | 4.35 | 4.35 | 4.35 | 4.35 | 4.26 | 4.28 |
| GLF6, GLF4, GLEX, GL7T, F2TH, E55P, E550, CRJ2, CL35, C680, C56X, BE40 | LFTH | 73.99 | 74.00 | 73.99 | 74.00 | 72.44 | 72.69 |
| LJ75, GLEX, CL35, B7M8, B738 | LFTW | 153.68 | 153.68 | 157.59 | 153.68 | 153.31 | 153.37 |
| PC12, C68A | LFTZ | 8.71 | 8.71 | 8.71 | 8.71 | 8.52 | 8.55 |
| H25B, GLF6, GLF5, GLF4, GLEX, GL5T, GALX, | LGAV | 769.12 | 769.13 | 787.58 | 769.13 | 766.47 | 766.89 |

| Aircraft type code | Destination | without development' 2024 | with development' 2024 | without development' 2028 | with development' 2028 | without development' 2032 | with development' 2032 |
|---|---|---|---|---|---|---|---|
| G150, FA7X, F2TH, E35L, E135, CRJ2, CL60, CL35, C680, B7M8, B738, B737, A321, A21N, A20N | | | | | | | |
| E135 | LGEL | 8.71 | 8.71 | 8.71 | 8.71 | 8.52 | 8.55 |
| GLEX, C55B, B7M8, B738, A320, A319, A20N | LGIR | 169.43 | 169.43 | 174.04 | 169.43 | 169.25 | 169.27 |
| C56X | LGKF | 4.35 | 4.35 | 4.35 | 4.35 | 4.26 | 4.28 |
| GLF4, GLEX, B735 | LGKL | 13.06 | 13.06 | 13.06 | 13.06 | 12.78 | 12.83 |
| GLEX, DFL | LGKO | 8.71 | 8.71 | 8.71 | 8.71 | 8.52 | 8.55 |
| GLF4, GLEX, CL35, B7M8, B738, A320, A319, A20N | LGKR | 334.50 | 334.50 | 343.73 | 334.50 | 334.23 | 334.27 |
| CL35 | LGKV | 4.35 | 4.35 | 4.35 | 4.35 | 4.26 | 4.28 |
| GLF6, GLF5, GLEX, FA7X, E55P, E550, E35L, E135, CRJ2, CL60, CL35, C680, C56X, C550, A320, A319, A20N | LGMK | 212.72 | 212.73 | 215.32 | 212.73 | 210.16 | 210.57 |
| C750, C56X | LGPZ | 13.06 | 13.06 | 13.06 | 13.06 | 12.78 | 12.83 |
| B7M8, A320, A319, A20N | LGRP | 178.19 | 178.19 | 183.31 | 178.19 | 178.19 | 178.19 |
| E135 | LGRX | 4.35 | 4.35 | 4.35 | 4.35 | 4.26 | 4.28 |
| B7M8, B738 | LGSK | 45.42 | 45.42 | 46.73 | 45.42 | 45.42 | 45.42 |

| Aircraft type code | Destination | without development' 2024 | with development' 2024 | without development' 2028 | with development' 2028 | without development' 2032 | with development' 2032 |
|---|---|---|---|---|---|---|---|
| GLF6 | LGSM | 4.35 | 4.35 | 4.35 | 4.35 | 4.26 | 4.28 |
| GLF5, GLEX | LGSR | 8.71 | 8.71 | 8.71 | 8.71 | 8.52 | 8.55 |
| F900, E135, CL60, C56X, B7M8, A321, A320, A319, A21N, A20N | LGTS | 326.60 | 358.05 | 335.23 | 358.05 | 326.05 | 357.58 |
| C750, B7M8 | LGZA | 49.77 | 49.77 | 51.08 | 49.77 | 49.68 | 49.70 |
| F2TH, E190, E135, CL60, C55B, A21N, A20N | LHBP | 1388.77 | 1388.77 | 1427.89 | 1388.77 | 1388.22 | 1388.31 |
| A321, A21N, A20N | LHDC | 457.71 | 457.71 | 470.85 | 457.71 | 457.71 | 457.71 |
| PC12, E135 | LHSM | 8.71 | 8.71 | 8.71 | 8.71 | 8.52 | 8.55 |
| GLEX, FA7X, C680, C550, A321, A21N, A20N | LIBD | 202.59 | 202.59 | 207.91 | 202.59 | 202.23 | 202.28 |
| GLF5, CL35, C56X | LIBR | 13.06 | 13.06 | 13.06 | 13.06 | 12.78 | 12.83 |
| GLF6, CRJ2, CL60 | LICA | 13.06 | 13.06 | 13.06 | 13.06 | 12.78 | 12.83 |
| GLF6, GLEX, E35L, E135, CL60, C750, C550, A320, A319, A20N | LICC | 220.00 | 220.00 | 225.32 | 220.00 | 219.27 | 219.39 |
| GLF6, GLEX, F2TH, CL60, CL30, C680, A320, A319, A20N | LICJ | 175.44 | 175.44 | 179.35 | 175.44 | 174.62 | 174.75 |
| GLF5, F2TH, CL60 | LICT | 17.41 | 17.41 | 17.41 | 17.41 | 17.05 | 17.10 |
| A320, A20N | LIEA | 94.34 | 94.34 | 86.26 | 94.34 | 83.86 | 94.34 |
| H25B, C56X, C550, BE40 | LIEE | 21.76 | 21.76 | 21.76 | 21.76 | 21.31 | 21.38 |

| Aircraft type code | Destination | without development' 2024 | with development' 2024 | without development' 2028 | with development' 2028 | without development' 2032 | with development' 2032 |
|---|---|---|---|---|---|---|---|
| H25B, GLF6, GLF5, GLEX, GL5T, GALX, FA8X, FA7X, F900, F2TH, E55P, E550, E35L, E135, CRJ2, CL35, CL30, C750, C680, C650, C56X, C550, C25C, A320, A319, A20N | LIEO | 426.11 | 426.13 | 429.72 | 426.13 | 419.81 | 420.81 |
| GLF5, GLEX, FA7X, F2TH, E55P, E550, E50P, E35L, E135, CL60, CL35, C680, C56X, C550, C25A, BET, BE2, B752, B734, A320, A319, A306, A20N | LIMC | 831.87 | 831.88 | 836.34 | 510.44 | 829.04 | 508.05 |
| GLEX, F900, B734, A306 | LIME | 43.78 | 43.78 | 42.02 | 43.78 | 43.60 | 43.63 |
| H25B, GLEX, FA7X, E50P, C510, C25A | LIMF | 39.17 | 39.18 | 39.17 | 39.18 | 38.35 | 38.48 |
| GLF6, GLF4, GLEX, F2TH, E55P, CRJ2, C750, C680, C56X, C25A, | LIMJ | 205.91 | 205.91 | 199.04 | 205.91 | 193.96 | 204.68 |

| Aircraft type code | Destination | without development' 2024 | with development' 2024 | without development' 2028 | with development' 2028 | without development' 2032 | with development' 2032 |
|---|---|---|---|---|---|---|---|
| BE40, A320, A319, A20N | | | | | | | |
| GLF6, GLF5, GLF4, GLEX, F900, F2TH, E55P, E135, CL60, CL35, C56X, C550, BE40 | LIML | 69.64 | 69.65 | 69.64 | 69.65 | 68.18 | 68.41 |
| LJ75, E550, E135, C56X | LIMP | 17.41 | 17.41 | 17.41 | 17.41 | 17.05 | 17.10 |
| E55P, CL60, C56X | LIPB | 13.06 | 13.06 | 13.06 | 13.06 | 12.78 | 12.83 |
| FA7X, E55P, E135, CRJ2, CL30, C56X, C550, B7M8, B738 | LIPE | 351.91 | 351.92 | 30.47 | 351.92 | 29.83 | 351.38 |
| B752, A306 | LIPO | 13.15 | 13.15 | 12.49 | 13.15 | 13.15 | 13.15 |
| LJ40 | LIPQ | 4.35 | 4.35 | 4.35 | 4.35 | 4.26 | 4.28 |
| GLF4, E135, CL35, C680, C56X, C510 | LIPX | 43.53 | 43.53 | 43.53 | 43.53 | 42.61 | 42.76 |
| LJ40, H25B, GLF6, GLF5, GLF4, GLEX, FA7X, F2TH, E55P, E550, CL60, CL35, C56X, C55B, C550, C25C, A320, A319, A20N | LIPZ | 410.22 | 410.22 | 419.24 | 410.22 | 408.21 | 408.53 |
| H25B, GLF5, G150, E55P, CL35 | LIQS | 21.76 | 21.76 | 21.76 | 21.76 | 21.31 | 21.38 |
| GLF6, GLF5, GLF4, FA7X, F900, | LIRA | 95.76 | 95.76 | 95.76 | 95.76 | 93.75 | 94.07 |

| Aircraft type code | Destination | without development' 2024 | with development' 2024 | without development' 2028 | with development' 2028 | without development' 2032 | with development' 2032 |
|---|---|---|---|---|---|---|---|
| F2TH, E55P, E50P, E135, CL35, C680, C56X, C510, BE40 | | | | | | | |
| RJ1H, A320, A319, A20N | LIRF | 318.81 | 318.81 | 327.84 | 318.81 | 318.72 | 318.73 |
| GLF6, GLF5, GLF4, GLEX, G280, F2TH, E550, E135, CL60, CL35, C68A, C680, C56X, C25C | LIRI | 91.40 | 91.41 | 91.40 | 91.41 | 89.49 | 89.79 |
| H25B, GLF6, GLF4, GLEX, GL5T, FA8X, FA7X, E135, CL60, CL35, C750, C56X, C550, A320, A319, A20N | LIRN | 535.88 | 535.89 | 511.57 | 525.41 | 498.20 | 523.09 |
| H25B, GLEX, FA7X, F2TH, E55P, E35L, E135, CL60, CL35, CL30, C510, C25A, A320, A319, A20N | LIRP | 521.22 | 521.23 | 534.06 | 521.23 | 519.67 | 519.92 |
| LJ40, GL5T, FA8X, E55P, E550, E135, CRJ2, CL35, C680, C56X, | LIRQ | 183.11 | 183.11 | 185.61 | 183.11 | 181.10 | 181.42 |

| Aircraft type code | Destination | without development' 2024 | with development' 2024 | without development' 2028 | with development' 2028 | without development' 2032 | with development' 2032 |
|---|---|---|---|---|---|---|---|
| C550, C510, C500, A320, A319, A20N | | | | | | | |
| H25B, GLF6, FA7X, F2TH, E55P, E550, E35L, C56X | LIRS | 39.17 | 39.18 | 39.17 | 39.18 | 38.35 | 38.48 |
| E35L, CL35, C56X, C55B, C550 | LIRZ | 26.12 | 26.12 | 26.12 | 26.12 | 25.57 | 25.65 |
| C55B, A321, A320, A21N, A20N | LJLJ | 172.06 | 172.06 | 176.88 | 172.06 | 171.97 | 171.99 |
| GLF5 | LKKV | 8.71 | 8.71 | 8.71 | 8.71 | 8.52 | 8.55 |
| E35L, C680 | LKMT | 8.71 | 8.71 | 8.71 | 8.71 | 8.52 | 8.55 |
| E55P, CRJ2, C680, C56X, BE40, A321, A320, A21N, A20N | LKPR | 357.13 | 357.13 | 362.66 | 357.13 | 352.81 | 356.43 |
| C56X | LKTB | 4.35 | 4.35 | 4.35 | 4.35 | 4.26 | 4.28 |
| H25B, GLF6, GLF5, GLF4, GLEX, FA7X, F2TH, E135, CL60, C750, B7M8, B788, B772, B739, B738, A320, A319, A21N, A20N | LLBG | 1581.56 | 1581.56 | 1624.09 | 1581.56 | 1579.46 | 1579.79 |
| CL60 | LLSD | 4.35 | 4.35 | 4.35 | 4.35 | 4.26 | 4.28 |
| LJ75, GLF5, F2TH, E35L, CL60, C680, C56X, C25C, B7M8 | LMML | 414.75 | 414.75 | 425.28 | 414.75 | 413.74 | 413.90 |
| E135, A321 | LOWG | 8.71 | 8.71 | 8.71 | 8.71 | 8.52 | 8.55 |

| Aircraft type code | Destination | without development' 2024 | with development' 2024 | without development' 2028 | with development' 2028 | without development' 2032 | with development' 2032 |
|---|---|---|---|---|---|---|---|
| GLEX, E50P, CL35, C550, ASTR | LOWI | 30.47 | 30.47 | 30.47 | 30.47 | 29.83 | 29.93 |
| GLEX, F2TH, C510 | LOWK | 17.41 | 17.41 | 17.41 | 17.41 | 17.05 | 17.10 |
| RJ85, H25B, GLF6, F900, E55P, E135, CRJ2, C750, C680, C56X | LOWS | 47.88 | 47.88 | 47.88 | 47.88 | 46.87 | 47.03 |
| GLF4, GLEX, E135, CRJ2, CL60, C680, B737, A320, A319, A20N | LOWW | 228.71 | 228.71 | 234.02 | 228.71 | 227.79 | 227.94 |
| C510 | LOXZ | 4.35 | 4.35 | 4.35 | 4.35 | 4.26 | 4.28 |
| E55P, E35L, C750 | LPCS | 13.06 | 13.06 | 13.06 | 13.06 | 12.78 | 12.83 |
| LJ40, H25B, GLF6, GLF5, GLF4, GLEX, F2TH, E55P, CL35, C680, C56X, C500, B7M8, B738, A320, A319, A20N | LPFR | 1223.28 | 1223.29 | 1117.69 | 1223.29 | 1087.49 | 1220.74 |
| B7M8, B738 | LPMA | 24.46 | 24.46 | 25.16 | 24.46 | 24.46 | 24.46 |
| GLF6, GLF4, GLEX, E35L, E135, CL60, C25A, A321, A320, A319, A21N, A20N | LPPR | 344.01 | 364.98 | 248.40 | 364.98 | 241.77 | 364.20 |
| GLF4, CL35, C56X, BE2, A321, | LPPT | 1213.21 | 1213.21 | 1247.42 | 1213.21 | 1212.75 | 1212.83 |

| Aircraft type code | Destination | without development' 2024 | with development' 2024 | without development' 2028 | with development' 2028 | without development' 2032 | with development' 2032 |
|---|---|---|---|---|---|---|---|
| A320, A319, A21N, A20N | | | | | | | |
| B7M8, B738 | LRBC | 276.02 | 276.02 | 283.95 | 276.02 | 276.02 | 276.02 |
| GLF6, GLF4, CRJ2, C56X | LRBS | 17.41 | 17.41 | 17.41 | 17.41 | 17.05 | 17.10 |
| A321, A21N, A20N | LRCK | 216.63 | 216.63 | 222.85 | 216.63 | 216.63 | 216.63 |
| E35L, B7M8, A320, A21N, A20N | LRCL | 870.86 | 870.86 | 895.74 | 870.86 | 870.77 | 870.78 |
| A21N, A20N | LRCV | 415.78 | 415.78 | 427.72 | 415.78 | 415.78 | 415.78 |
| C500, B7M8, B738, A320, A21N, A20N | LRIA | 549.41 | 549.41 | 565.06 | 549.41 | 549.32 | 549.34 |
| C56X, B7M8, B738, A321, A320, A21N, A20N | LROP | 1726.88 | 1643.03 | 1776.34 | 1643.03 | 1726.79 | 1642.95 |
| A320, A21N, A20N | LRSB | 370.36 | 370.36 | 381.00 | 370.36 | 370.36 | 370.36 |
| A320, A21N, A20N | LRSM | 185.18 | 185.18 | 190.50 | 185.18 | 185.18 | 185.18 |
| A321, A21N, A20N | LRSV | 324.94 | 377.35 | 334.27 | 377.35 | 324.94 | 377.35 |
| A320, A21N, A20N | LRTM | 132.77 | 132.77 | 136.58 | 132.77 | 132.77 | 132.77 |
| A321, A320, A21N, A20N | LRTR | 447.23 | 447.23 | 460.07 | 447.23 | 447.23 | 447.23 |
| PC24, LJ75, LJ55, H25B, GLF6, GLF5, GLF4, GLEX, GL5T, G280, FA7X, F900, F2TH, E55P, E35L, E135, CRJ2, | LSGG | 1054.61 | 1054.64 | 1072.77 | 1054.64 | 1045.76 | 1047.17 |

| Aircraft type code | Destination | without development' 2024 | with development' 2024 | without development' 2028 | with development' 2028 | without development' 2032 | with development' 2032 |
|---|---|---|---|---|---|---|---|
| CL60, CL35, CL30, C750, C680, C56X, C55B, C550, C510, BET, BE2, B737, A320, A319, A20N | | | | | | | |
| PC12, H25B, GLF6, FA7X, F2TH, E55P, E50P, CL60, CL30, C680, C56X, C55B | LSGS | 78.35 | 78.35 | 78.35 | 78.35 | 76.70 | 76.96 |
| GLEX, FA7X, E55P, C680, C25C | LSZA | 34.82 | 34.82 | 34.82 | 34.82 | 34.09 | 34.21 |
| GLEX, G280, F2TH, E135, CL35, C56X, C550, C510, BE40 | LSZB | 56.58 | 56.59 | 56.58 | 56.59 | 55.40 | 55.59 |
| E55P, CL60 | LSZC | 8.71 | 8.71 | 8.71 | 8.71 | 8.52 | 8.55 |
| LJ75, H25B, GLF6, GLF5, GLF4, GLEX, GL7T, G280, FA8X, FA7X, F900, F2TH, E55P, E50P, E35L, E135, CRJ2, CL60, CL35, C68A, C680, C56X, C510, C500, C25A, | LSZH | 812.46 | 812.48 | 800.66 | 812.48 | 779.86 | 808.55 |

| Aircraft type code | Destination | without development' 2024 | with development' 2024 | without development' 2028 | with development' 2028 | without development' 2032 | with development' 2032 |
|---|---|---|---|---|---|---|---|
| A320, A319, A20N | | | | | | | |
| FA7X, C56X | LSZR | 13.06 | 13.06 | 13.06 | 13.06 | 12.78 | 12.83 |
| GLF5, E55P, C56X, C500 | LSZS | 17.41 | 17.41 | 17.41 | 17.41 | 17.05 | 17.10 |
| LJ55, F2TH, B7M8, B738 | LTAC | 54.13 | 54.13 | 55.43 | 54.13 | 53.94 | 53.97 |
| H25B, B7M8, A320, A319, A20N | LTAI | 231.46 | 231.46 | 173.28 | 231.46 | 168.48 | 231.38 |
| B7M8, B738 | LTAJ | 45.42 | 45.42 | 46.73 | 45.42 | 45.42 | 45.42 |
| LJ40, GLF5, GLEX, CRJ2, CL60, CL30, A332, A306 | LTBA | 170.64 | 170.65 | 164.50 | 170.65 | 169.64 | 169.80 |
| GLF4, E55P, B7M8, B738 | LTBJ | 111.75 | 111.75 | 114.46 | 111.75 | 111.38 | 111.44 |
| CL60 | LTBO | 4.35 | 4.35 | 4.35 | 4.35 | 4.26 | 4.28 |
| GLF6, GLF4, GLEX, CRJ2, C750, B7M8, B738, A320, A319, A20N | LTBS | 174.52 | 174.52 | 178.03 | 174.52 | 173.42 | 173.60 |
| F2TH | LTCG | 4.35 | 4.35 | 4.35 | 4.35 | 4.26 | 4.28 |
| H25B, GLF6, GLF5, GLF4, GLEX, GL5T, FA7X, F900, E135, CRJ2, CL60, CL30, C56X, C55B, B7M8, A320, A319, A20N | LTFE | 280.94 | 280.95 | 217.96 | 280.95 | 212.54 | 279.25 |

| Aircraft type code | Destination | without development' 2024 | with development' 2024 | without development' 2028 | with development' 2028 | without development' 2032 | with development' 2032 |
|---|---|---|---|---|---|---|---|
| FA7X, CRJ2 | LTFJ | 13.06 | 13.06 | 13.06 | 13.06 | 12.78 | 12.83 |
| A320, A21N, A20N | LUKK | 454.22 | 454.22 | 467.26 | 454.22 | 454.22 | 454.22 |
| A320, A21N, A20N | LWOH | 90.84 | 90.84 | 93.45 | 90.84 | 90.84 | 90.84 |
| C550, A320, A21N, A20N | LWSK | 210.50 | 210.50 | 216.42 | 210.50 | 210.41 | 210.42 |
| C56X, B735, A320, A319, A20N | LXGB | 29.67 | 29.67 | 30.27 | 29.67 | 29.49 | 29.52 |
| GLF4, FA50, C56X, C55B, C550, A321, A320, A21N, A20N | LYBE | 211.30 | 211.30 | 216.61 | 211.30 | 210.75 | 210.84 |
| GLF4 | LYBT | 4.35 | 4.35 | 4.35 | 4.35 | 4.26 | 4.28 |
| F2TH, C680 | LYTV | 8.71 | 8.71 | 8.71 | 8.71 | 8.52 | 8.55 |
| GLF6, C56X, A321, A21N, A20N | LZIB | 330.15 | 330.15 | 339.38 | 330.15 | 329.97 | 330.00 |
| A321, A21N, A20N | LZKZ | 321.45 | 321.45 | 330.68 | 321.45 | 321.45 | 321.45 |
| A320, A21N, A20N | LZTT | 136.27 | 136.27 | 140.18 | 136.27 | 136.27 | 136.27 |
| GLEX | MMUN | 8.71 | 8.71 | 8.71 | 8.71 | 8.52 | 8.55 |
| E35L | OEDF | 4.35 | 4.35 | 4.35 | 4.35 | 4.26 | 4.28 |
| GLF6, B7M8, B739 | OEDR | 13.06 | 13.06 | 13.06 | 13.06 | 12.78 | 12.83 |
| GLF6, GLF4, GLEX, E135, CL60, B7M8, B739, B737, A319 | OEJN | 69.64 | 69.65 | 69.64 | 69.65 | 68.18 | 68.41 |
| GLF6, GLF4, GLEX, FA8X, F900, E190, E135, A319 | OERK | 60.94 | 60.94 | 60.94 | 60.94 | 59.66 | 59.86 |
| B7M8, B739 | OERY | 4.35 | 4.35 | 4.35 | 4.35 | 4.26 | 4.28 |

| Aircraft type code | Destination | without development' 2024 | with development' 2024 | without development' 2028 | with development' 2028 | without development' 2032 | with development' 2032 |
|---|---|---|---|---|---|---|---|
| GLF5 | OETF | 4.35 | 4.35 | 4.35 | 4.35 | 4.26 | 4.28 |
| GLF5, GLEX, E135 | OKBK | 13.06 | 13.06 | 13.06 | 13.06 | 12.78 | 12.83 |
| GLF4, GLEX, E550, E35L, CRJ2, CL60 | OLBA | 39.17 | 39.18 | 39.17 | 39.18 | 38.35 | 38.48 |
| GLF5, GLEX, GL5T, F2TH, A319 | OMAD | 34.82 | 34.82 | 34.82 | 34.82 | 34.09 | 34.21 |
| GLF4, GLEX | OMDB | 21.76 | 21.76 | 21.76 | 21.76 | 21.31 | 21.38 |
| GLF6, GLF4, A319 | OMDW | 17.41 | 17.41 | 17.41 | 17.41 | 17.05 | 17.10 |
| GLEX | OMSJ | 8.71 | 8.71 | 8.71 | 8.71 | 8.52 | 8.55 |
| GLF4, F900, CL60 | OOMS | 13.06 | 13.06 | 13.06 | 13.06 | 12.78 | 12.83 |
| GLF4, CL60 | ORER | 8.71 | 8.71 | 8.71 | 8.71 | 8.52 | 8.55 |
| GLEX | ORSU | 4.35 | 4.35 | 4.35 | 4.35 | 4.26 | 4.28 |
| GLF5, GLEX, E135 | OTBD | 39.17 | 39.18 | 39.17 | 39.18 | 38.35 | 38.48 |
| GLF6, GLEX | RJAA | 8.71 | 8.71 | 8.71 | 8.71 | 8.52 | 8.55 |
| GLF6, GLEX | RJTT | 13.06 | 13.06 | 13.06 | 13.06 | 12.78 | 12.83 |
| GLF6 | RKSI | 4.35 | 4.35 | 4.35 | 4.35 | 4.26 | 4.28 |
| GLF5 | SBGL | 4.35 | 4.35 | 4.35 | 4.35 | 4.26 | 4.28 |
| GLF6, GLEX | SBGR | 8.71 | 8.71 | 8.71 | 8.71 | 8.52 | 8.55 |
| GLEX | TBPB | 4.35 | 4.35 | 4.35 | 4.35 | 4.26 | 4.28 |
| GLEX | TJSJ | 4.35 | 4.35 | 4.35 | 4.35 | 4.26 | 4.28 |
| GLF4, FA7X, F900 | TXKF | 26.12 | 26.12 | 26.12 | 26.12 | 25.57 | 25.65 |
| GLF4, GLEX, E135, CL60 | UAAA | 30.47 | 30.47 | 30.47 | 30.47 | 29.83 | 29.93 |
| GLF5, GLF4, CL60, A319 | UACC | 26.12 | 26.12 | 26.12 | 26.12 | 25.57 | 25.65 |
| CL60 | UATG | 17.41 | 17.41 | 17.41 | 17.41 | 17.05 | 17.10 |
| GLF6, GLF4, G280, A319 | UBBB | 21.76 | 21.76 | 21.76 | 21.76 | 21.31 | 21.38 |
| GALX | UDYZ | 4.35 | 4.35 | 4.35 | 4.35 | 4.26 | 4.28 |
| A320, A21N, A20N | UGKO | 94.34 | 94.34 | 97.05 | 94.34 | 94.34 | 94.34 |
| CL60 | UGSB | 4.35 | 4.35 | 4.35 | 4.35 | 4.26 | 4.28 |
| F2TH, E35L, B738 | UGTB | 13.06 | 13.06 | 13.06 | 13.06 | 12.78 | 12.83 |
| GLEX | UHWW | 4.35 | 4.35 | 4.35 | 4.35 | 4.26 | 4.28 |
| LJ55, GALX, CRJ2, CL30, A320, | UKBB | 38.37 | 38.38 | 38.98 | 38.38 | 38.01 | 38.07 |

| Aircraft type code | Destination | without development' 2024 | with development' 2024 | without development' 2028 | with development' 2028 | without development' 2032 | with development' 2032 |
|---|---|---|---|---|---|---|---|
| A21N, A20N | | | | | | | |
| CL35 | UKDD | 4.35 | 4.35 | 4.35 | 4.35 | 4.26 | 4.28 |
| CL30 | UKHH | 4.35 | 4.35 | 4.35 | 4.35 | 4.26 | 4.28 |
| GLF6, GLF4, GALX, E35L, CRJ2, CL60, C55B, A320, A21N, A20N | UKKK | 192.05 | 192.05 | 196.56 | 192.05 | 191.32 | 191.44 |
| A320, A21N, A20N | UKLL | 136.27 | 136.27 | 140.18 | 136.27 | 136.27 | 136.27 |
| CL30, C56X | UKOO | 13.06 | 13.06 | 13.06 | 13.06 | 12.78 | 12.83 |
| GLF6, GLEX, F900, CL60, CL35, C56X | ULLI | 39.17 | 39.18 | 39.17 | 39.18 | 38.35 | 38.48 |
| H25B, GLF5, GALX, G280, BE40 | UMMS | 21.76 | 21.76 | 21.76 | 21.76 | 21.31 | 21.38 |
| GLF4 | URKA | 4.35 | 4.35 | 4.35 | 4.35 | 4.26 | 4.28 |
| FA8X | URSS | 4.35 | 4.35 | 4.35 | 4.35 | 4.26 | 4.28 |
| FA50 | URWW | 4.35 | 4.35 | 4.35 | 4.35 | 4.26 | 4.28 |
| H25B | USSS | 4.35 | 4.35 | 4.35 | 4.35 | 4.26 | 4.28 |
| CL60 | UTAA | 4.35 | 4.35 | 4.35 | 4.35 | 4.26 | 4.28 |
| FA8X | UTTT | 4.35 | 4.35 | 4.35 | 4.35 | 4.26 | 4.28 |
| GLF5, GLEX | UUDD | 8.71 | 8.71 | 8.71 | 8.71 | 8.52 | 8.55 |
| H25B, GLF6, GLEX, F900, F2TH, CRJ2, CL60, CL35, CL30, C750, C25A | UUEE | 73.99 | 74.00 | 73.99 | 74.00 | 72.44 | 72.69 |
| H25B, GLF6, GLF5, GLF4, GLEX, GALX, G280, G150, FA8X, FA7X, F900, F2TH, E135, CL60, | UUWW | 139.28 | 139.29 | 139.28 | 139.29 | 136.36 | 136.83 |

| Aircraft type code | Destination | without development' 2024 | with development' 2024 | without development' 2028 | with development' 2028 | without development' 2032 | with development' 2032 |
|---|---|---|---|---|---|---|---|
| CL35, CL30, C750, B737 | | | | | | | |
| CRJ2 | UWWW | 4.35 | 4.35 | 4.35 | 4.35 | 4.26 | 4.28 |
| GLEX | VAAH | 4.35 | 4.35 | 4.35 | 4.35 | 4.26 | 4.28 |
| GLF6, GLEX | VABB | 39.17 | 39.18 | 39.17 | 39.18 | 38.35 | 38.48 |
| GLF5, GLEX | VAPO | 17.41 | 17.41 | 17.41 | 17.41 | 17.05 | 17.10 |
| GLEX | VCBI | 4.35 | 4.35 | 4.35 | 4.35 | 4.26 | 4.28 |
| GLF5 | VGHS | 4.35 | 4.35 | 4.35 | 4.35 | 4.26 | 4.28 |
| GLF6, GLF5, GLEX | VHHH | 69.64 | 69.65 | 69.64 | 69.65 | 68.18 | 68.41 |
| GLF6, GLF5, GLEX, GL5T | VIDP | 34.82 | 34.82 | 34.82 | 34.82 | 34.09 | 34.21 |
| GLEX, GL5T | VOBL | 8.71 | 8.71 | 8.71 | 8.71 | 8.52 | 8.55 |
| GLEX | VOHS | 4.35 | 4.35 | 4.35 | 4.35 | 4.26 | 4.28 |
| GLEX | VRMM | 4.35 | 4.35 | 4.35 | 4.35 | 4.26 | 4.28 |
| GLF6 | VTBD | 8.71 | 8.71 | 8.71 | 8.71 | 8.52 | 8.55 |
| FA8X | WMSA | 4.35 | 4.35 | 4.35 | 4.35 | 4.26 | 4.28 |
| GLF6 | WSSL | 4.35 | 4.35 | 4.35 | 4.35 | 4.26 | 4.28 |
| GLF6, GLF5, GLEX, FA7X, B737 | ZBAA | 21.76 | 21.76 | 21.76 | 21.76 | 21.31 | 21.38 |
| GLF6 | ZGSZ | 4.35 | 4.35 | 4.35 | 4.35 | 4.26 | 4.28 |
| GLF6, GLF5, GLEX, E55P | ZSSS | 17.41 | 17.41 | 17.41 | 17.41 | 17.05 | 17.10 |
| GLF6 | ZSWX | 4.35 | 4.35 | 4.35 | 4.35 | 4.26 | 4.28 |
| GLEX, GL5T | ZWWW | 8.71 | 8.71 | 8.71 | 8.71 | 8.52 | 8.55 |
| PUMA, HELI, EC55, B06, AS55, A109 | ZZZJ | 36.09 | 36.09 | 36.09 | 36.09 | 36.00 | 36.02 |
| HELI, EC55, C56X, A109 | ZZZZ | 34.10 | 34.10 | 34.10 | 34.10 | 33.92 | 33.95 |

# Appendix 8A
# Noise - Legislation, policy, and guidance

Noise from airports is considered in several planning policy documents and is subject to legislative control and regulation. At an international level, standards governing aircraft noise emissions are set by the International Civil Aviation Organization (ICAO). In the UK, the DfT and Defra are responsible for regulating the various environmental aspects of the aviation industry. At a local level, the local planning authority also has some control over the development of an airport through planning policy.

## Legislative context

*The Civil Aviation Act*[1] is the principal legislation for the regulation of aircraft operations. It was updated in 2006 when additional powers to avoid, limit or mitigate the effects of noise connected with departures or arrivals of aircraft at an aerodrome were introduced.

*The Airports (Noise-related Operating Restrictions) (England and Wales) Regulations 2018*[2] implements into UK law the provisions of *European Union (EU) Regulation 598*[3], aimed at enabling authorities to deal with aircraft noise within the international framework of the Balanced Approach. The Balanced Approach to noise management involves consideration of noise in the context of environmental benefit and economic incentives, but without imposing control measures that would be overly restrictive. *EU Regulation 598* makes it clear that for airports where a noise problem has been identified, additional noise abatement measures should be identified in accordance with the Balanced Approach method and should restrictions be required these should be cost-effective and be introduced only when other Balanced Approach measures are not sufficient to attain the specific noise abatement objectives.

*The Environmental Noise Directive(2002/49/EC)*[4] (END) requires all Member States within the EU to produce Noise Maps and Action Plans for the main sources of environmental noise, including major airports. The requirements of the *Environmental Noise Directive* are transposed into the *Environmental Noise (England) Regulations 2006* (as amended)[5]. These regulations require major airports (such as LLA) to prepare Noise Maps and Action Plans.

[1] Civil Aviation Act, 2006 [online]. Available at: https://www.legislation.gov.uk/ukpga/2006/34/contents [Checked November 2020].
[2] The Airports (Noise-related Operating Restrictions) (England and Wales) Regulations, 2018 [online]. Available at: https://www.legislation.gov.uk/uksi/2018/785#:~:text=The%20Airports%20(Noise-related%20Operating%20Restrictions)%20(England%20and%20Wales),in%20the%20content%20and%20are%20referenced%20with%20annotations [Checked December 2020].
[3] Regulation (EU) 598/2014, [online]. Available at: https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32014R0598&from=EN [Checked November 2020].
[4] Directive 2002/49/EC, [online]. Available at: https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32002L0049&from=EN [Checked November 2020].
[5] The Environmental Noise (England) Regulations, 2006 [online]. Available at: http://www.legislation.gov.uk/uksi/2006/2238/contents/made [Checked November 2020].

# Planning policy context

## National planning policy framework

Noise is considered by the *National Planning Policy Framework* (MHCLG, 2019). The NPPF advises that significant adverse impacts on health and the quality of life as a result of noise from new development should be avoided. It also advises that other adverse impacts on health and quality of life arising from noise from new development should be reduced to a minimum.

The NPPF states in Paragraph 180 that "Planning policies and decisions should also ensure that new development is appropriate for its location taking into account the likely effects (including cumulative effects) of pollution on health, living conditions and the natural environment, as well as the potential sensitivity of the site or the wider area to impacts that could arise from the development. In doing so they should:

- "mitigate and reduce to a minimum potential adverse impacts resulting from noise from new development – and avoid noise giving rise to significant adverse impacts on health and the quality of life;
- identify and protect tranquil areas which have remained relatively undisturbed by noise and are prized for their recreational and amenity value for this reason."

Paragraph 182 advises that "*Planning policies and decisions should ensure that new development can be integrated effectively with existing businesses and community facilities (such as places of worship, pubs, music venues and sports clubs). Existing businesses and facilities should not have unreasonable restrictions placed on them as a result of development permitted after they were established. Where the operation of an existing business or community facility could have a significant adverse effect on new development (including changes of use) in its vicinity, the applicant (or 'agent of change') should be required to provide suitable mitigation before the development has been completed.*" This should be taken into account when considering whether proposed development is an acceptable use of land.

The NPPF document does not refer to any other documents regarding noise other than the *Noise Policy Statement for England* (NPSE, 2010).

## Noise Policy Statement for England (2010)

The *Noise Policy Statement for England* (NPSE) (Defra, 2010) forms the overarching statement of noise policy for England (and hence is of direct relevance to the assessment of planning applications under the NPPF for developments in England only). It sets out the long-term vision of the Government, as follows:

> *"[to] Promote good health and a good quality of life through the effective management of noise within the context of Government policy on sustainable development."*

This vision is supported by the following aims, which are reflected in the provisions of the NPPF:

> *"Through the effective management and control of environmental, neighbour and neighbourhood noise within the context of Government policy on sustainable development:*
>
> - *Avoid significant adverse impacts on health and quality of life:*
> - *Mitigate and minimise adverse impacts on health and quality of life; and*
> - *Where possible, contribute to the improvement of health and quality of life."*

The Explanatory Note to the NPSE (paragraph 2.14) acknowledges that noise contributing to annoyance and / or sleep disturbance in human populations can have long-term consequences for health and wellbeing. It introduces three 'Effect Levels' relevant to the assessment of noise. These are:

- **NOEL: No Observed Effect Level** – this is the level below which no effect can be detected. In simple terms, below this level there is no detectable effect on health and quality of life due to the noise;
- **LOAEL: Lowest Observed Adverse Effect Level** – this is the level above which adverse effects on health and quality of life can be detected; and
- **SOAEL: Significant Observed Adverse Effect Level** – this is the level above which significant adverse effects on health and quality of life occur.

The aim of the NPSE is to avoid all noise occurring at the SOAEL level and to minimise, as far as possible, all noise occurring between the LOAEL and SOAEL brackets.

The NPSE states that it is not possible to have a single, numerical definition of the SOAEL that is applicable to all sources of noise in all situations, since the SOAEL is likely to be different for different noise sources, for different receptors at different times. Further research is required to increase understanding of what constitutes a significant adverse impact on health and quality of life due to noise, and the NPSE states that not stating specific SOAEL levels provides a suitable degree of policy flexibility until such evidence is available.

## Planning Practice Guidance, 2019

The *Planning Practice Guidance-Noise*[6] (PPG-N) (MCHLG, 2019), published by the Ministry of Housing, Communities and Local Government, was revised in July 2019. The PPG-N introduces a fourth effect level not included in the NPSE:

- **UAEL – Unacceptable Adverse Effect Level** – this is the level above which extensive and regular changes in behaviour and / or an inability to mitigate the effect of noise leading to psychological stress or physical effects occurs.

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

PPG-N advises that the noise impact may be partially offset if the residents of those dwellings have access to:

- a relatively quiet façade (containing windows to habitable rooms) as part of their dwelling;
- a relatively quiet external amenity space for their sole use (e.g. a garden or balcony). Although the existence of a garden or balcony is generally desirable, the intended benefits will be reduced with increasing noise exposure and could be such that significant adverse effects occur;
- a relatively quiet, protected, nearby external amenity space for sole use by a limited group of residents as part of the amenity of their dwellings; and
- a relatively quiet, protected, external publicly accessible amenity space (e.g. a public park or a local green space designated because of its tranquillity) that is nearby (e.g. within 5 minutes walking distance).

The potential effect of an existing business on a new residential development being located close to it should be carefully considered as the existing noise levels from the business may be regarded as unacceptable by the new residents and subject to enforcement action. In the case of an established business, the policy set out in Paragraph 182 of the NPPF should be followed.

[6] Gov.uk (2019) Planning Practice Guidance – Noise, [online]. Available at https://www.gov.uk/guidance/noise--2 [Checked May 2020]

PPG-N links the increasing effect levels to an effect, perception by receptor and associated action, as summarised in **Table 8A.1**.

Table 8A.1 PPG-N – Summary of noise exposure hierarchy

| Increasing effect level | Effect | Perception | Action |
|---|---|---|---|
| **Less than NOEL (No Observed Effect)** | No effect | Not noticeable | No specific measures |
| **Greater than LOAEL (Lowest Observed Adverse Effect Level)** | Adverse effect | Noticeable and intrusive | Mitigate and reduce to a minimum |
| **Greater than SOAEL (Significant Observed Adverse Effect Level)** | Significant adverse effect | Noticeable and disruptive | Avoid |
| **Greater than UAEL (Unacceptable Adverse Effect Level)** | Unacceptable adverse effect | Noticeable and very disruptive | Prevent |

Source: Planning Practice Guidance – Noise, 2019

# Aviation policy and guidance

## Aviation 2050

The Government announced that the Department for Transport (DfT) is currently progressing work to develop a new strategy for UK aviation[7] that will set out the long-term direction for aviation policy to 2050 and beyond.

In December 2018, the Government published *Aviation 2050: The Future of UK Aviation* – A consultation document seeking views until April 2019. Recognising the strong and continuing growth in demand for air services, the strategy will look to address what should constitute a framework for future sustainable growth and consider how the UK can balance environmental costs with the economic benefits of aviation.

The *Aviation 2050* notes on page 8 that it aims *"To achieve a safe, secure and sustainable aviation sector that meets the needs of consumers and of a global, outward-looking Britain"*. This aim is underpinned by the following six objectives:

- *Help the aviation industry work for its customers;*
- *Ensure a safe and secure way to travel;*
- *Build a global and connected Britain;*
- *Encourage competitive markets;*
- *Support growth while tackling environmental impacts; and*
- *Develop innovation, technology and skills.*

The "*increasing demand*" section (i.e. Paragraphs 1.17~1.21) clearly acknowledges the significantly increasing demand for flying in terms of transporting both passengers and freight. The need for further aviation capacity is highlighted and the Government is supportive of a new runway at London Heathrow Airport as well as other airports throughout the UK making best use of their existing runways.

[7] Written Statement to Parliament on Airport Capacity and Airspace Policy – 2nd February 2017.

The Government essentially encourages making best use of existing runways throughout the UK and acknowledges the important role of airports beyond London Heathrow Airport. In particular, the Government recognises the economic benefits that airports can have on the local area to act as catalysts to encourage economic growth and development in the region. However, it also recognises the importance of appropriately managing the environmental impacts that airports could cause on surroundings particularly with respect to noise implications.

There is currently an ongoing consultation process regarding the 'Aviation 2050 – the future of UK aviation' document with initial results available for *'Legislation for enforcing the development of airspace change proposals'*[8] section, annex A of the consultation document. On the basis of the consultation, the government intends to:

- *"to take forward new powers for the Secretary of State (delegable to the CAA) to direct that airspace change proposals are taken forward by airports or other relevant bodies;*
- *take forward its sanctions and penalties regime proposal; and*
- *give the CAA the responsibility for enforcing the sanctions and penalties regime."*[9]

Further responses are to be published, leading to a final strategy for aviation growth.

## Aviation policy framework

The *Aviation Policy Framework*[10] (APF) was published in March 2013 and fully replaces the *2003 Air Transport White Paper*[11] as Government policy on aviation. The framework outlines objectives and principles to guide plans and decisions on airport developments, bringing together many related and discreet policies. By defining the Government's objectives and policies on the impacts of aviation, the APF sets out the framework within which decisions on aviation ought to be made to deliver a balanced approach to securing the benefits of aviation and to support economic growth.

The APF states that the "*Government wants to see the best use of existing airport capacity*" and that in the short-term, a key priority for Government is to continue to work with the aviation industry and other stakeholders to make better use of existing runways at all UK airports to improve performance, resilience and the passenger experience.

There has been no update to the *Aviation Policy Framework* (APF) 2013[12] which underpinned the noise assessment for the Original Permission, and hence the APF 2013 continues to act as the primary policy framework for this assessment. However, to ensure consistency with recent aviation policy guidance contained in the Consultation Response on *UK Airspace Policy: A Framework for balanced decisions on the design and use of airspace*[13], noise levels have been reported down to 51 dB $L_{Aeq,16hr}$ and 45 dB $L_{Aeq,\ 8hr}$ and these values are considered as the lowest-observed adverse-effect level (LOAEL) for daytime and night-time respectively.

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[8] Department for Transport (2019). Consultation Response on Legislation for Enforcing the Development of Airspace Change [online]. Proposals Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/841247/consultation-response-on-legislation-for-enforcing-the-development-of-airspace-change-proposals.pdf [Checked December 2020].

[9] Department for Transport https://www.gov.uk/government/consultations/aviation-2050-the-future-of-uk-aviation

[10] Department for Transport (2013). Aviation Policy Framework, [online]. Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/153776/aviation-policy-framework.pdf [Checked November 2018].

[11] Department for Transport (2003). The Future of Air Transport, [online]. Available at: https://www.gov.uk/government/publications/the-future-of-air-transport [Checked November 2018].

[12] Department for Transport (2013) Aviation Policy Framework, [online]. Available at https://www.gov.uk/government/publications/aviation-policy-framework [Checked March 2019].

[13] Department for Transport and Civil Aviation Authority (2017) Consultation Response on UK Airspace Policy: A framework for balanced decisions on the design and use of airspace [online] Available at https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/653801/consultation-response-on-uk-airspace-policy-web-version.pdf [Checked October 2018].

Several guidance documents have also been updated since the Original Permission, including the *Air Navigation Guidance (ANG) 2017*[14], which, took effect from 2018 and provides guidance to the CAA on the implementation of the changes to airspace policy. Furthermore, the CAA published CAP1616[15] in response to the ANG, and this provides guidance for the assessment of noise required for an airspace change. Although the ANG 2017 and CAP1616 are considered best practice for the assessment of noise resulting from an airspace change, the guidance is not considered primary policy for this assessment on the basis that this is not an airspace change assessment, nor does it seek to alter established flight paths.

Alongside the updated airspace guidance, the Government published its *Consultation Response on UK Airspace Policy 2017*, which provides the reasoning behind policy changes and reaffirms that the Government's objective for aviation noise management as being, to:

> "*Limit and, where possible, reduce the number of people in the UK significantly affected by the adverse impacts of aircraft noise*"[16].

**Table 8A.2** presents a summary of aviation policy and guidance that has been updated between the Original Permission and this report.

Table 8A.2 Aviation policy and guidance relevant to the noise assessment

| Policy reference | Policy information relevant to noise |
|---|---|
| **Air Navigation Guidance, 2017**[17] | Section 70(2) of the *Transport Act 2000*[18] requires the CAA to take account of any guidance on environmental objectives given to it by the Secretary of State (SoS) when carrying out its air navigation function. Following extensive review by the CAA, the *Air Navigation Guidance 2017* was introduced. The guidance is considered statutory guidance to the CAA on environmental objectives in respect of its air navigation functions. The Guidance defines the Government's key environmental objective in respect to noise as:<br>*"Limit and, where possible, reduce the number of people in the UK significantly affected by adverse impacts from aircraft noise".*<br>The Guidance goes on to define a daytime LOAEL of 51 dB $L_{Aeq,16hr}$ and 45 dB $L_{Aeq,8hr}$ for night-time. The Guidance also highlights altitude-based priorities and identifies that noise is the priority objective for aircraft below 4,000 ft., between 4,000 and 7,000 ft noise should be balanced with other environmental objectives and above 7,000 ft noise is no longer priority. |
| **CAP 1129: Noise Envelopes**[19] | CAP 1129 introduces and defines the concept of a noise envelope and provides example of use at other airports. The guidance defines three approaches to setting an envelope including restricting inputs; restricting noise exposure and restricting noise impact. A noise envelope should also be clearly defined, be agreed by stakeholders, be legally binding, take account |

[14] Department for Transport and Civil Aviation Authority (2017) Air Navigation Guidance 2017, [online]. Available at https://www.gov.uk/government/publications/uk-air-navigation-guidance-2017 [Checked March 2019]
[15] Civil Aviation Authority (2017) CAP1616 Airspace Design: Guidance on the regulatory process for changing airspace design including community engagement requirements, [online]. Available at http://publicapps.caa.co.uk/modalapplication.aspx?appid=11&mode=detail&id=8127 [Checked March 2019]
[16] Department for Transport (2017) Consultation Response on UK Airspace Policy: A framework for balanced decisions on the design and use of airspace [online] Available at https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/653801/consultation-response-on-uk-airspace-policy-web-version.pdf [Checked February 2018].
[17] Department for Transport and Civil Aviation Authority (2017) UK Air Navigation Guidance 2017, [online]. Available at: https://www.gov.uk/government/publications/uk-air-navigation-guidance-2017 [Checked March 2019].
[18] Transport Act, 2000, [online]. Available at: https://www.legislation.gov.uk/ukpga/2000/38/contents [Checked March 2019]
[19] Civil Aviation Authority (2013). Noise Envelopes, CAP 1129, [online]. Available at: https://publicapps.caa.co.uk/docs/33/CAP%201129%20Noise%20Envelopes.pdf [Checked March 2019].

| Policy reference | Policy information relevant to noise |
|---|---|
| | of noise and annoyance, consider modern technology and have aims proportionate to the airport. |
| **CAP 1278: Aircraft Noise and Health Effects: Recent Findings**[20] | Published by the CAA, this report is an update to the previous *ERCD Report 0907* and highlights key research that has been published in aircraft noise and health effects since 2007, including sleep disturbance, cardiovascular disease, children's learning, and other health effects. |
| **CAP 1506: Survey of Noise Attitudes 2014: Aircraft**[21] | Latest UK-based evidence on the effects of aircraft noise exposure on social attitudes and annoyance. The results of this survey have been used to aid the setting of noise exposure thresholds in the *Air Navigation Guidance 2017*. |
| **CAP 1616: Airspace Design Guidance**[22] | CAP 1616 presents guidance to support the new process of assessing airspace change and outlines the process and metrics for environmental assessments, including noise and states that:<br><br>*"In the airspace from the ground to 4,000 ft, the Government's environmental priority is to minimise the noise impact of aircraft and the number of people on the ground affected by it".*<br><br>Furthermore, for airspace between 4,000 ft and 7,000 ft the focus is to continue minimising the noise impact on populated areas as well as balancing other requirements.<br><br>CAP 1616a[23] provides technical guidance in support of CAP 1616. The guidance defines noise metrics and provides a method for calculating aircraft noise using a recognised and validated model. |
| **Consultation Response on UK Airspace Policy: A Framework for Balanced Decisions on the Design and use of Airspace**[24] | The Consultation Response confirms: *"The government has issued revised Air Navigation Directions and Air Navigation Guidance to the CAA which will take effect from 1 January 2018"*. With regard to aircraft noise the Consultation Response sets out that:<br><br>• *"The Government's current aviation policy is set out in the Aviation Policy Framework (APF). The policies set out within this document provide an update to some of the policies on aviation noise contained within the APF and should be viewed as the current government policy."*<br><br>• *"Consistent with the Noise Policy Statement for England, our objectives in implementing this [UK airspace] policy are to: … limit and, where possible, reduce the number of people in the UK significantly affected by the adverse impacts from aircraft noise."* |

[20] Civil Aviation Authority (2016). Aircraft noise and health effects: recent findings, CAP 1278, [online]. Available at: https://publicapps.caa.co.uk/docs/33/CAP%201278%20MAR16.pdf [Checked March 2019].
[21] Civil Aviation Authority (2017). Survey of noise attitudes 2014: aircraft, CAP 1506, [online]. Available at: https://publicapps.caa.co.uk/docs/33/CAP%201506%20FEB17.pdf [Checked March 2019].
[22] Civil Aviation Authority (2017) Airspace Design: guidance on the regulatory process for changing airspace design including community engagement requirements, CAP 1616, [online]. Available at: https://publicapps.caa.co.uk/modalapplication.aspx?appid=11&mode=detail&id=8127 [Checked March 2019].
[23] Civil Aviation Authority (2017) Airspace Design: Environmental requirements technical annex, CAP 1616a, [online]. Available at: https://publicapps.caa.co.uk/modalapplication.aspx?appid=11&mode=detail&id=8128 [Checked March 2019].
[24] Department for Transport (2017) Consultation Response on UK Airspace Policy: a framework for balanced decisions on the design and use of airspace, [online]. Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/653801/consultation-response-on-uk-airspace-policy-web-version.pdf [Checked March 2019].

| Policy reference | Policy information relevant to noise |
|---|---|
| | • *"The specific daytime and night-time values proposed for the LOAEL: 51 dB LAeq 16hr and 45 dB Lnight also received broad support" and therefore "We [the Government] will set a LOAEL at 51 dB $L_{Aeq\ 16hr}$ for daytime noise …. and based on feedback and further discussion with CAA we are making one minor change to the LOAEL night metric to be 45 dB $L_{Aeq\ 8hr}$ rather than Lnight to be consistent with the daytime metric."*<br><br>• *"The Government acknowledges the evidence from recent research which shows that sensitivity to aircraft noise has increased, with the same percentage of people reporting to be highly annoyed at a level of 54 dB $L_{Aeq\ 16hr}$ as occurred at 57 dB $L_{Aeq\ 16hr}$ in the past."*<br><br>Similar to the APF, 2012 The Consultation Response also confirms:<br>• The Government continues to expect airport operators to offer households exposed to levels of noise of 69 dB $L_{Aeq,16h}$ or more, assistance with the costs of moving;<br><br>• The Government also expects airport operators to offer acoustic insulation to noise-sensitive buildings, such as schools and hospitals, exposed to levels of noise of 63 dB $L_{Aeq,16h}$ or more; and<br><br>• *"As a minimum, the Government would expect airport operators to offer financial assistance towards acoustic insulation to residential* dwellings *which experience an increase in noise of 3 dB or more which leaves them exposed to levels of noise of 63 dB $L_{Aeq,16h}$ or more."* |

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# Appendix 8B
# Noise - Modelling report

**LONDON LUTON AIRPORT**

A11060-N57-DR

21 December 2020

**SECTION 73 – NOISE CONTOURING METHODOLOGY**

## 1.0 INTRODUCTION

London Luton Airport Operations Limited (LLAOL) are making a Section 73 application to Luton Borough Council (LBC) to increase their annual passenger limit to 19 million passengers per annum (mppa), and for an increase in the limits on the area of the 57 dB daytime and 48 dB night time noise contours. For both contours there is a short term limit that applies until the end of 2027 and a lower long term limit that applies from 2028 onwards.

Chapter 7 of the Environmental Statement accompanying the application contains aircraft noise contours for a number of scenarios. This appendix details the methodology for the production of these noise contours. It follows the same format as the corresponding appendix in the 2012 ES, specifically *Appendix H Appendix N03 Detailed Noise Input Data, Methodology and Airport Noise Contours*.

The latest contours and those in the 2012 ES, have been prepared by Bickerdike Allen Partners LLP (BAP) based on actual and forecast future movements provided by London Luton Airport Operations Limited (LLAOL). These include the actual and expected number of movements by the individual aircraft types.

Chapter 7 contains contours for the following scenarios:

- Existing Short Term Limit
- 2021 18mppa (Proposed Short Term Contour Area Limit)
- 2022 18mppa (Worst Intermediate Year)
- 2023 18mppa
- 2024 19mppa
- Existing Long Term Limit
- 2028 19mppa (Proposed Long Term Contour Area Limit)
- 2028 12.5mppa (Future Baseline)

Details of the noise contour methodology for these scenarios are given below. The 2028 12.5mppa scenario is based on the forecast movements from the 2012 ES, but using the latest methodology.

## 2.0 SOFTWARE

The overall $L_{Aeq,T}$ contours were produced using the version 7.0d of the Federal Aviation Administration (FAA) Integrated Noise Model (INM). This is relatively minor update of version 7.0c which was used to produce the contours presented in the 2012 ES.

To produce the number above contours (N65 and N60) the INM software was used in conjunction with the Transport Noise Information Package (TNIP Expert v2.3b) from the Australian Government Department of Transport and Regional Services.

## 3.0 GEOGRAPHICAL INFORMATION

Geographical information about the location and height of the runway have been taken from the UK Aeronautical Information Package (AIP) for London Luton Airport. This is unchanged from the information used in the 2012 ES.

As before the INM study includes the effect of local topography. The data is based on the Ordnance Survey Landform Panorama product and then processed for input into the INM model.

## 4.0 AIRCRAFT OPERATIONS

The basis for the summer noise contours are the aircraft movements during a 92 day summer period. Specifically, the movements from the 16th June to the 15th September inclusive were used. This is the standard summer period used when producing noise contours in the U.K. This period represents a worst case as it includes the peak period at the airport due to holidays. For annual contours, the movements across the whole year are considered.

### 4.1 Traffic Distribution by Aircraft Type

The forecast of future aircraft operations used within this assessment are presented in Appendix 3A of the ES.

### 4.2 Flight Tracks and Dispersion

Arrivals at London Luton Airport (LLA) use Standard Arrival Routes (STARs), which involve straight final approaches with the aircraft typically joining the extended centreline of the runway around 8 nautical miles from the thresholds. Arrivals are therefore modelled as straight approaches, along the runway centreline.

Departures use the published Standard Instrument Departures (SIDs) given in the UK Aeronautical Information Publication (AIP). The use of the departure flight tracks is monitored by the Airport's track keeping system. The tracks flown are also available to view via the Airport's web site using the TraVis system.

A number of the SIDs are initially similar close to the airport. Therefore, a set of six modelled representative departure tracks, three from each runway end, for use in the INM model were generated based on actual tracks flown. The traffic has then been dispersed from these representative tracks as described below.

The dispersion model has the assumption that there are three "dispersed" tracks associated with each departure route; these comprise the representative track of each route and one sub-track either side. The allocation of departure movements to each track is as follows:

• 68.26 % along the representative track;

• 15.87 % along each of the two sub-tracks either side of the representative track.

This dispersion model is that assumed by the INM software when it generates the sub-tracks from the actual tracks. These assumptions are identical to those used for the previous contours.

The same set of modelled flight tracks were used to produce all of the noise contours. These are the same as those used to produce the contours for the *2011 Current Aircraft Noise Baseline* scenario with the exception of the departure routes to the west. These have been revised since the 2012 ES to reflect an airspace change and also the adjustments to an on route bearing to counter the natural drift in magnetic north.

### 4.3 Flight Profiles

For the departure movements the INM model offers a number of standard flight profiles for most aircraft types, particularly for the larger aircraft types. These relate to different departure weights which are greatly affected by the length of the flight, and consequently the fuel load.

In the INM the weight is referred to as the stage length. Stage lengths occur in increments of 500 up to 1500 nmi and then in increments of 1000 nmi. The INM model assumes all aircraft take off with a full load irrespective of stage length. As the stage length increases the aircraft has to depart with greater fuel and so its flight profile is slightly lower than when a shorter stage length is flown.

Following long term measurement of aircraft departures in southern Luton and discussion with airlines the standard flight profiles were supplemented with custom profiles for the Airbus A319 and A320 and the Boeing 737-800. These better reflected the operational procedures flown and also improved the correlation between measured and predicted noise levels, when considering both the results from southern Luton and the fixed monitors of the airport’s noise and track keeping system. This change occurred after the 2012 ES, so the earlier contours used standard flight profiles.

For the departure movements the appropriate stage lengths were determined from the destinations, which were provided in the forecasts. For the 2012 ES contours the stage length was similarly set for each departing aircraft based on its destination. In some cases, particularly for smaller aircraft, profiles do not exist in the INM model for the stage lengths flown. In these cases the closest available stage length was used.

### 4.4 Traffic Distribution by Route

For all scenarios, the modelled route usage is the average of the summer activity in the last five years (2015-2019). This five year average split of departures by route is summarised in Table 1.

| Runway | Modelled Departure Route | Percentage of Runway Departures |
|---|---|---|
| 08 | E1 | 11% |
| | E2 | 52% |
| | E3 | 38% |
| 26 | CPT_260 | 38% |
| | DVR_9Y | 51% |
| | OLY_260 | 11% |

**Table 1: Modelled departure route usage (2015-2019 average)**

### 4.5 Traffic Distribution by Runway

For all of the scenarios, the modelled runway usage is the average of the summer activity in the last five years (2015 to 2019). This five year average split by runway is given in Table 2.

| Runway | Percentage of Movements |
|---|---|
| 08 | 22% |
| 26 | 78% |

**Table 2: Modelled runway usage (2015-2019 average)**

### 4.6 Future Aircraft Types

For all the scenarios, the modelled performance of the modernised aircraft types has been based on current aircraft types available in the INM, but with an allowance for their expected lower noise levels.

For all of the scenarios the modelled change in noise for the A320neo compared with the A320ceo has been derived from measured noise levels.

When the *Current Short Term Limit* contours were produced measured results were not available for the A321neo. The modelled change in noise for the A321neo compared to the A321ceo was therefore based on a comparison of certification values. For the other scenarios, which were produced later, the modelled change in noise levels for the A321neo are based on measured results in 2018.

For all of the scenarios the modelled change in noise for the Boeing 737 MAX compared with the 737-800 are based on a comparison of certification noise levels. The modelled changes in noise levels for the modernised aircraft are detailed in Table 3.

| Scenario | Modernised Aircraft Type | Current Aircraft Type | Change in Modernised Aircraft Noise | |
|---|---|---|---|---|
| | | | Arrivals | Departures |
| All | Airbus A320neo | Airbus A320ceo | -1 dB | -3.8 dB |
| Current Short Term Limit | Airbus A321neo | Airbus A321ceo | -1.8 dB | -6.3 dB |
| All Other | Airbus A321neo | Airbus A321ceo | 0 dB | -1.9 dB |
| All | Boeing 737 MAX | Boeing 737-800 | -2.2 dB | -3 dB |

**Table 3: Latest modelled change in noise produced by modernised aircraft types**

At the time of the 2012 ES none of the modernised aircraft types had flown, let alone been certificated or entered service. Consequently, assumptions were made on their expected performance, and these are detailed in Table 4.

| Modernised Aircraft Type | Current Aircraft Type | Change in Modernised Aircraft Noise | |
|---|---|---|---|
| | | Arrivals | Departures |
| Airbus A319neo | Airbus A319 | -3 dB | -3 dB |
| Airbus A320neo | Airbus A320 | -3 dB | -3 dB |
| Airbus A321neo | Airbus A321 | -3 dB | -3 dB |
| Boeing 737 MAX | Boeing 737-800 | -3 dB | -3 dB |

**Table 4: 2012 ES modelled change in noise produced by modernised aircraft types**

Comparing Tables A3 and A4 shows a similar overall modelled improvement from departures, but a decrease in the modelled improvement from arrivals. The Airbus A319neo has only sold in very limited numbers and does not feature in the latest forecast so is not included in Table 3.

## 5.0 VALIDATION OF INM MODEL

To provide a check of the methodology used for producing the regular noise contours for London Luton Airport (LLA) a validation exercise has been conducted annually for several years. This involves the comparison of predicted noise levels for individual operations by key aircraft types with the measured noise levels obtained from the Noise and Track Keeping (NTK) system.

For all the scenarios the results of the validation exercise used to produce the actual contours for 2019 at the airport were used and are summarised below.

The validation exercise for the 2019 actual contours was based on the then most recent set of annual measured results from the airport's NTK system, the data for 2018. The exercise considered the most common and loudest aircraft types. The measured sound exposure levels (SELs) obtained for the three main aircraft types operating at Luton Airport, the Airbus A319ceo, Airbus A320ceo, and the Boeing 737-800, from the fixed Noise Monitoring Terminals (NMTs) in 2018 are shown in Table 5. These are the averages of thousands of results in 2018 for each operation. Table 5 also includes the noise levels from the Validated INM Prediction. These are generally very similar to the measured noise levels, being less than 1 dB different.

| Aircraft Type | Operation | Movement-Weighted NMT Noise Level, SEL dB(A) | |
|---|---|---|---|
| | | 2018 Average[1] | Validated INM Prediction |
| Airbus A319ceo | Arrival | 84.7 | 84.5 |
| | Departure | 83.6 | 84.2 |
| Airbus A320ceo | Arrival | 84.4 | 84.2 |
| | Departure | 83.9 | 84.5 |
| Boeing 737-800 | Arrival | 85.7 | 86.5 |
| | Departure | 86.2 | 86.0 |

**Table 5: Comparison of Measured Sound Exposure Levels – Fixed NMTs**

[1] Average based on results from specific NMTs exposed by each operation.

Measured noise levels for each aircraft type vary to some degree year on year. BAP have reviewed the average measured arrival and departure noise levels for the A320ceo, the most common type, over the period 2014-2018. The highest arrival noise levels occurred in 2018, the highest departure noise levels occurred in 2014.

To allow for this variation in noise level, for all the future scenarios except the *Current Short Term Limit* the modelled noise level for the A320ceo on departure has been increased to the 2014 level, which is 0.7 dB higher than that in 2018. The arrival noise levels have not been altered. For the *Current Short Term Limit* scenario the A320ceo noise levels are based on the measured results in 2018 as described above.

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# Appendix 8C
# Noise - Assessment results

Table 8C.1 Comparisons of operational noise levels ($L_{Aeq,T}$ dB) for existing condition 10 2021 – 2027 and for Proposed Development years 2021 to 2024

| | Area (sq.km) | | | | | No. of Dwellings | | | | | No. of Population | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Contour Level, $L_{Aeq,T}$** | **Existing Condition 10 2021-2027** | **18 mppa 2021** | **18 mppa 2022** | **18 mppa 2023** | **19 mppa 2024** | **Existing Condition 10 2021-2027** | **18 mppa 2021** | **18 mppa 2022** | **18 mppa 2023** | **19 mppa 2024** | **Existing Condition 10 2021-2027** | **18 mppa 2021** | **18 mppa 2022** | **18 mppa 2023** | **19 mppa 2024** |
| **Daytime contour level, $L_{Aeq,16hr}$** | | | | | | | | | | | | | | | |
| **51** | 54.1 | 59.0 | 57.6 | 56.1 | 53.5 | 13981 | 16746 | 16411 | 15547 | 14644 | 32966 | 39386 | 38687 | 36681 | 34550 |
| **52** | 46.4 | 50.4 | 49.4 | 48.1 | 46.1 | 10624 | 12568 | 12485 | 11835 | 11057 | 25386 | 29947 | 29744 | 28290 | 26477 |
| **53** | 39.6 | 43.2 | 42.3 | 41.2 | 39.4 | 8385 | 9579 | 9546 | 9302 | 8604 | 19917 | 22589 | 22523 | 22017 | 20364 |
| **54** | 33.5 | 36.8 | 36.0 | 35.0 | 33.3 | 7080 | 7661 | 7827 | 7619 | 7258 | 16752 | 18348 | 18610 | 18080 | 17194 |
| **55** | 28.1 | 31.0 | 30.2 | 29.4 | 28.0 | 5988 | 6839 | 6920 | 6736 | 6452 | 14185 | 16224 | 16335 | 15959 | 15228 |
| **56** | 23.4 | 26.1 | 25.4 | 24.5 | 23.3 | 4900 | 5572 | 5629 | 5388 | 5187 | 11511 | 13156 | 13423 | 12740 | 12275 |
| **57** | 19.4 | 21.6 | 21.1 | 20.4 | 19.4 | 4170 | 4730 | 4759 | 4722 | 4567 | 9577 | 11076 | 11202 | 11060 | 10682 |
| **58** | 15.9 | 17.9 | 17.4 | 16.8 | 16.0 | 3441 | 3949 | 4056 | 3941 | 3731 | 8033 | 9088 | 9298 | 8981 | 8579 |
| **59** | 13.0 | 14.6 | 14.3 | 13.9 | 13.2 | 2639 | 3257 | 3300 | 3230 | 2848 | 6405 | 7592 | 7663 | 7533 | 6745 |
| **60** | 10.8 | 12.0 | 11.9 | 11.6 | 11.0 | 1742 | 2140 | 2371 | 2210 | 1966 | 4530 | 5409 | 5808 | 5509 | 5070 |
| **61** | 9.0 | 10.0 | 10.0 | 9.7 | 9.3 | 1210 | 1601 | 1658 | 1581 | 1526 | 3222 | 4187 | 4336 | 4136 | 3985 |
| **62** | 7.6 | 8.4 | 8.5 | 8.3 | 7.9 | 807 | 1006 | 1104 | 1053 | 882 | 2196 | 2720 | 2976 | 2848 | 2372 |

| | Area (sq.km) | | | | | No. of Dwellings | | | | | No. of Population | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Contour Level, $L_{Aeq,T}$** | **Existing Condition 10 2021-2027** | **18 mppa 2021** | **18 mppa 2022** | **18 mppa 2023** | **19 mppa 2024** | **Existing Condition 10 2021-2027** | **18 mppa 2021** | **18 mppa 2022** | **18 mppa 2023** | **19 mppa 2024** | **Existing Condition 10 2021-2027** | **18 mppa 2021** | **18 mppa 2022** | **18 mppa 2023** | **19 mppa 2024** |
| **63** | 6.3 | 7.1 | 7.1 | 6.9 | 6.6 | 720 | 758 | 805 | 776 | 720 | 1935 | 2036 | 2187 | 2077 | 1935 |
| **64** | 5.1 | 5.9 | 5.9 | 5.7 | 5.4 | 407 | 559 | 649 | 559 | 522 | 1091 | 1473 | 1736 | 1473 | 1380 |
| **65** | 4.1 | 4.8 | 4.8 | 4.7 | 4.4 | 149 | 398 | 398 | 396 | 316 | 419 | 1066 | 1066 | 1055 | 829 |
| **66** | 3.2 | 3.8 | 3.9 | 3.7 | 3.5 | 9 | 11 | 11 | 11 | 9 | 22 | 27 | 27 | 27 | 22 |
| **67** | 2.5 | 3.0 | 3.0 | 2.9 | 2.7 | 9 | 9 | 9 | 9 | 9 | 22 | 22 | 22 | 22 | 22 |
| **68** | 2.1 | 2.3 | 2.4 | 2.3 | 2.2 | 0 | 2 | 4 | 4 | 0 | 0 | 4 | 12 | 12 | 0 |
| **69** | 1.7 | 1.9 | 1.9 | 1.9 | 1.8 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Night-time contour level, $L_{Aeq,8hr}$** | | | | | | | | | | | | | | | |
| **45** | 60.9 | 70.5 | 68.5 | 68.2 | 64.5 | 19490 | 25426 | 24906 | 24815 | 22328 | 45579 | 59686 | 58666 | 58491 | 52238 |
| **46** | 51.5 | 59.6 | 58.1 | 57.9 | 54.8 | 13750 | 18246 | 18634 | 18482 | 16394 | 32080 | 42749 | 43669 | 43308 | 38404 |
| **47** | 43.8 | 50.3 | 49.3 | 49.1 | 46.6 | 9114 | 12601 | 12808 | 12792 | 11056 | 21472 | 29394 | 30246 | 30202 | 25703 |
| **48** | 37.2 | 42.9 | 42.1 | 41.9 | 39.8 | 7423 | 8622 | 9287 | 9234 | 8431 | 17654 | 20438 | 21890 | 21796 | 20166 |
| **49** | 31.2 | 36.4 | 35.6 | 35.4 | 33.5 | 6156 | 7297 | 7578 | 7549 | 7275 | 14531 | 17327 | 17957 | 17884 | 17195 |
| **50** | 25.9 | 30.5 | 29.8 | 29.7 | 28.0 | 4982 | 5894 | 6456 | 6264 | 5916 | 11614 | 13864 | 15235 | 14837 | 14040 |
| **51** | 21.5 | 25.4 | 24.6 | 24.5 | 23.1 | 4204 | 4955 | 5321 | 5321 | 4974 | 9631 | 11497 | 12481 | 12481 | 11575 |
| **52** | 17.7 | 21.0 | 20.5 | 20.4 | 19.2 | 3418 | 4016 | 4515 | 4515 | 4088 | 7995 | 9258 | 10528 | 10528 | 9367 |
| **53** | 14.6 | 17.2 | 17.0 | 16.9 | 16.0 | 2604 | 3330 | 3741 | 3741 | 3395 | 6447 | 7796 | 8624 | 8624 | 7908 |

| | Area (sq.km) | | | | | No. of Dwellings | | | | | No. of Population | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Contour Level, $L_{Aeq,T}$** | **Existing Condition 10 2021-2027** | **18 mppa 2021** | **18 mppa 2022** | **18 mppa 2023** | **19 mppa 2024** | **Existing Condition 10 2021-2027** | **18 mppa 2021** | **18 mppa 2022** | **18 mppa 2023** | **19 mppa 2024** | **Existing Condition 10 2021-2027** | **18 mppa 2021** | **18 mppa 2022** | **18 mppa 2023** | **19 mppa 2024** |
| **54** | 11.8 | 14.1 | 14.1 | 14.0 | 13.2 | 1839 | 2383 | 2866 | 2818 | 2530 | 4727 | 6062 | 6835 | 6721 | 6205 |
| **55** | 9.6 | 11.4 | 11.5 | 11.5 | 10.8 | 1184 | 1790 | 1908 | 1908 | 1742 | 3166 | 4616 | 4909 | 4909 | 4539 |
| **56** | 8.0 | 9.3 | 9.6 | 9.6 | 9.1 | 811 | 1012 | 1380 | 1380 | 1258 | 2206 | 2734 | 3644 | 3644 | 3334 |
| **57** | 6.6 | 7.7 | 8.1 | 8.1 | 7.7 | 695 | 785 | 886 | 886 | 811 | 1856 | 2155 | 2382 | 2382 | 2206 |
| **58** | 5.4 | 6.4 | 6.8 | 6.8 | 6.4 | 470 | 588 | 722 | 722 | 720 | 1231 | 1559 | 1944 | 1944 | 1935 |
| **59** | 4.4 | 5.2 | 5.6 | 5.6 | 5.2 | 158 | 460 | 529 | 529 | 469 | 444 | 1201 | 1397 | 1397 | 1226 |
| **60** | 3.5 | 4.2 | 4.5 | 4.5 | 4.2 | 10 | 145 | 325 | 312 | 145 | 26 | 408 | 854 | 818 | 408 |
| **61** | 2.7 | 3.4 | 3.6 | 3.6 | 3.4 | 10 | 10 | 10 | 10 | 10 | 26 | 26 | 26 | 26 | 26 |
| **62** | 2.2 | 2.6 | 2.8 | 2.8 | 2.6 | 0 | 9 | 9 | 9 | 4 | 0 | 22 | 22 | 22 | 12 |

*Current Condition 10 daytime limit is 19.4 sq.km
**Current Condition 10 night-time limit is 37.2 sq.km

Table 8C.2 Comparisons of operational noise levels ($L_{Aeq,T}$ dB) for 2028 Scenarios

| | Area (sq.km) | | | No. of Dwellings | | | No. of Population | | |
|---|---|---|---|---|---|---|---|---|---|
| **Contour Level, $L_{Aeq,T}$** | **Existing Future Condition 2028+** | **12.5 mppa Future Baseline 2028** | **19 mppa 2028** | **Existing Future Condition 2028+** | **12.5 mppa Future Baseline 2028** | **19 mppa 2028** | **Existing Future Condition 2028+** | **12.5 mppa Future Baseline 2028** | **19 mppa 2028** |
| **Daytime contour level, LAeq,16hr** | | | | | | | | | |
| **51** | 44.5 | 45.6 | 45.3 | 10003 | 9990 | 10276 | 23512 | 23437 | 24195 |
| **52** | 37.9 | 39.0 | 38.7 | 8003 | 7857 | 8211 | 19006 | 18772 | 19584 |
| **53** | 31.9 | 32.8 | 32.6 | 6946 | 6872 | 7136 | 16455 | 16330 | 16877 |
| **54** | 26.5 | 27.4 | 27.1 | 5582 | 5560 | 5816 | 13130 | 13036 | 13840 |
| **55** | 22.1 | 22.8 | 22.6 | 4748 | 4682 | 4885 | 11185 | 10926 | 11445 |
| **56** | 18.3 | 18.9 | 18.7 | 4110 | 3888 | 4129 | 9440 | 8991 | 9477 |
| **57** | 15.2 | 15.5 | 15.5 | 3267 | 3045 | 3340 | 7629 | 7247 | 7786 |
| **58** | 12.5 | 12.7 | 12.8 | 2333 | 2045 | 2506 | 5765 | 5200 | 6139 |
| **59** | 10.4 | 10.4 | 10.6 | 1663 | 1386 | 1716 | 4348 | 3655 | 4471 |
| **60** | 8.7 | 8.5 | 8.9 | 1059 | 886 | 1169 | 2862 | 2382 | 3128 |
| **61** | 7.3 | 7.1 | 7.5 | 807 | 722 | 807 | 2196 | 1944 | 2196 |
| **62** | 6.1 | 5.9 | 6.2 | 643 | 511 | 720 | 1713 | 1348 | 1935 |
| **63** | 5.0 | 4.8 | 5.1 | 411 | 331 | 460 | 1102 | 869 | 1201 |
| **64** | 4.0 | 3.8 | 4.1 | 143 | 17 | 143 | 404 | 39 | 404 |
| **65** | 3.2 | 3.0 | 3.2 | 10 | 10 | 10 | 26 | 26 | 26 |

| | Area (sq.km) | | | No. of Dwellings | | | No. of Population | | |
|---|---|---|---|---|---|---|---|---|---|
| **Contour Level, $L_{Aeq,T}$** | **Existing Future Condition 2028+** | **12.5 mppa Future Baseline 2028** | **19 mppa 2028** | **Existing Future Condition 2028+** | **12.5 mppa Future Baseline 2028** | **19 mppa 2028** | **Existing Future Condition 2028+** | **12.5 mppa Future Baseline 2028** | **19 mppa 2028** |
| **66** | 2.4 | 2.4 | 2.5 | 4 | 2 | 4 | 12 | 4 | 12 |
| **67** | 2.0 | 2.0 | 2.0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **68** | 1.7 | 1.7 | 1.7 | 0 | 0 | 0 | 0 | 0 | 0 |
| **69** | 1.4 | 1.4 | 1.4 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Night-time contour level, LAeq,8hr** | | | | | | | | | |
| **45** | 52.5 | 57.0 | 58.4 | 15597 | 16706 | 19637 | 36403 | 39151 | 45912 |
| **46** | 44.4 | 48.8 | 49.5 | 10475 | 11824 | 13761 | 24377 | 28124 | 32067 |
| **47** | 37.7 | 41.9 | 42.0 | 7989 | 9131 | 9508 | 18915 | 21674 | 22374 |
| **48** | 31.6 | 35.6 | 35.5 | 6860 | 7574 | 7624 | 16252 | 17968 | 18083 |
| **49** | 26.1 | 29.9 | 29.6 | 5391 | 6503 | 6145 | 12647 | 15335 | 14637 |
| **50** | 21.6 | 24.9 | 24.5 | 4747 | 5412 | 5221 | 11072 | 12703 | 12216 |
| **51** | 18.1 | 20.8 | 20.3 | 3805 | 4582 | 4502 | 8733 | 10715 | 10358 |
| **52** | 15.0 | 17.2 | 17.0 | 3077 | 3879 | 3544 | 7186 | 8948 | 8264 |
| **53** | 12.4 | 14.3 | 14.1 | 2053 | 3025 | 2785 | 5348 | 7188 | 6645 |
| **54** | 10.2 | 11.8 | 11.6 | 1625 | 2099 | 1891 | 4247 | 5311 | 4912 |
| **55** | 8.6 | 9.9 | 9.6 | 1012 | 1406 | 1385 | 2734 | 3709 | 3656 |
| **56** | 7.2 | 8.2 | 8.1 | 781 | 886 | 886 | 2143 | 2382 | 2382 |

| | Area (sq.km) | | | No. of Dwellings | | | No. of Population | | |
|---|---|---|---|---|---|---|---|---|---|
| **Contour Level, $L_{Aeq,T}$** | **Existing Future Condition 2028+** | **12.5 mppa Future Baseline 2028** | **19 mppa 2028** | **Existing Future Condition 2028+** | **12.5 mppa Future Baseline 2028** | **19 mppa 2028** | **Existing Future Condition 2028+** | **12.5 mppa Future Baseline 2028** | **19 mppa 2028** |
| **57** | 6.0 | 6.9 | 6.8 | 530 | 722 | 722 | 1399 | 1944 | 1944 |
| **58** | 4.9 | 5.7 | 5.6 | 396 | 529 | 510 | 1054 | 1397 | 1343 |
| **59** | 3.9 | 4.6 | 4.5 | 144 | 318 | 264 | 407 | 833 | 679 |
| **60** | 3.1 | 3.7 | 3.6 | 10 | 10 | 12 | 26 | 26 | 30 |
| **61** | 2.4 | 2.9 | 2.8 | 2 | 9 | 10 | 8 | 22 | 26 |
| **62** | 1.9 | 2.2 | 2.2 | 0 | 0 | 0 | 0 | 0 | 0 |

# Appendix 8D
# Noise - $L_{Amax}$ Assessment data

Table 8D.1 Old aircraft, dB $L_{Amax}$ (non-residential)

| Location | A320 ceo Arr 26 | A320ceo Arr 08 | A320ceo Dep SL2 26 | A320ceo Dep SL2 08 | 737-800 Arr 26 | 737-800 Dep SL2 26 | 737-800 Dep SL3 26 | A321ceo Dep SL3 26 |
|---|---|---|---|---|---|---|---|---|
| Old Knebworth Lodge Farm | 37 | 14 | 30 | 63 | 41 | 37 | 37 | 33 |
| Caddington | 24 | 75 | 56 | 39 | 32 | 61 | 61 | 63 |
| Park Town, Luton | 37 | 63 | 73 | 56 | 44 | 77 | 77 | 82 |
| Whitwell | 53 | 25 | 40 | 62 | 57 | 48 | 48 | 46 |
| Breachwood Green | 65 | 25 | 39 | 73 | 68 | 47 | 47 | 45 |
| St Pauls Walden | 64 | 22 | 36 | 69 | 67 | 44 | 44 | 42 |
| Farley Hill School Luton | 28 | 60 | 58 | 43 | 35 | 64 | 64 | 67 |
| Slip End | 28 | 54 | 76 | 44 | 35 | 78 | 79 | 82 |
| Harpenden Children's Home | 28 | 28 | 44 | 39 | 35 | 50 | 49 | 47 |
| Walkern | 61 | 6 | 20 | 37 | 60 | 29 | 29 | 25 |
| Stevenage (Eastern Perimeter) | 63 | 8 | 22 | 44 | 66 | 31 | 31 | 27 |
| Stevenage Station | 65 | 13 | 26 | 61 | 69 | 36 | 36 | 32 |
| Luton (Wandon End) | 52 | 44 | 63 | 68 | 57 | 68 | 68 | 68 |
| Kensworth | 16 | 70 | 42 | 29 | 25 | 47 | 48 | 45 |
| Hudnall Corner | 11 | 36 | 43 | 23 | 20 | 48 | 47 | 44 |
| Flamstead | 21 | 30 | 63 | 35 | 29 | 67 | 67 | 66 |
| Markyate | 20 | 42 | 67 | 35 | 28 | 70 | 71 | 69 |

Table 8D.2 New aircraft, dB $L_{Amax}$ (non-residential)

| Location | A320 neo Arr 26 | A320neo Arr 08 | A320neo Dep SL2 26 | A320neo Dep SL2 08 | 737 MAX 8 Arr 26 | 737 MAX 8 Dep SL2 26 | 737 MAX 8 Dep SL3 26 | A321neo Dep SL3 26 |
|---|---|---|---|---|---|---|---|---|
| Old Knebworth Lodge Farm | 36 | 13 | 26 | 36 | 39 | 34 | 34 | 27 |
| Caddington | 23 | 74 | 52 | 35 | 30 | 58 | 58 | 56 |
| Park Town, Luton | 37 | 62 | 69 | 52 | 42 | 74 | 74 | 75 |
| Whitwell | 52 | 24 | 36 | 59 | 54 | 45 | 45 | 39 |
| Breachwood Green | 64 | 24 | 35 | 68 | 66 | 44 | 44 | 39 |
| St Pauls Walden | 63 | 21 | 32 | 65 | 65 | 41 | 41 | 35 |
| Farley Hill School Luton | 27 | 59 | 55 | 40 | 33 | 61 | 61 | 60 |
| Slip End | 27 | 53 | 73 | 40 | 33 | 75 | 76 | 75 |
| Harpenden Children's Home | 27 | 27 | 41 | 36 | 33 | 47 | 46 | 40 |
| Walkern | 60 | 5 | 16 | 26 | 58 | 26 | 26 | 18 |
| Stevenage (Eastern Perimeter) | 62 | 7 | 18 | 31 | 64 | 28 | 28 | 21 |
| Stevenage Station | 64 | 12 | 22 | 44 | 67 | 33 | 33 | 26 |
| Luton (Wandon End) | 51 | 43 | 59 | 64 | 55 | 65 | 65 | 61 |
| Kensworth | 15 | 69 | 39 | 26 | 22 | 44 | 45 | 39 |
| Hudnall Corner | 10 | 35 | 39 | 19 | 18 | 45 | 44 | 38 |
| Flamstead | 20 | 29 | 59 | 32 | 27 | 64 | 64 | 59 |
| Markyate | 19 | 41 | 63 | 31 | 26 | 67 | 68 | 63 |

Table 8D.3 Residential, dwellings, old aircraft

| dB $L_{Amax}$ | A320 ceo Arr 26 | A320ceo Arr 08 | A320ceo Dep SL2 26 | A320ceo Dep SL2 08 | 737-800 Arr 26 | 737-800 Dep SL2 26 | 737-800 Dep SL3 26 | A321ceo Dep SL3 26 |
|---|---|---|---|---|---|---|---|---|
| **80** | 3 | 190 | 81 | 9 | 18 | 700 | 734 | 2541 |
| **81** | 1 | 190 | 11 | 6 | 16 | 407 | 554 | 1887 |
| **82** | 1 | 129 | 2 | 6 | 16 | 244 | 389 | 1558 |
| **83** | 1 | 43 | 2 | 6 | 3 | 16 | 10 | 1140 |
| **84** | 0 | 0 | 0 | 5 | 3 | 5 | 4 | 835 |
| **85** | 0 | 0 | 0 | 0 | 1 | 2 | 2 | 685 |
| **86** | 0 | 0 | 0 | 0 | 1 | 2 | 2 | 450 |
| **87** | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 392 |
| **88** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 74 |
| **89** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 |
| **90** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **91** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **92** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **93** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **94** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **95** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **96** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **97** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **98** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **99** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **100** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Total** | 6 | 552 | 96 | 32 | 58 | 1376 | 1697 | 9564 |

Table 8D.4 Residential, dwellings, new aircraft

| dB $L_{Amax}$ | A320 neo Arr 26 | A320neo Arr 08 | A320neo Dep SL2 26 | A320neo Dep SL2 08 | 737 MAX 8 Arr 26 | 737 MAX 8 Dep SL2 26 | 737 MAX 8 Dep SL3 26 | A321neo Dep SL3 26 |
|---|---|---|---|---|---|---|---|---|
| **80** | 1 | 190 | 0 | 5 | 16 | 16 | 10 | 395 |
| **81** | 1 | 129 | 0 | 0 | 3 | 5 | 4 | 346 |
| **82** | 1 | 43 | 0 | 0 | 1 | 2 | 2 | 74 |
| **83** | 0 | 0 | 0 | 0 | 1 | 2 | 2 | 2 |
| **84** | 0 | 0 | 0 | 0 | 1 | 0 | 2 | 0 |
| **85** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **86** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **87** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **88** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **89** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **90** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **91** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **92** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **93** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **94** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **95** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **96** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **97** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **98** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **99** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **100** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Total** | 3 | 362 | 0 | 5 | 22 | 25 | 20 | 817 |

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# Appendix 8E
# Noise - N-Contours report

**LONDON LUTON AIRPORT**

A11060-N59-DR

17 December 2020

**N65 & N60 Contours**

## 1.0 INTRODUCTION

London Luton Airport Operations Limited (LLAOL) are making a Section 73 application to Luton Borough Council (LBC) to increase their annual passenger limit to 19 million passengers per annum (mppa), and for an increase in the limits on the area of the 57 dB daytime and 48 dB night time noise contours. For both contours there is a short term limit that applies until the end of 2027 and a lower long term limit that applies from 2028 onwards.

Bickerdike Allen Partners LLP (BAP) have produced N65 and N60 number above contours as supplementary metrics for the Environmental Statement (ES) prepared to accompany the application. These contours were produced for two scenarios, one representing the current limits under Condition 10 and the other representing the proposed limits being applied for.

Number above contours outline the extent of the area exposed to at least a certain $L_{Amax}$ noise level at least a certain number of times. An N65, 200 contour outlines the area exposed to at least 65 dB $L_{Amax}$ at least 200 times in the period it is for, typically the day (07:00 – 22:59). Due to the nature of these contours they can be very sensitive to small changes in the movements used to produce them. For instance, if an airport had 190 movements per day it would have no N65, 200 contour, however this doesn't mean that the 190 movements are not significant. Equally if the airport had ten extra movements there would be an N65 200 contour, although any impact of the 10 extra movements is likely to be small.

Number above contours are often formed by the common area exposed by the combination of $L_{Amax}$ footprints for various operations. If there were 15 arrivals and 10 departures neither operation on its own would be sufficient to generate an N65 25 contour. However, in combination they do reach the threshold of 25 movements and therefore the N65 25 contour would be the outline of the area where the 65 dB $L_{Amax}$ footprints of the arrivals and departures overlap.

There are a number of examples of small changes in the number of aircraft movements having a relatively large impact of the size of the number above contours prepared as part of the ES. This note reports the areas and the number of people and dwellings within the contours and provides context for understanding the differences between those representing the current and proposed limits.

## 2.0 NUMBER ABOVE CONTOURS

### 2.1 Daytime N65 Contours

#### 2.1.1 Short Term Limits

N65 contours were produced at values of 25, 50, 100 and 200 for the daytime period (07:00-22:59) based on average summer day movements for scenarios representing the current and proposed short term limits. These are shown in the attached Figures A11060-N59-01 and A11060-N59-02 respectively. The areas of these contours and the number of people and dwellings within them are shown in Table 1 below. Table 2 shows a summary of the average summer day movements in terms of arrivals and departures by runway direction for the current and proposed short term limit scenarios.

| Contour Value (N65) | Contour Area ($km^2$) | | Dwellings | | Population | |
|---|---|---|---|---|---|---|
| | Current Short Term | Proposed Short Term | Current Short Term | Proposed Short Term | Current Short Term | Proposed Short Term |
| 25 | 76.5 | 81.7 | 22,275 | 23,404 | 52,801 | 55,497 |
| 50 | 48.9 | 51.7 | 11,042 | 13,024 | 26,014 | 30,735 |
| 100 | 32.5 | 35.3 | 6,269 | 7,148 | 14,856 | 17,001 |
| 200 | 2.9 | 3.6 | 14 | 15 | 31 | 35 |

**Table 1: Summer daytime N65 contour areas, and dwelling and population counts**

| Operation (Runway) | Average Summer Day Representative Movements | |
|---|---|---|
| | Current Short Term | Proposed Short Term |
| Westerly Arrivals (Rwy 26) | 129 | 143 |
| Easterly Arrivals (Rwy 08) | 37 | 40 |
| Westerly Departures (Rwy 26) | 136 | 148 |
| Easterly Departures (Rwy 08) | 38 | 42 |

**Table 2: Average summer day movements[1]**

#### 2.1.2 N65 25 Contour

In both cases the N65 25 contour is based on the combination of footprints for each of the four basis operations as they all have over 25 movements a day. The contour based on the proposed limits scenario is larger. This is due to the increased movements resulting in the footprints of some noisier types contributing.

[1] Movements are rounded to the nearest whole number

### 2.1.3 N65 50 Contour

The N65 50 contours for the current and proposed limits are based on the combination of footprints for westerly operations. The N65 contour for the proposed limits scenario is larger. This is due to the increased movements resulting in the footprints of some noisier types contributing.

### 2.1.4 N65 100 Contour

The N65 100 contours for the current and proposed limits are based on the combination of footprints for westerly operations as they have over 100 movements a day. The contour based on the proposed limits scenario is larger. This is due to the increased movements resulting in the footprints of some noisier types contributing.

### 2.1.5 N65 200 Contour

The N65 200 contours for the current and proposed limits are similar in shape. The contour based on the proposed limits scenario is larger.

In both cases to the east of the airport the contours are based on the overlap of the footprints for the westerly arrivals and those for the westerly departures to reach the threshold of 200 movements. As the contour is based on the start of roll noise from westerly departures it does not extend far beyond the east end of the runway.

To the west of the airport the contours are formed by the overlap of footprints for the westerly departures, easterly arrivals and the easterly departures. As the contour is based on start of roll noise from easterly departures it doesn't extend far beyond the west end of the runway.

### 2.1.6 Long Term Limits

N65 contours were produced at values of 25, 50, 100 and 200 for the daytime period (07:00-22:59) based on average summer day movements for scenarios representing the current and proposed long term limits. These are shown in the attached Figures A11060-N59-03 and A11060-N59-04 respectively. The areas of these contours and the number of people and dwellings within them are shown in Table 3 below. Table 4 shows a summary of the average summer day movements in terms of arrivals and departures by runway direction for the current and proposed long term limit scenarios.

| Contour Value (N65) | Contour Area (km²) | | Dwellings | | Population | |
|---|---|---|---|---|---|---|
| | Current Long Term | Proposed Long Term | Current Long Term | Proposed Long Term | Current Long Term | Proposed Long Term |
| 25 | 54.0 | 54.6 | 13,815 | 14,038 | 32,321 | 32,997 |
| 50 | 37.0 | 37.5 | 8,088 | 8,171 | 19,025 | 19,265 |
| 100 | 25.8 | 26.3 | 4,920 | 5,015 | 11,375 | 11,645 |
| 200 | 3.1 | 3.2 | 15 | 15 | 35 | 35 |

**Table 3: Summer daytime N65 contour areas, and dwelling and population counts**

| Operation (Runway) | Average Summer Day Representative Movements | |
|---|---|---|
| | Current Long Term | Proposed Long Term |
| Westerly Arrivals (Rwy 26) | 141 | 145 |
| Easterly Arrivals (Rwy 08) | 40 | 41 |
| Westerly Departures (Rwy 26) | 147 | 150 |
| Easterly Departures (Rwy 08) | 42 | 43 |

**Table 4: Average summer day movements[2]**

### 2.1.7 N65 25 Contour

In both cases the N65 25 contour is based on the combination of footprints for each of the operations as they all have over 25 movements a day. The contour based on the proposed limits scenario is slightly larger than that based on the current limits scenario.

### 2.1.8 N65 50 Contour

The N65 50 contours for the current and proposed limits are based on the combination of footprints for westerly operations. The N65 contour for the proposed limits scenario is slightly larger than that based on the current limits scenario.

### 2.1.9 N65 100 Contour

The N65 100 contours for the current and proposed limits are based on the combination of footprints for westerly operations as they all have over 100 movements a day. The contour based on the proposed limits scenario is slightly larger than that based on the current limits scenario.

[2] Movements are rounded to the nearest whole number

### 2.1.10 N65 200 Contour

The N65 200 contours for the current and proposed limits are similar in shape. The contour based on the proposed limits scenario is larger than that based on the current limits scenario.

In both cases to the east of the airport the contours are based on the overlap of the footprints for the westerly arrivals and those for the westerly departures to reach the threshold of 200 movements. As the contour is based on the start of roll noise from westerly departures it does not extend far beyond the east end of the runway.

To the west of the airport the contours are formed by the overlap of footprints for the westerly departures, easterly arrivals and the easterly departures. As the contour is based on start of roll noise from easterly departures it doesn't extend far beyond the west end of the runway.

## 2.2 Night Time N60 Contours

### 2.2.1 Short Term Limits

N60 contours were produced at values of 25 and 50[3] for the night time period (23:00-06:59) based on average summer night movements representing the current and proposed short term limits scenarios. These are shown in the attached Figures A11060-N59-05 and A11060-N59-06 respectively. The areas of these contours and the number of people and dwellings within them are shown in Table 5 below. Table 6 shows a summary of the average summer night movements in terms of arrivals and departures by runway direction for the current and proposed short term limit scenarios.

| Contour Value (N60) | Contour Area ($km^2$) | | Dwellings | | Population | |
|---|---|---|---|---|---|---|
| | Current Short Term | Proposed Short Term | Current Short Term | Proposed Short Term | Current Short Term | Proposed Short Term |
| 25 | 13.0 | 24.8 | 273 | 3,959 | 744 | 9,264 |
| 50 | - | 1.1 | - | 0 | - | 0 |
| 100 | - | - | - | - | - | - |
| 200 | - | - | - | - | - | - |

**Table 5: Summer night time N60 contour areas, and dwelling and population counts**

[3] There are insufficient night time movements to generate an N60 100 or 200 contour under either the current or proposed limits scenarios, or to generate an N60 50 contour under the current limits scenario.

| Operation (Runway) | Average Summer Night Representative Movements | |
|---|---|---|
| | Current Short Term | Proposed Short Term |
| Westerly Arrivals (Rwy 26) | 21 | 25 |
| Easterly Arrivals (Rwy 08) | 6 | 7 |
| Westerly Departures (Rwy 26) | 15 | 19 |
| Easterly Departures (Rwy 08) | 4 | 5 |

**Table 6: Average summer night movements[1]**

### 2.2.2 N60 25 Contour

The night time N60 25 contour shows increases in both area and the number of dwellings and population from the current to the proposed limits scenario. This is due to the proposed limits contour extending further east, over Stevenage, and further west, over portion of south Luton.

The current limits contour to the east of the airport is based on the overlap of the footprints for the 21 westerly arrivals and 4 easterly departures, to just reach the threshold of 25 movements. This ends before Stevenage where some of the departures turn off the extended runway centreline. The proposed limits scenario has more movements, and the 4 additional westerly arrivals are sufficient for the number of arrivals to reach the threshold of 25 on their own. This causes an extension of the contour over Stevenage as it no longer ends after the departures turn.

To the west of the airport the proposed limits contour is formed by the overlap of the footprints for the 19 westerly departures and 7 easterly arrivals. It ends where the arrival and departure routes diverge. The combination of westerly departures and easterly arrivals is only 21 movements under the current limits scenario and therefore is insufficient to generate a 25 contour to the west of the airport.

### 2.2.3 N60 50 Contour

There are insufficient movements in the current limits scenario to generate an N60 50 contour. The proposed limits N60 50 contour is formed by the overlap of the footprints for the 19 westerly departures, the 25 westerly arrivals, the 5 easterly departures and the 7 easterly arrivals, which between them are sufficient to reach the contour threshold.

### 2.2.4 Long Term Limits

N60 contours were produced at values of 25 and 50[4] for the night time period (23:00-06:59) based on average summer night movements representing the current and proposed long term limits scenarios. These are shown in the attached Figures A11060-N59-07 and A11060-N59-08 respectively, and the areas of these contours and the number of people and dwellings within them are shown in Table 7 below. Table 8 shows a summary of the average summer night movements in terms of arrivals and departures and runway direction for the current and proposed long term limit scenarios.

| Contour Value (N60) | Contour Area ($km^2$) | | Dwellings | | Population | |
|---|---|---|---|---|---|---|
| | Current Long Term | Proposed Long Term | Current Long Term | Proposed Long Term | Current Long Term | Proposed Long Term |
| 25 | 11.6 | 20.0 | 251 | 1,936 | 692 | 5,097 |
| 50 | - | 1.0 | - | 0 | - | 0 |
| 100 | - | - | - | - | - | - |
| 200 | - | - | - | - | - | - |

**Table 7: Summer night time N60 contour areas, and dwelling and population counts**

| Operation (Runway) | Average Summer Night Representative Movements | |
|---|---|---|
| | Current Long Term | Proposed Long Term |
| Westerly Arrivals (Rwy 26) | 21 | 24 |
| Easterly Arrivals (Rwy 08) | 6 | 7 |
| Westerly Departures (Rwy 26) | 16 | 18 |
| Easterly Departures (Rwy 08) | 4 | 5 |

**Table 8: Average summer night movements[1]**

### 2.2.5 N60 25 Contour

The night time N60 25 contour shows increases in both area and the number of dwellings and population from the current to the proposed limits scenario. This is due to the proposed limits contour extending further east, over Stevenage, and further west, over portion of south Luton.

[4] There are insufficient night time movements to generate an N60 100 or 200 contour under either the current or proposed limits scenarios, or to generate an N60 50 contour under the current limits scenario.

The current limits contour to the east of the airport is based on the overlap of the footprints for the 21 westerly arrivals and 4 easterly departures, to just reach the threshold of 25 movements. This ends before Stevenage where some of the departures turn off the extended runway centreline. The proposed limits scenario has more movements, and the 3 additional westerly arrivals combined with the approximately 50% of easterly departures that turn off the extended runway centreline around 2.5km later are sufficient to exceed the threshold of 25. This causes an extension of the contour towards Stevenage, as the contour only ends when all of the departures have turned off the extended runway centreline.

To the west of the airport the proposed limits contour is formed by the overlap of the footprints for the 18 westerly departures and 7 easterly arrivals. It ends where the arrival and departure routes begin to diverge. The combination of westerly departures and easterly arrivals is only 21 movements under the current limits scenario and therefore is insufficient to generate a 25 contour to the west of the airport.

### 2.2.6 N60 50 Contour

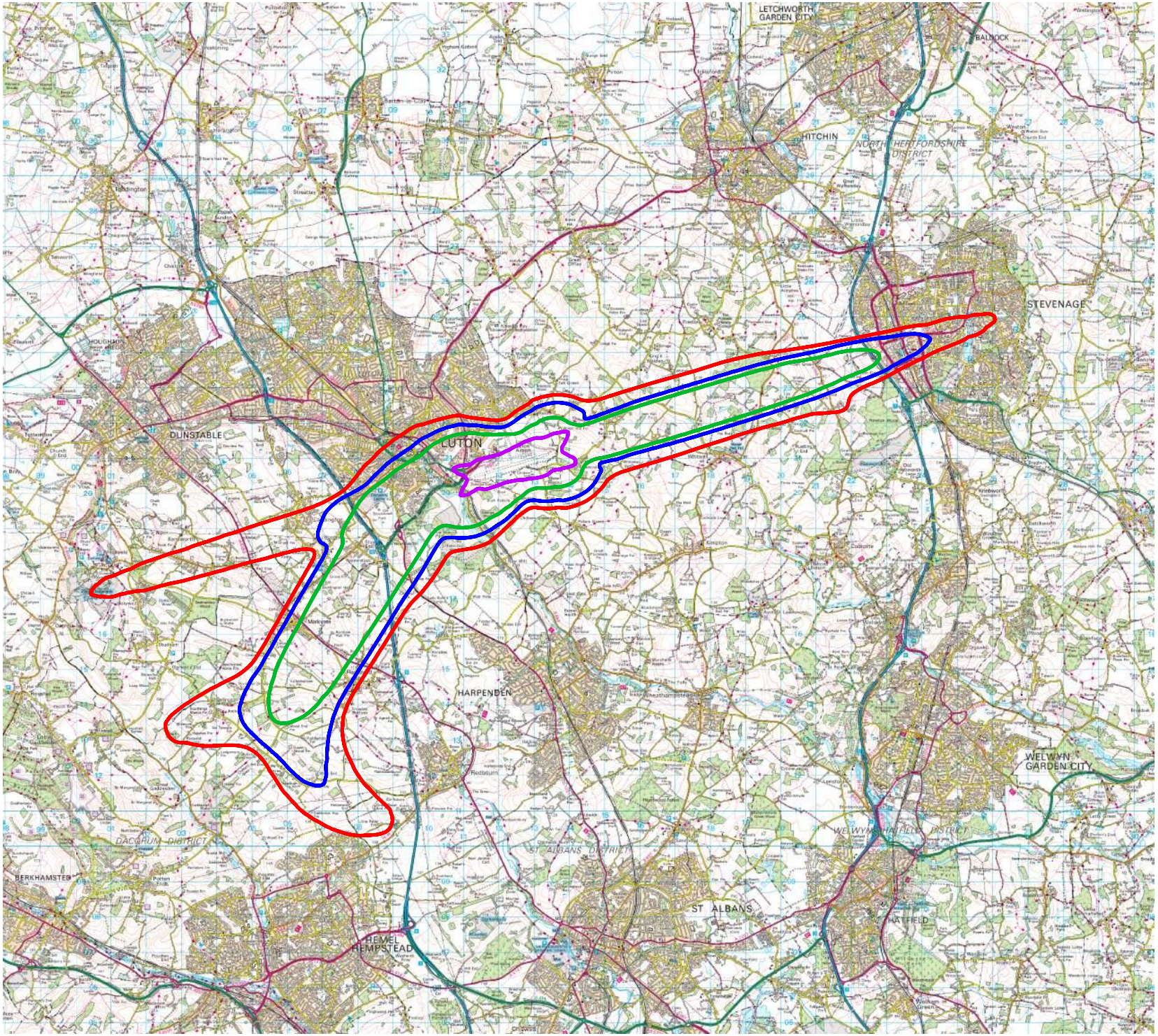
There are insufficient movements in the current limits scenario to generate an N60 50 contour. The proposed limits N60 50 contour is formed by the overlap of the footprints for the 18 westerly departures, the 24 westerly arrivals, the 5 easterly departures and the 7 easterly arrivals, which between them are sufficient to reach the contour threshold.

## 3.0 SUMMARY

BAP have produced number above contours as supplementary metrics for an environmental statement prepared to accompany an application to vary Luton airport's planning conditions. The contours have been produced for four scenarios, based on the airport's existing short term and long term limits, and the proposed short term and long term limits being applied for. The areas and the number of dwellings and population within the contours have been presented.

Some of the contours based on the proposed limits scenario are noticeably larger than those based on the current limits, despite relatively small increases in the numbers of movements used to produce them. The individual contributions of easterly and westerly arrivals and departures to the contours have been discussed to provide context regarding these increases in contour size.

| | |
|---|---|
| **Duncan Rogers** | **David Charles** |
| **for Bickerdike Allen Partners** | **Partner** |

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LEGEND:

- N65, 25
- N65, 50
- N65, 100
- N65, 200

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London Luton Airport

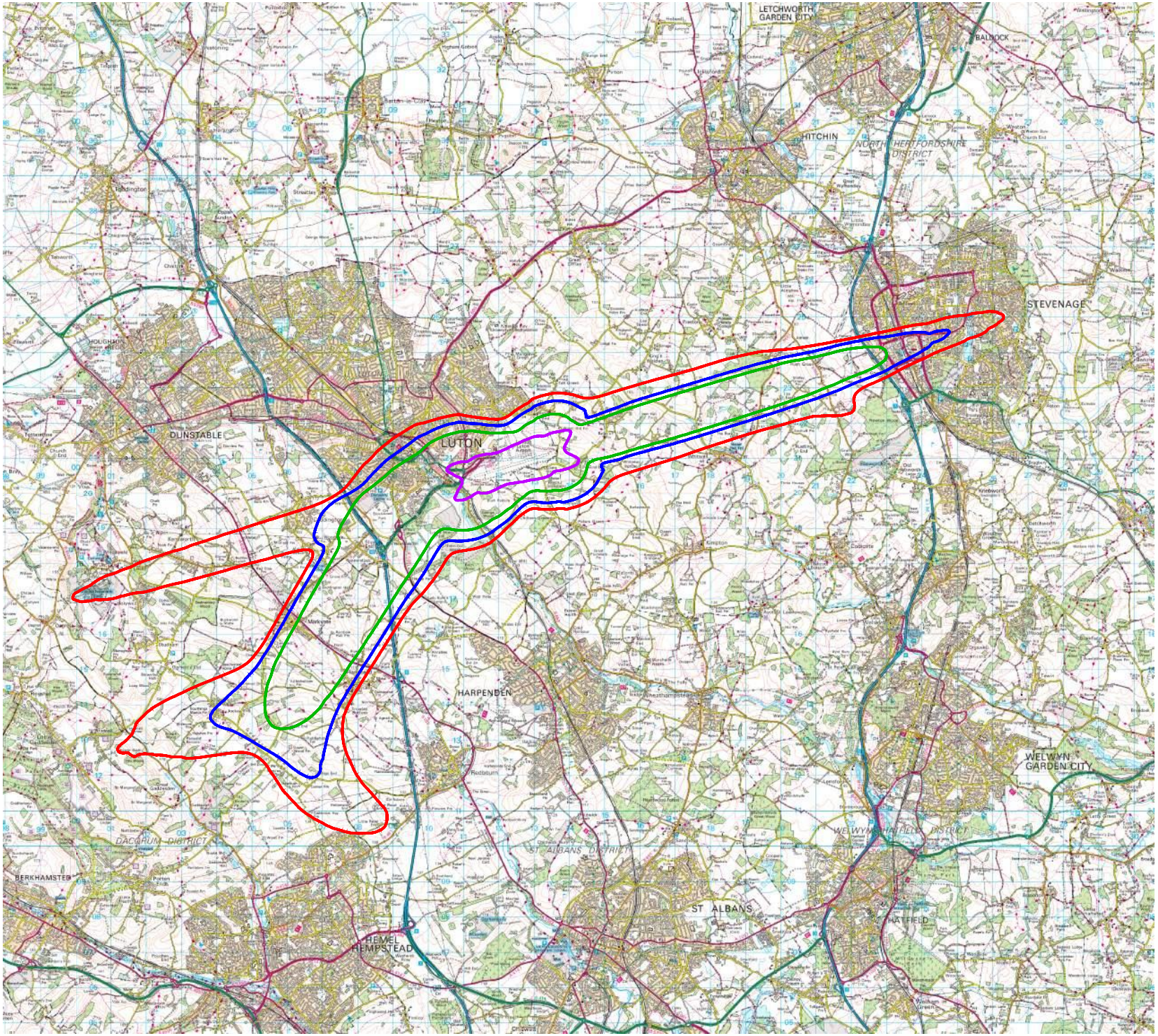
Summer Daytime N65 Noise Contours
Existing Short Term Contour Area Limit

DRAWN: DR CHECKED: DC

DATE: December 2020 SCALE: 1:150000@A4

FIGURE No:

A11060-N59-01-1.0

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LEGEND:

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- N65, 50
- N65, 100
- N65, 200

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Summer Daytime N65 Noise Contours
Proposed Short Term Contour Area Limit

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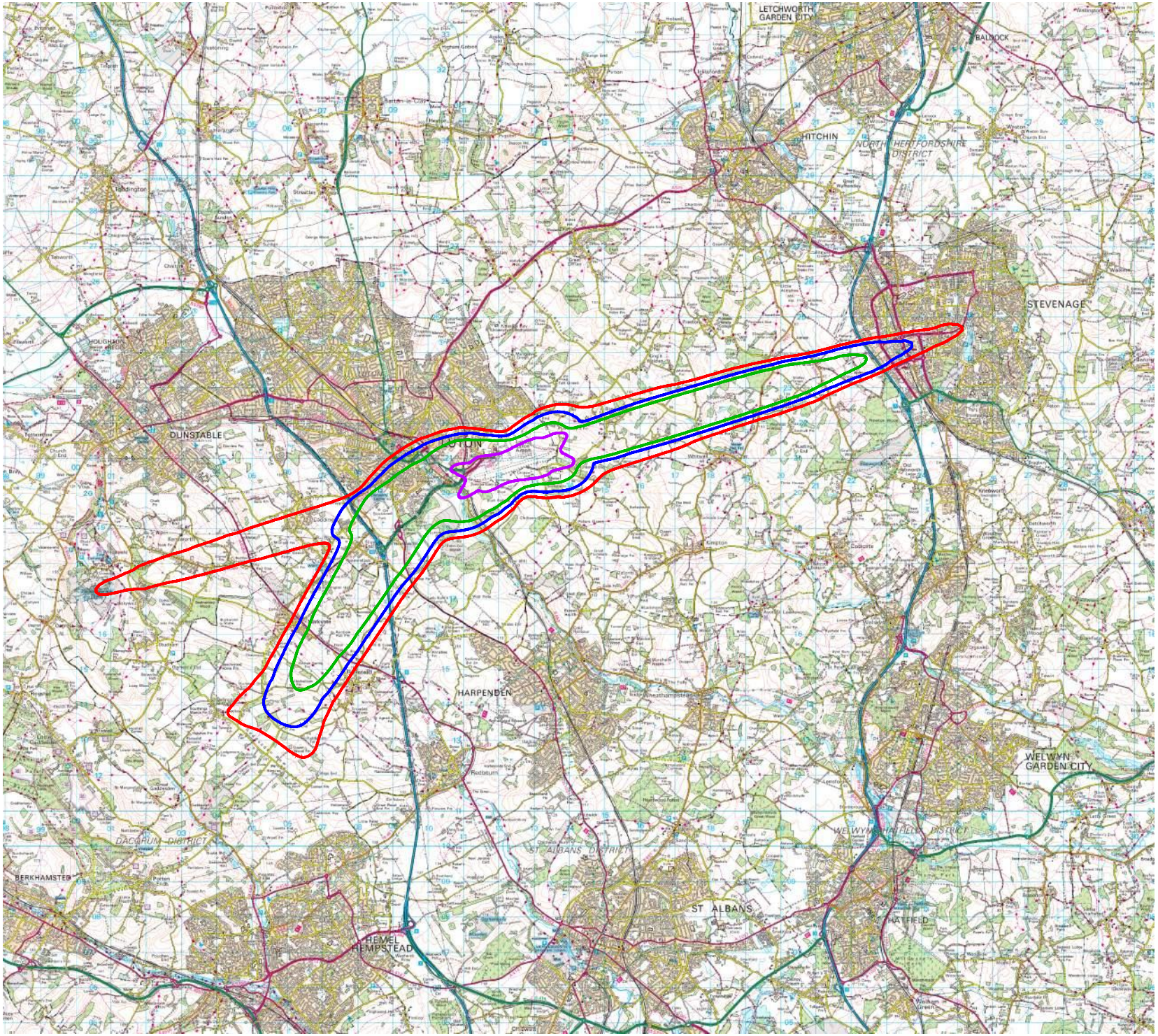
DATE: December 2020 SCALE: 1:150000@A4

FIGURE No:

A11060-N59-02-1.0

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LEGEND:

- N65, 25
- N65, 50
- N65, 100
- N65, 200

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Summer Daytime N65 Noise Contours
Existing Long Term Contour Area Limit

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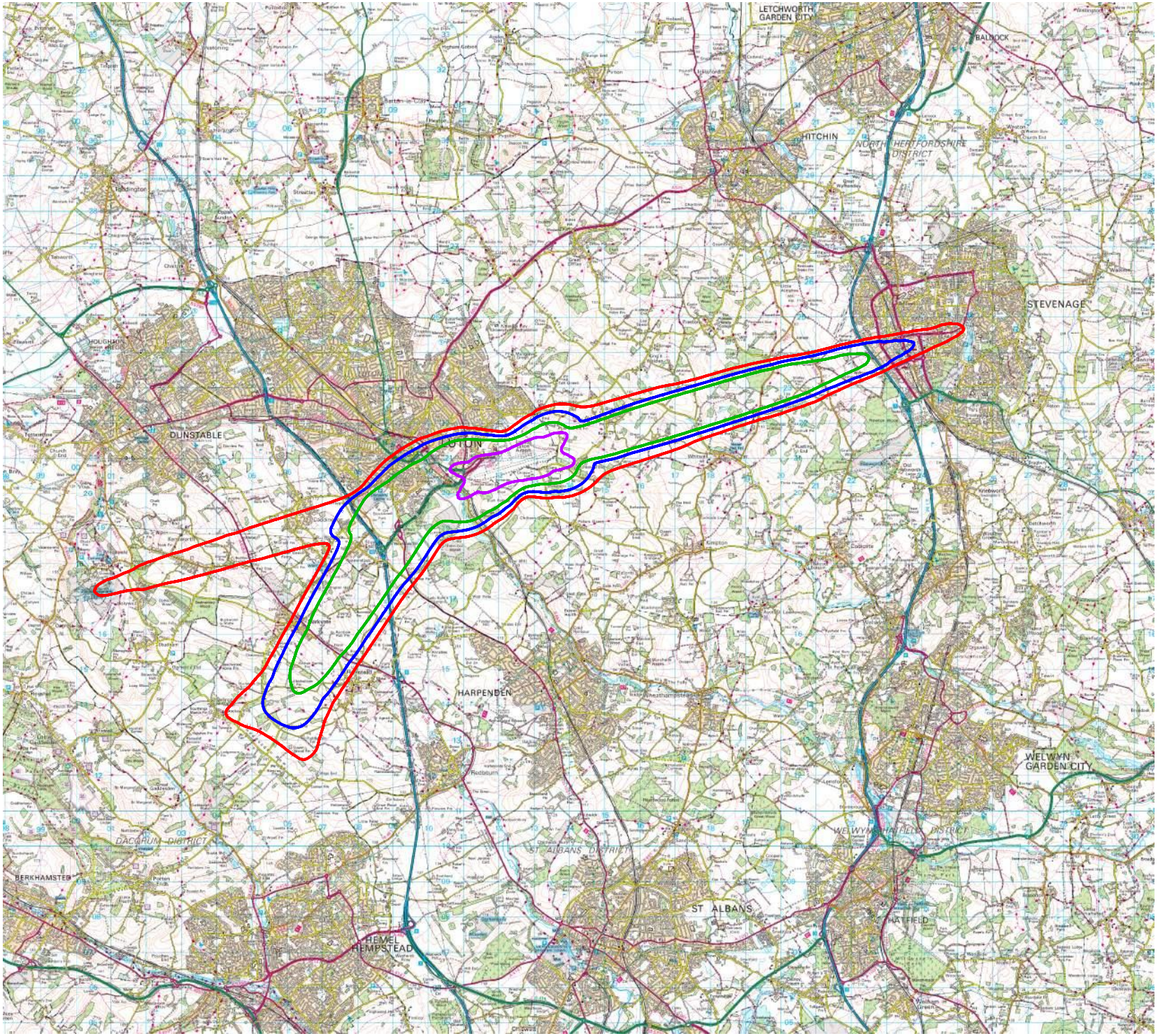
DATE: December 2020 SCALE: 1:150000@A4

FIGURE No:

A11060-N59-03-1.0

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LEGEND:

- N65, 25
- N65, 50
- N65, 100
- N65, 200

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Summer Daytime N65 Noise Contours
Proposed Long Term Contour Area Limit

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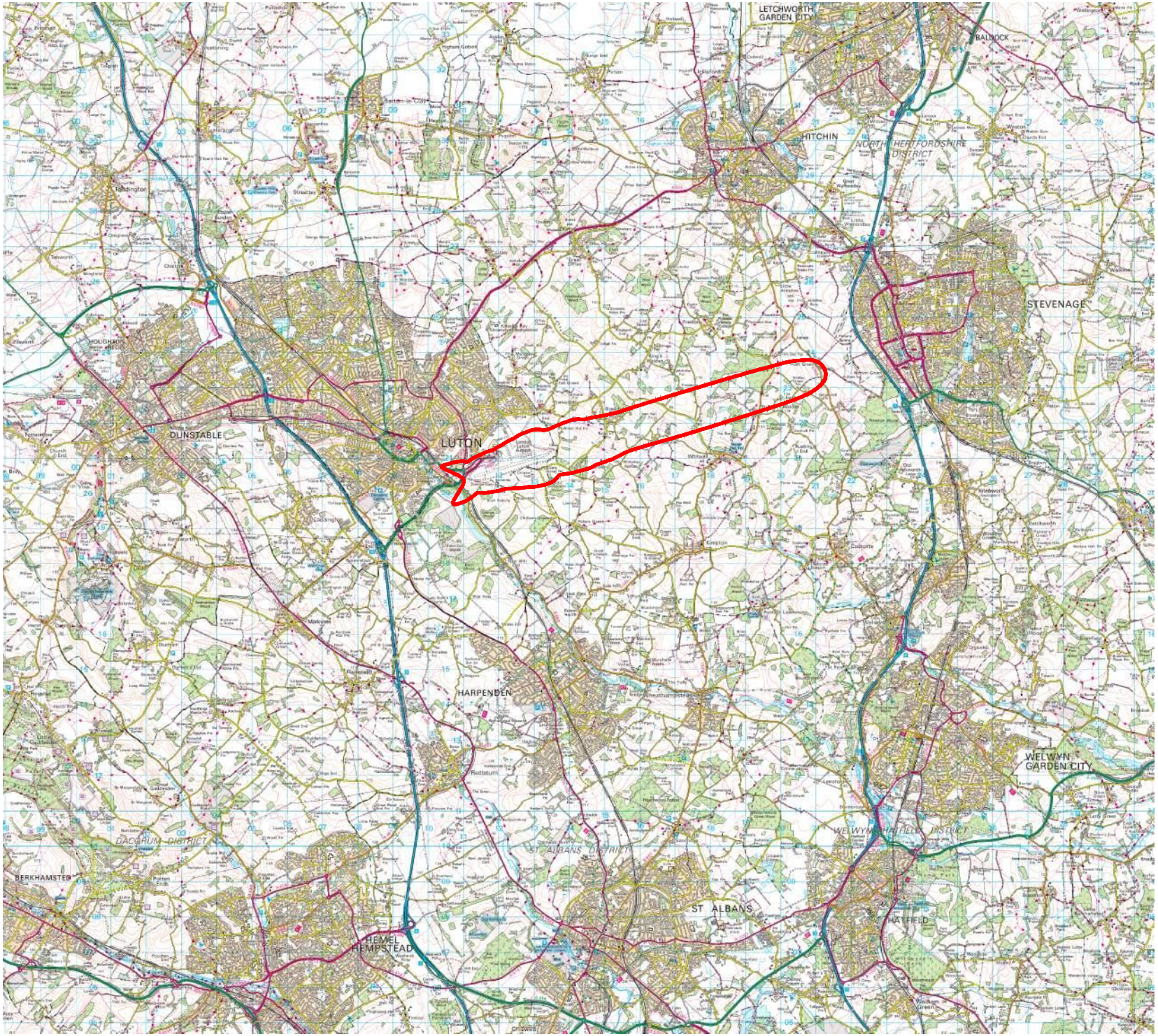
DATE: December 2020 SCALE: 1:150000@A4

FIGURE No:

A11060-N59-04-1.0

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LEGEND:

N60, 25

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Summer Night Time N60 Noise Contours
Existing Short Term Contour Area Limit

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DATE: December 2020 SCALE: 1:150000@A4

FIGURE No:

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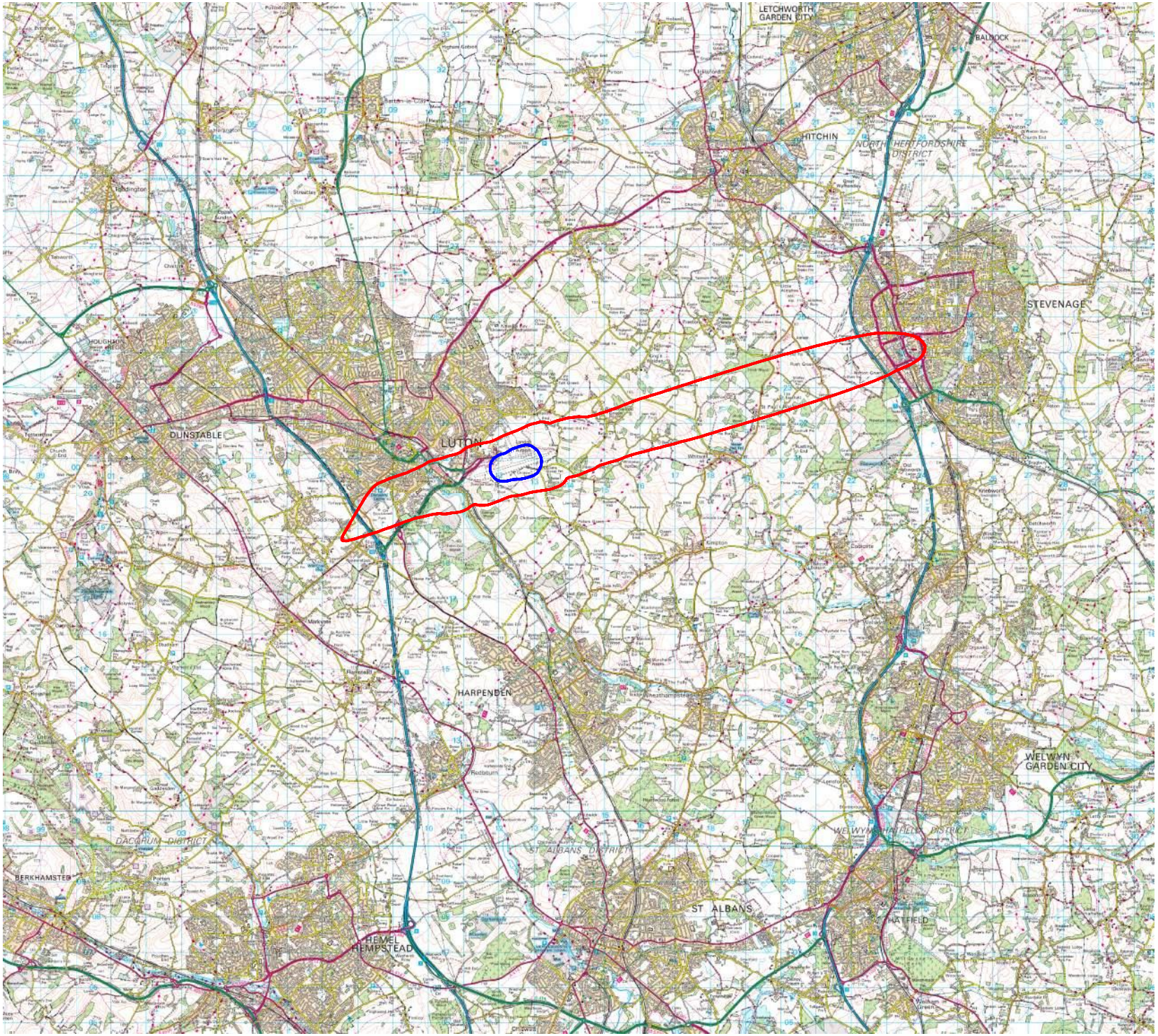


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LEGEND:

- N60, 25
- N60, 50

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Proposed Short Term Contour Area Limit

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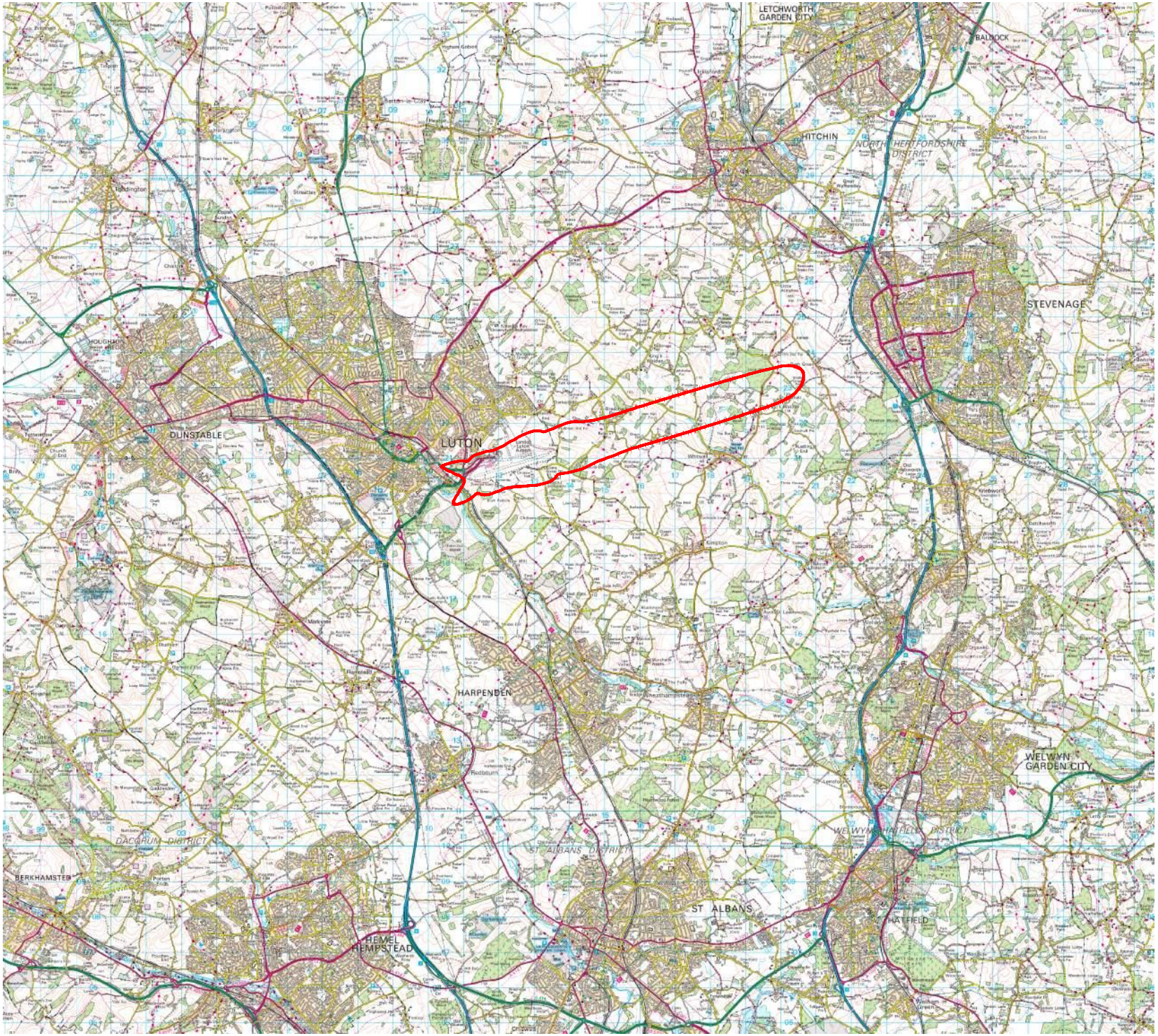
DATE: December 2020 SCALE: 1:150000@A4

FIGURE No:

A11060-N59-06-1.0

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LEGEND:

N60, 25

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Summer Night Time N60 Noise Contours
Existing Long Term Contour Area Limit

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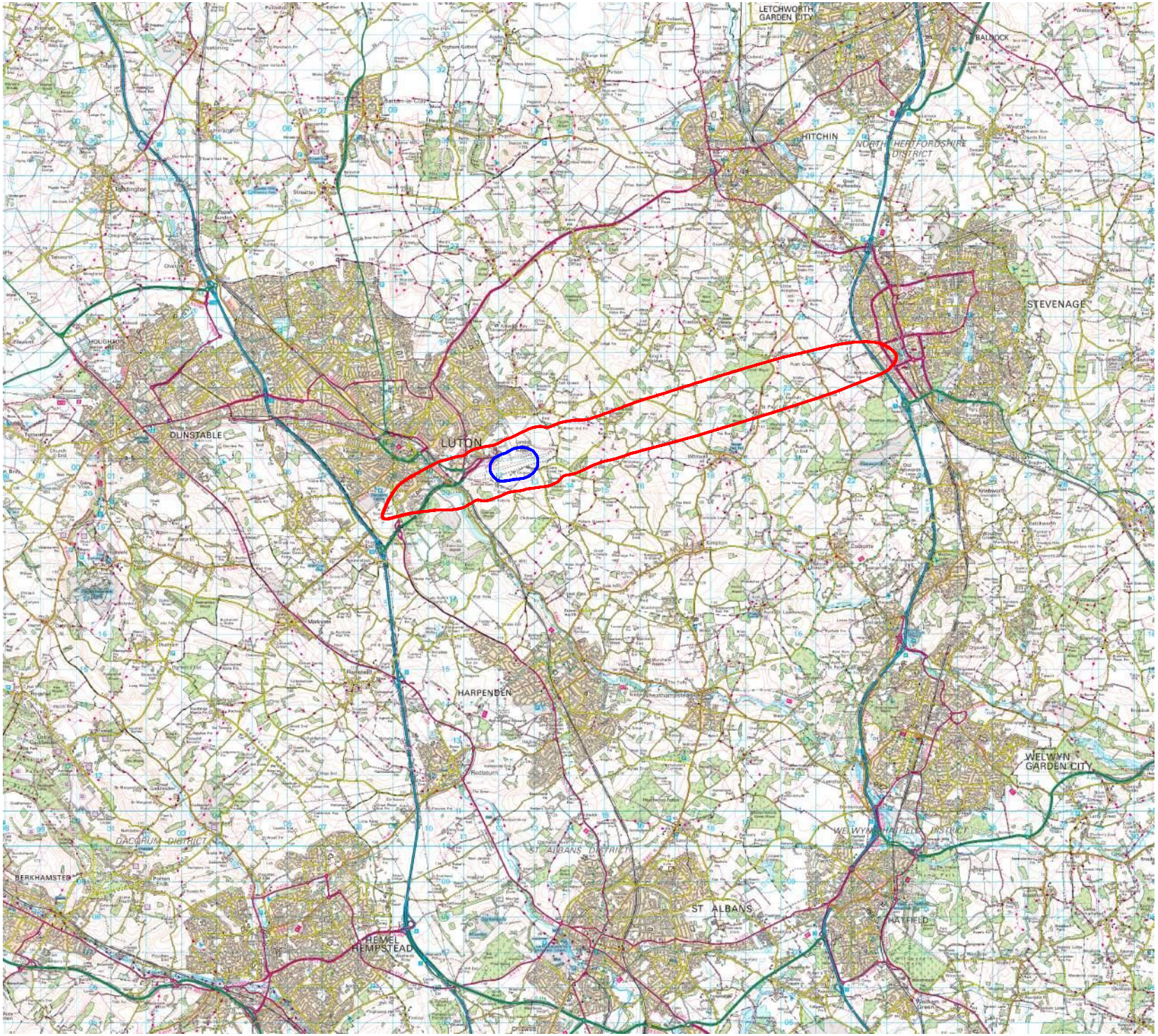
DATE: December 2020 SCALE: 1:150000@A4

FIGURE No:

A11060-N59-07-1.0

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LEGEND:

- N60, 25
- N60, 50

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Summer Night Time N60 Noise Contours
Proposed Long Term Contour Area Limit

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FIGURE No:

A11060-N59-08-1.0

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# Appendix 8F
# Noise - Mitigation

## Environmental measures embedded into the development proposals

The assessment of noise effects from the Proposed Scheme has identified a requirement for compensatory measures in the form of the Noise Insulation Fund. The following sections provide a rationale for the compensation and the describe how the quantity of funding seeks to meet requirements.

### Assessment context for mitigation

The proposal to increase the contribution to the Noise Insulation Fund applies to properties affected by noise greater than the SOAEL (significant observed adverse effect level).

The SOAEL and LOAEL are defined in the **Table 8F.1** for both daytime and night-time.

Table 8F.1 : Levels adopted for LOAEL and SOAEL

| | **Daytime ($L_{Aeq,16hr}$)** | **Night-time ($L_{Aeq,8hr}$)** |
|---|---|---|
| SOAEL | 63 | 55 |
| LOAEL | 51 | 45 |

The assessment of noise effects identified the 18 mppa 2022 scenario as the worst-case year in terms of significance of effect based on additional dwellings affected by noise above SOAEL. The resulting area and number of dwellings related to the LOAEL and SOAEL are presented in **Table 8F.2**.

Table 8F.2 : LOAEL and SOAEL for various noise model scenarios

| | **Area of SOAEL (sq.km)** | **No. Dwellings in SOAEL** | **Area of LOAEL (sq.km)** | **No. Dwellings in LOAEL** |
|---|---|---|---|---|
| Daytime | | | | |
| Current Condition 10 contour | 6.3 | 720 | 54.1 | 13,981 |
| Forecast 18 mppa 2022 | 7.1 | 805 | 57.6 | 16,411 |
| Night-time | | | | |
| Current Condition 10 contour | 9.6 | 1,184 | 60.9 | 19,490 |
| Forecast 18mppa 2022 | 11.5 | 1,908 | 68.5 | 24,906 |

## Mitigation for properties exposed to noise higher than SOAEL

The Independent Commission on Civil Aviation Noise (ICCAN) is working towards forming best practice for noise mitigation, but this information is not yet available. Based on current guidance LLAOL have defined two options for mitigation for properties greater than SOAEL; either insulation or compensation.

Taking the daytime situation, a total of 805 dwellings are forecast to be exposed to noise levels above 63 dB $L_{Aeq16hr}$ (SOAEL) in the 18 mppa 2022 scenario (day-time worst-case year). Based on the current condition, 720 of these properties would already be exposed to these noise levels. Therefore, 85 new properties would be exposed to an increased level of noise due to the forecasted increase in air traffic in 2022.

For the night-time, a total of 1,908 dwellings were predicted to be exposed to noise levels above 55 dB $L_{Aeq\ 8hr}$ (SOAEL) in the 18 mppa 2022 scenario (worst-case year) and therefore eligible for insulation. There are currently 1,184 properties within the SOAEL based on the current Condition 10. Therefore in 2022 an increase of 724 new properties would be exposed to an increased level of noise due to the forecasted increase in air traffic.

It is forecast that the maximum increase of 85 properties in the daytime SOAEL will be fully contained in the 2022 night-time SOAEL contour and therefore mitigation has been defined based on dwellings within the 2022 night-time SOAEL.

As 2022 is forecast to be the worst-case year in terms of noise insulation provision, the 2022 noise insulation eligibility contour would be fixed for 6 years. Therefore, the scheme would not change each year, but would always be based on 2022 data, allowing everyone affected by the worst-case year to be eligible for insulation in future years.

The **Table 8F.3** shows the existing funding and the funding to be proposed in this ES. For reference it also shows the funding in 2016 to 2020. LLAOL would continue spending up to approximately £3,000 per property to enhance noise insulation.

Table 8F.3: Increased noise insulation funding

| | **Existing funding** | | **Proposed in this version of Section 73 application** | |
|---|---|---|---|---|
| **Year** | **Proposed funding** | **Number of properties** | **Proposed funding** | **Number of properties** |
| 2016 | £100,000 | 33 | £100,000 | 33 |
| 2017 | £100,000 | 33 | £100,000 | 33 |
| 2018 | £100,000 | 33 | £100,000 | 33 |
| 2019 | £100,000 | 33 | £100,000 | 33 |
| 2020 | £100,000 | 33 | £100,000 | 33 |
| 2021 | £100,000 | 33 | £400,000 | 133 |
| 2022 | £100,000 | 33 | £900,000 | 300 |
| 2023 | £100,000 | 33 | £700,000 | 233 |
| 2024 | £100,000 | 33 | £100,000 | 33 |
| 2025 | £100,000 | 33 | £100,000 | 33 |
| 2026 | £100,000 | 33 | £100,000 | 33 |

| | Existing funding | | Proposed in this version of Section 73 application | |
|---|---|---|---|---|
| **Year** | **Proposed funding** | **Number of properties** | **Proposed funding** | **Number of properties** |
| 2027 | £100,000 | 33 | £100,000 | 33 |
| 2028 | £100,000 | 33 | £100,000 | 33 |
| Total | £1,300,000 | 429 | £3,000,000 | 996 |

The scheme would continue to give insulation to those dwellings with the highest noise levels as a priority.

The additional budget of £1,700,000 (further to the £1,300,000 funding existing) would be sufficient to noise insulate properties in areas above SOAEL as a result of proposed variation to Condition 10 assuming no more than 78% take-up. The current take-up of insulation is approximately 50%, therefore the contribution is considered sufficient.

## Mitigation for communities between SOAEL and LOAEL

Properties with levels between SOAEL and LOAEL would not be eligible to receive insulation as the effects are considered less. Therefore, LLAOL is proposing to use the 2022 contours and give one-off grants to local (parish or borough) councils that fall between the night-time LOAEL and SOAEL. This would be between £12,000-£15,000 to these councils to be spent on something which will improve the lives of those community members living in dwellings exposed between LOAEL and SOAEL (for example new park equipment or village hall improvements). Evidence would need to be provided to LLAOL. Grants would be paid in Q1 2021 after the actual 2020 summer contours have been created. Councils closer to the SOAEL experiencing a relatively higher aviation noise level than other Councils would receive £15,000. Based on forecasts these councils are likely to be: Caddington Parish Council, Slip End Parish Council, Luton Borough Council, Kings Walden Parish Council, Kensworth Parish Council, and St Pauls Walden Parish Council. Councils closer to the LOAEL experiencing a relatively lower aviation noise level than other Councils would receive £12,000. Based on forecasts the 5 councils are likely to be: Markyate Parish Council, Flamstead Parish Council, Great Gaddesden Parish Council, Whipsnade Parish Council and Stevenage Parish Council.