Dublin Airport North Runway Relevant Action Application

Environmental Impact Assessment Report
Main Report

December 2020

Prepared for:

daa

Project number: PR-407849

Prepared by:

AECOM Ireland Limited
4th Floor
Adelphi Plaza
Georges Street Upper
Dun Laoghaire
Co. Dublin A96 T927
Ireland

T: +353 1 238 3100
aecom.com

Quality information

Prepared by	Checked by	Approved by
Various Authors	Peta Donkin Associate Director	Barry Sheridan Technical Director

Table of Contents

Figures

Tables

Acronyms and Abbreviations

Abbreviation / Term	Definition
%	Percentage.
µg/m³	Microgram per cubic meter. A measure of concentration commonly used to present air quality conditions.
µm	Micro-metre. A measure of length equaling $1x10^{-6}$ of a metre.
AA	Appropriate Assessment
ABP	An Bord Pleanála
ACA	Architectural Conservation Area
AEDT	Aviation Environmental Design Tool
ANCA	Aircraft Noise Competent Authority
ANPR	Automatic Number Plate Registration
ANQ	Annual Noise Quota
APU	Auxiliary Power Units
AQLV	Air Quality Limit Values
ATM	Air Traffic Movement
ASI	Archaeological Survey of Ireland
AQC	Air Quality Consultants
ACDM	Airport Collaborative Decision Making
BCT	Bat Conservation Trust
BNL	Basic Noise Level.
BSI	British Standards Institute
CAR	Commission for Aviation Regulation
CAFE	Cleaner Air for Europe
CCD	Climb, Cruise and Descent
CCR	Climate Change Resilience
CEMP	Construction Environmental Management Plan.
CFRAM	Catchment Flood Risk Assessment and Management
CGI	Computer Generated Imagery
CHD	Coronary Heart Disease
CH_4	Methane
CIEEM	Chattered Institute of Ecology and Environmental Management
CIRIA	Construction Industry Research and Information Association
cNAO	Candidate Noise Abatement Objective
CO	Carbon monoxide.
COD	Chemical Oxygen Demand
CODA	Central Office of Delay Analysis
CO_2	Carbon dioxide.
COMAR	Control of Major Accident Hazard
CTPRO	Change to Permitted Runway Operations
CSO	Central Statistics Office
CD	Cardiovascular disease
C_6H_6	Benzene
DAA	Dublin Airport Authority

Abbreviation / Term	Definition
dB	The unit of noise measurement that expresses the loudness in terms of decibels (dB) based on a weighting factor for humans sensitivity to sound (A).
dB(A)	The unit of sound level, weighted according to the A-scale, which takes into account the increased sensitivity of the human ear at some frequencies.
DBA	Desk-Based Assessment.
DCHG	Department of Culture, Heritage and the Gaeltacht
DCLG	Department od Communities and Local Government
DECC	Department of Energy and Climate Change
Defra	Department for Environment, Food and Rural Affairs
DfE	Department of Education
DfT	Department for Transport
DoEHLG	Department of Transport and the Department of Environment, Heritage and Local Government
DRAQMP	Dublin Regional Air Quality Management Plan
DTTAS	Department of Transport, Tourism and Sport
DUB	Dublin
EASA	European Aviation Safety Agency
EC	European Commission.
ED	Electoral Divisions
EIA	Environmental Impact Assessment. A technique for ensuring that the likely effects of new development on the environment are fully understood and taken into account before the development is allowed to go ahead. It provides a focus for public scrutiny of the project and enables the importance of the predicted effects, and the scope for modifying or mitigating them, to be properly evaluated by the decision-making authority.
EIAR	Environmental Impact Assessment Report. A technique for ensuring that the likely effects of new development on the environment are fully understood and taken into account before the development is allowed to go ahead. It provides a focus for public scrutiny of the project and enables the importance of the predicted effects, and the scope for modifying or mitigating them, to be properly evaluated by the decision-making authority.
EIS	Environmental Impact Statement
EPA	Environmental Protection Agency
EPS	European Protected Species
EPUK	Environmental Protection UK.
ES	Environmental Statement. The report that documents the findings of the EIA.
ETS	Emission Trading Scheme
EU	European Union.
FAA	Federal Aviation Administration
FDI	Foreign Direct Investment
FEGP	Fixed Electrical Ground Power
FCC	Fingal County Council
FRA	Flood Risk Assessment.
NFTMS	Flight Track Monitoring System
GDP	Gross Domestic Product
GHG	Greenhouse Gas.
GLVIA	Guidelines for Landscape and Visual Impact Assessment
GSE	Ground Support Equipment
ha	hectare
HFCs	Hydrofluorocarbons

Abbreviation / Term	Definition
HIA	Health Impact Assessment.
HSA	Health and Safety Authority
HSE	Health and Safety Executive
HT	High Technology
IAA	Irish Aviation Authority
IAI	Institute of Archaeologists Ireland
IAQM	Institute of Air Quality Management.
ICAO	International Civil Aviation Organisation
ICE	Inventory of Carbon and Energy
ICCI	In-combination climate change impact assessment
IEMA	Institute of Environmental Management and Assessment.
IFC	International Finance Corporation
IFI	Inland Fisheries Ireland
IGI	Institute of Geologists of Ireland
IHD	Ischaemic Heart Disease
IHT	Institution of Highways and Transportation
IPC	Integrated Pollution Control
IPPC	Intergovernmental Panel on Climate Change
ISO	International Organisation for Standardisation
IW	Irish Water
JA	Jobseekers Allowance
JB	Jobseekers Benefit
km	Kilometres.
LAP	Local Area Plan
LAQM	Local Air Quality Management.
LDC	Least Developed Countries
LLDC	Landlocked Developing Countries
Ltd	Limited
LTO	Landing and Take-off
mppa	Million Passengers Per Anum
NAO	Noise Abatement Objective
NAP	National Aviation Policy
N/A	‘Not applicable’ or ‘Not appropriate’.
NDP	The National Development Plan 2018 – 2027
NFTMS	Noise and Flight Track Monitoring System
NF_3	Nitrogen trifluoride
NIAH	National Inventory of Architectural Heritage
NIS	Natura Impact Statement
NLS	National Landscape Strategy
NMS	National Monument Service
NMTs	Noise Monitoring Terminals
NO_2	Nitrogen dioxide.
NOEL	No Observed Effect Level.

Abbreviation / Term	Definition
NO_x	Nitrogen oxides.
NPPF	National Planning Policy Framework. A document that sets out government's planning policies for England and how these are expected to be applied.
NPF	National Planning Framework. The Government's high-level strategic plan for shaping the future growth and development of our country out to the year 2040.
NPPG	National Planning Policy Guidance notes set out the Government's policies on different aspects of planning. Local planning authorities must take their content into account in preparing their development plans and the guidance may also be material to decisions on individual planning applications and appeals.
NPWS	National Parks and Wildlife Services
NQP	Night Quota Period
NRA	National Roads Authority
NSO	National Strategic Outcomes
NSS	National Spatial Strategy
NTA	National Transport Authority
NTS	Non-Technical Summary. A concise document that provides a description of the EIA process and its findings in a manner that is both appealing to read and easily understood by the general public.
N_2O	Nitrous Oxide
O-D	Origin-Destination
OPW	Office of Public Works
OS	Ordnance Survey
OSI	Ordnance Survey Ireland
PAX	Annual Passengers
PDA	Planning and Development Acts
PFCs	Perfluorocarbons
PM_{10}	Particulate Matter
$PM_{2.5}$	Particulate Matter
PWHT	Polluted Water Holding Tank
QC	Quota Count
QI	Qualifying Interest
RMP	Record of Monument and Places
RMSE	Root Mean Square Error
RoI	Republic of Ireland
RPS	Record of Protected Structures
RSES	Regional Spatial and Economic Strategy
PSZ	Public Safety Zones
SA	Small Areas
SAC	Special Area of Conservation
SCI	Special Conservation Interests
SEAI	Sustainable Energy Authority of Ireland
SF_6	Sulphur hexafluoride
SI	Statutory Instrument
SID	Standard Instrument Departure
SIDS	Small Island Developing States
SO_2	Sulphur dioxide

Abbreviation / Term	Definition
SPA	Special Protected Area
SRI	Societal Risk Index
SSSI	Site of Special Scientific Interest.
TFS	Trans frontier Shipping
TII	Transport Infrastructure Ireland
TOC	Total Organic Carbon
TPA	Tom Philips + Associates
TTA	Traffic and Transport Assessment
UK	United Kingdom.
UV	Ultraviolet
VOC	Volatile Organic Compounds
WFD	Water Framework Directive
WHO	World Health Organisation.
ZOI	Zone of Influence.

Chapter 01: Introduction

01

1. Introduction

1.1 Background

This Environmental Impact Assessment Report (EIAR) has been prepared on behalf of daa (hereafter referred to as 'the Applicant') to accompany the application to be made pursuant to Section 34 of the Planning and Development Acts 2000 as amended (the "PDA"). Specifically, this report relates to an application for a proposed Relevant Action to be taken in accordance with Section 34C(1)(a) of the PDA, to amend and replace two planning conditions, namely conditions no. 3(d) and 5 of the North Runway Planning Permission (Fingal County Council Reg. Ref. No. F04A/1755; ABP Ref. No.: PL06F.217429, 'the North Runway Permission'), which limit access or reduces the operational capacity of Dublin Airport.

The proposed Relevant Action relates to the night-time use of the runway system at Dublin Airport. It involves the amendment of the operating restriction set out in condition no. 3(d) and the replacement of the operating restriction in condition no. 5 of the North Runway Planning Permission (Fingal County Council Reg. Ref. No. F04A/1755; ABP Ref. No.: PL06F.217429 as amended by Fingal County Council F19A/0023, ABP Ref. No. ABP-305289-19, the **North Runway Permission**), as well as proposing new noise mitigation measures. Conditions no. 3(d) and 5 have not yet come into effect or operation, as the construction of the North Runway on foot of the North Runway Planning Permission is ongoing.

The proposed Relevant Action, if permitted, would be to remove the numerical cap on the number of flights permitted between the hours of 11pm and 7am daily that is due to come into effect in accordance with the North Runway Permission and to replace it with an annual night-time noise quota between the hours of 11.30pm and 6am and also to allow flights to take off from and/or land on the North Runway (Runway 10L 28R) for an additional 2 hours i.e. 2300 hrs to 2400hrs and 0600 hrs to 0700 hrs. Overall, this would allow for an increase in the number of flights taking off and/or landing at Dublin Airport between 2300 hrs and 0700 hrs over and above the number stipulated in condition no. 5 of the North Runway Planning Permission, in accordance with the annual night time noise quota.

The relevant action pursuant to Section 34C(a) is to amend condition no. 3(d) of the North Runway Planning Permission (Fingal County Council Reg. Ref. No. F04A/1755; ABP Ref. No.: PL06F.217429 as amended by Fingal County Council F19A/0023, ABP Ref. No. ABP-305289-19). Condition 3(d) and the exceptions at the end of Condition 3 state the following:

> *'3(d). Runway 10L-28R shall not be used for take-off or landing between 2300 hours and 0700 hours.*
>
> *except in cases of safety, maintenance considerations, exceptional air traffic conditions, adverse weather, technical faults in air traffic control systems or declared emergencies at other airports.'*

Permission is being sought to amend the above condition so that it reads:

> *'Runway 10L-28R shall not be used for take-off or landing between 0000 hours and 0559 hours*
>
> *except in cases of safety, maintenance considerations, exceptional air traffic conditions, adverse weather, technical faults in air traffic control systems or declared emergencies at other airports or where Runway 10L-28R length is required for a specific aircraft type.'*

The net effect of the proposed change, if permitted, would change the normal operating hours of the North Runway from the 0700hrs to 2300 hrs to 0600 hrs to 0000 hrs.

The relevant action also is to replace condition no. 5 of the North Runway Planning Permission (Fingal County Council Reg. Ref. No. F04A/1755; ABP Ref. No.: PL06F.217429 as amended by Fingal County Council F19A/0023, ABP Ref. No. ABP-305289-19) which provides as follows:

> *'5. On completion of construction of the runway hereby permitted, the average number of night time aircraft movements at the airport shall not exceed 65/night (between 2300 hours and 0700 hours) when measured over the 92 day modelling period as set out in the reply to the further information request received by An Bord Pleanála on the 5th day of March, 2007.*

> ***Reason**: To control the frequency of night flights at the airport so as to protect residential amenity having regard to the information submitted concerning future night time use of the existing parallel runway.'*

With the following:

A noise quota system is proposed for night time noise at the airport. The airport shall be subject to an annual noise quota of 7990 between the hours of 2330hrs and 0600hrs.

In addition to the proposed night time noise quota, the relevant action also proposes the following noise mitigation measures:

- A noise insulation grant scheme for eligible dwellings within specific night noise contours
- A detailed Noise Monitoring Framework to monitor the noise performance with results to be reported annually to the Aircraft Noise Competent Authority (ANCA), in compliance with the Aircraft Noise (Dublin Airport) Regulation Act 2019.

The proposed relevant action does not seek any amendment of conditions of the North Runway Planning Permission governing the general operation of the runway system (i.e., conditions which are not specific to night-time use, namely conditions no. 3 (a), 3(b), 3(c) and 4 of the North Runway Planning Permission) or any amendment of permitted annual passenger capacity of the Terminals at Dublin Airport. Condition no. 3 of the Terminal 2 Planning Permission (Fingal County Council Reg. Ref. No. F04A/1755; ABP Ref. No. PL06F.220670) and condition no. 2 of the Terminal 1 Extension Planning Permission (Fingal County Council Reg. Ref. No. F06A/1843; ABP Ref. No. PL06F.223469) provide that the combined capacity of Terminal 1 and Terminal 2 together shall not exceed 32 million passengers per annum.

The planning application will be subject to an assessment by the Aircraft Noise Competent Authority in accordance with the Aircraft Noise (Dublin Airport) Regulations Act 2019 and Regulation (EU) No 598/2014. The planning application is accompanied by information provided for the purposes of such assessment.

1.2 Project Overview

The Site is defined as being located at Dublin Airport, Co. Dublin, in the townlands of Collinstown, Toberbunny, Commons, Cloghran, Corballis, Coultry, Portmellick, Harristown, Shanganhill, Sandyhill, Huntstown, Pickardstown, Dunbro, Millhead, Kingstown, Barberstown, Forrest Great, Forrest Little and Rock on a site of c. 580 ha. North Runway is currently under construction within the northern extent of the Airport.

The North Runway Permission contains 31 planning conditions. Two of these planning conditions (Conditions 3(d) and 5) relates to operating restrictions on the use of the runways and overall number of permitted flights at night, and these are due to come into force once the North Runway is operational in 2022. In addition, Condition 4 of the North Runway Permission introduces a restriction on the use of the cross-wind runway (16/34). For avoidance of doubt there is no intention to apply to amend, review or revoke Condition 4.

Since the North Runway Permission was granted, there was rapid growth in passenger numbers, and the current runway infrastructure was already at capacity at peak times in 2018 and 2019.

Notwithstanding the current situation with Covid-19, there is still a need to safeguard the return to growth in air traffic movements at the airport which means addressing the night-time operating restrictions attached to the North Runway permission.

A Relevant Action application has therefore been prepared to request an amendment to Condition 3d and a replacement of condition 5 as conditioned by the North Runway Permission. Further detail regarding for the characteristics of the proposed Relevant Action is contained within Chapter 2, and further detail of the need for the proposed Relevant Action is contained within Chapter 3, of this EIAR.

1.3 EIA Process

EIA is the process for assessing the effects, if any, which proposed development, if carried out, would have on the environment. An EIA is required for certain classes of project as defined in domestic legislation that transposes the EIA Directives 2011/92/EU and 2014/52/EU. Amendments introduced by the EIA Directives were transposed into Irish law on the 1st September 2018 in the form of the European Union (Planning and Development) (Environmental Impact Assessment) Regulations 2018 (hereafter referred to as 'the EIA Regulations'). EIA requirements derive from Council Directive 85/337/EEC (as amended by Directives 97/11/EC, 2003/35/EC and 2009/31/EC) and as codified and replaced by Directive 2011/92/EU of the European Parliament and the Council on the assessment of the effects of certain public and private projects on the environment. Amending EIA Directive 2014/52/EU, constitutes an update of the preceding Directive 2011/1192/EU and has been considered in the assessments completed herein.

Directive 2014/52/EU was transposed into Irish law on September 1st 2018 in the form of the European Union (Planning and Development) (Environmental Impact Assessment) Regulations 2018.

An EIA is required for certain classes of projects defined in (Schedule 5, Part 2(10) (d)) of the Planning and Development Regulations 2001, as amended. Where a project falls into one of these classes and exceeds a related size threshold (also defined in the legislation) an EIA is required. Where the project is below the threshold an EIA may still be required if there is the potential for significant environmental effects and this potential is assessed in relation to criteria set out in Annex III of the EIA Directive.

1.4 Need for an EIA

The application relates to a proposed Relevant Action only, comprising a change in operating restrictions, and will involve no construction works or changes to the consented physical infrastructure of the North Runway. Therefore, the proposed Relevant Action is not a project within the meaning of the EIA Directive.

On the basis of the case law of the Court of Justice of the European Union (CJEU), and, in particular, the Judgments in the *Brussels Airport* Case (Case C-275/09) and *Pro-Braine* (Case C-121/11), this application to remove, replace or vary Conditions No. 3(d) and No 5 of the North Runway permission is not an application for development consent for a 'project' within the meaning of the EIA Directive, and is therefore outside the scope of that Directive. Strictly without prejudice to that position, daa is submitting an EIAR with the application out of an abundance of caution.

This EIAR has been prepared as part of the EIA process, which includes a baseline assessment to determine the status of the existing environment, and a statement of the effects, if any, which the proposed Relevant Action, if carried out, would have on the environment.

1.5 EIAR Methodology and Relevant Guidelines

1.5.1 EIAR Preparation

An EIAR is defined by the European Union (Planning and Development) (Environmental Impact Assessment) Regulations 2018 (S.I. No. 246 of 2018) as:

> "…*a report of the effects, if any, which proposed development, if carried out, would have on the environment and shall include the information specified in Annex IV of the Environmental Impact Assessment Directive*".

The primary objective of the EIAR is therefore to identify baseline environmental conditions in the proposed project area, identify significant environmental effects, predict potential beneficial and/or significant adverse effects of the proposed development and propose appropriate mitigating measures where necessary, as set out in Figure 1-1 below.

This EIAR assesses, as required, the direct effects and any indirect, secondary, cumulative, transboundary, short term, medium term and long term permanent and temporary, positive and negative effects of the proposed Relevant Action.

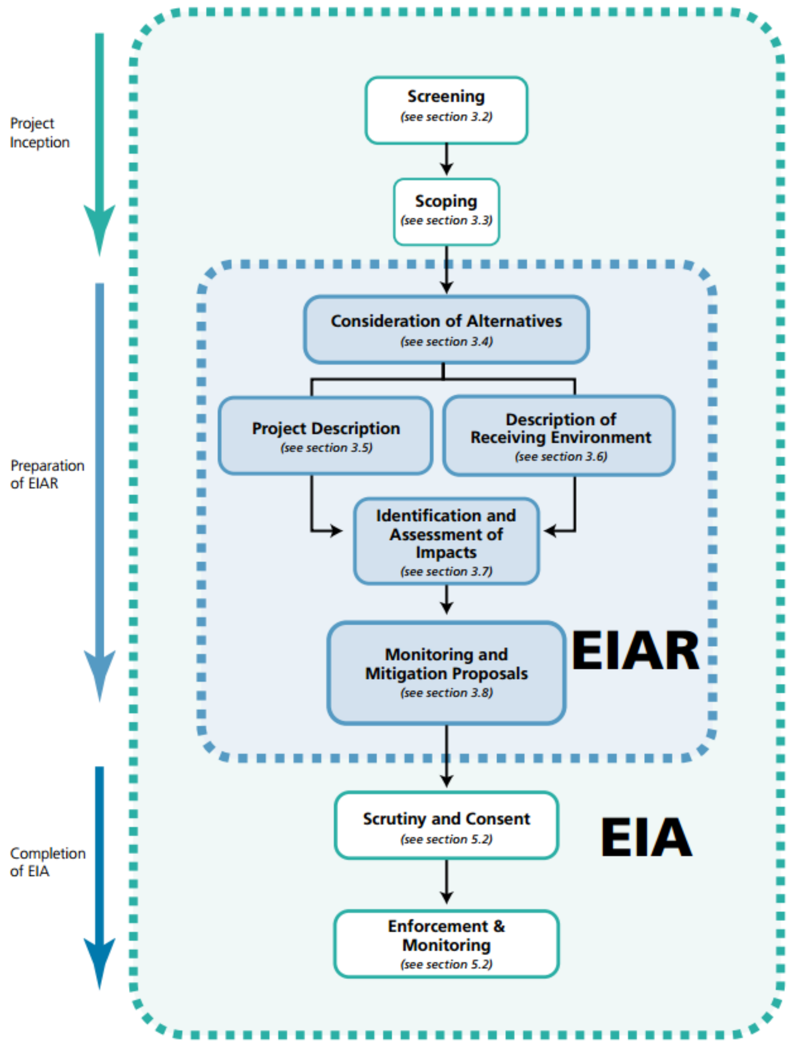


Figure 1-1 EIA Process (EIAR Draft Guidelines, EPA, 2017)

As outlined in Section 1.2, the proposed Relevant Action relates solely to proposals to amend condition 3(d) and replace condition 5 of the North Runway Permission and does not comprise or require the development of any physical or other infrastructure.

The assessment carried out in this EIAR will analyse / consider:

- the nature of the relevant environment;
- potential alternatives; and
- mitigation and monitoring measures will focus on the operation of the consented and constructed runway system.

The Environmental Protection Agency is required to "prepare Guidelines on information to be contained in environmental impact statements". The Environmental Protection Act 1992 (as amended) further provides that those preparing and evaluating EIARs shall have regard to such guidelines. This is intended to provide developers, CAs and the general public guidance on the preparation and assessment of EIARs, within the context of established development consent procedures.

The following EIA regulations and EPA guidelines were considered by AECOM in preparing this EIAR:

- The requirements of EC Directives and Irish Regulations regarding EIA, such as European Union (Planning and Development) (Environmental Impact Assessment) Regulations 2018 (S.I. No. 296/2018), and EIA Directives 2011/92/EU and 2014/52/EU;

- Guidelines on the information to be contained in Environmental Impact Statements, EPA, (Draft August 2017);
- Advice Notes for preparing Environmental Impact Statements, EPA, Draft September 2015;
- Environmental Impact Assessment of Projects – Guidance on the preparation of the Environmental Impact Assessment Report (Directive 2011/92/EU as amended by 2014/52/EU), European Union, 2017; and
- Guidelines for Planning Authorities and An Bord Pleanála on carrying out EIA, August 2018.

In addition to this, a number of specific guidance documents have been used in individual assessments where required. These will be addressed within the policy and legislation section of each assessment topic covered within the EIAR.

Information on the proposed Relevant Action and the receiving environment was obtained through a number of means including:

- Review of existing data for the general area of the site
- Review of previous studies carried out at the site and locality
- Site visits and field surveys
- Aerial photographs
- Meetings with FCC
- Engagement with local communities as part of the Dublin Airport consultation programme

1.5.2 Identifying Potentially Significant Environmental Effects

The Environmental Protection Agency (EPA) draft 'Guidelines on the information to be contained in Environmental Impact Assessment Reports' (2017) (hereafter referred to as 'the EPA Draft Guidelines') states the identification of potential likely significant impacts from different phases of a proposed development should be considered as far as reasonably possible. The environmental assessments for this project have evaluated the effects of the proposed Relevant Action, and the likelihood, extent, magnitude, duration, reversibility and significance of any likely potential impacts of the proposed Relevant Action versus the consented operations.

Specific criteria for each technical discipline has been utilised, giving due regard to the following criteria from the EPA Draft Guidelines:

- The magnitude and spatial extent of the impact (for example geographical area and size of the population likely to be affected);
- The nature of the impact;
- The transboundary nature of the impact;
- The intensity and complexity of the impact;
- The probability of the impact;
- The expected onset, duration, frequency and reversibility of the impact;
- The accumulation of the impact with the impact of other existing and/or approved projects; and
- The possibility of effectively reducing the impact.

1.5.3 Assessment Terminology

In order to provide a consistent approach across the different technical disciplines addressed within the EIA, the following terminology will be used throughout the EIAR. This terminology has been adapted from the EPA Draft Guidelines. Where individual environmental topics use different terminology due to specific guidance or legislative requirements, this will be described further in that section.

To define residual effects (i.e. the effect after the application of any required additional mitigation measures), the following terminology will be used:

- Positive Effects – A change which improves the quality of the environment (for example, by increasing species diversity; or improving the reproductive capacity of an ecosystem, or by removing nuisances or improving amenities).
- Negative/Adverse Effects – A change which reduces the quality of the environment (for example, lessening species diversity or diminishing the reproductive capacity of an ecosystem; or damaging health or property or by causing nuisance).
- Neutral Effects – No effects or effects that are imperceptible, within normal bounds of variation or within the margin of forecasting error.

When addressing the duration of an effect, the following terminology will be used:

- Momentary Effects – Effects lasting from seconds to minutes
- Brief Effects – Effects lasting less than a day
- Temporary Effects – Effects lasting less than a year
- Short-term Effects – Effects lasting one to seven years
- Medium-term Effects – Effects lasting seven to fifteen years
- Long-term Effects – Effects lasting fifteen to sixty years
- Permanent Effects – Effects lasting over sixty years
- Reversible Effects – Effects that can be undone, for example through remediation or restoration
- Frequency of Effects – Describe how often the effect will occur (once, rarely, occasionally, frequently, constantly – or hourly, daily, weekly, monthly, annually)

The extent and context of an effect will also be described as this can affect the perception of significance. These terms are defined as:

- Extent – Describe the size of the area, the number of sites, and the proportion of a population affected by an effect.
- Context – Describe whether the extent, duration, or frequency will conform or contrast with established (baseline) conditions (is it the biggest, longest effect ever?)

Where adverse or beneficial effects are identified, these will be assessed against the following scale:

- Imperceptible – An effect capable of measurement but without significant consequences.
- Not significant – An effect which causes noticeable changes in the character of the environment but without significant consequences.
- Slight Effects – An effect which causes noticeable changes in the character of the environment without affecting its sensitivities.
- Moderate Effects – An effect that alters the character of the environment in a manner that is consistent with existing and emerging baseline trends.
- Significant Effects – An effect which, by its character, magnitude, duration or intensity alters a sensitive aspect of the environment.
- Very Significant – An effect which, by its character, magnitude, duration or intensity significantly alters most of a sensitive aspect of the environment.
- Profound Effects – An effect which obliterates sensitive characteristics.

Finally, the probability of an effect should be defined to establish how likely it is to occur.

- Likely Effects – The effects that can reasonably be expected to occur because of the planned project if all mitigation measures are properly implemented.
- Unlikely Effects – The effects that can reasonably be expected not to occur because of the planned project if all mitigation measures are properly implemented.

1.5.4 Significance Criteria

For each technical EIAR chapter, the classification and significance of effects will be evaluated with reference to definitive standards, accepted criteria and legislation where available. Where it has not been possible to quantify effects, qualitative assessments will be carried out, based on professional opinion and professional judgement. Where uncertainty exists, this will be noted in the relevant EIAR chapter.

For each topic, the technical assessment will consider the magnitude of impacts and the sensitivity of the resources / receptors that could be affected in order to classify the effect. Each environmental factor and technical discipline will have its own method based on various standards and approaches, which will be detailed in a transparent and understandable way within the EIAR chapter.

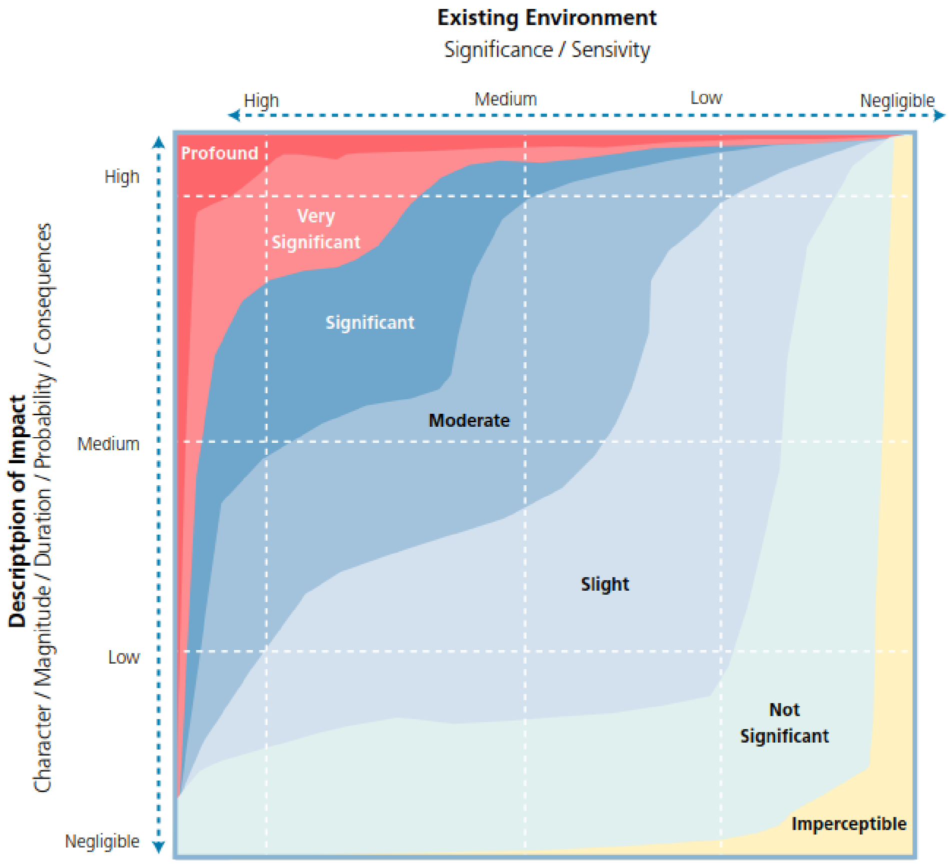


Figure 1-2 Determination of the Significance of an Effect (EPA, 2017)

In general, residual effects found to be 'significant', 'very significant' or 'profound' are deemed to be 'significant effects'. Effects found to be 'moderate' and 'slight' are considered to not be significant effects 'Not significant' and 'imperceptible' effects are considered to not be significant.

1.6 Cumulative Effects

The EIA Directive states an Environmental Impact Assessment Report (EIAR) should contain:

> '*A description of the likely significant effects of the project on the environment resulting from…the cumulation of effects with other existing and/or approved projects, taking into account any existing environmental problems relating to areas of particular environmental importance likely to be affected or the use of natural resources*.'

The Directive makes clear that the description of the likely significant effects should cover their cumulative effects. The Environmental Protection Agency's draft 'Guidelines on the information to be contained in Environmental

Impact Assessment Reports' (hereafter referred to as 'the EPA Draft Guidelines') explains that cumulative effects are '*the addition of many minor or significant effects, including the effects of other projects, to create larger, more significant effects'*.

Cumulative effects consider the impacts of other undeveloped permitted projects and reasonably foreseeable development within the vicinity and context of the project. This will include other projects planned by daa, and any known permitted or planned projects by third parties. *Chapter 21: Interaction and Cumulative Effects*, assesses the cumulative and in-combination effects associated with the proposed Relevant Action. These two types of environmental effects are defined as:

- In-combination Effects - Interrelationships that occur between the individual environmental effects of the proposed Relevant Action and the way that these effects have the potential to combine together to cause cumulative effects with one another at certain sensitive locations and lead to significant effects; and
- Cumulative Effects - The potential for effects of the proposed Relevant Action to combine with effects from other projects in the vicinity and lead to significant effects.

The receiving environment of the proposed Relevant Action within which any potential effects of the proposed Relevant Action may combine with the effects arising from other developments will be determined on the basis of the maximum study areas of the technical assessments considered within the EIAR.

A long list of schemes included in the cumulative effects assessment has been identified and filtered to short list 'other developments' for purposes of the assessment of cumulative effects together with the proposed Relevant Action. Each technical assessment within the EIAR has considered which of these schemes may result in cumulative effects together with the proposed Relevant Action from the perspective of the relevant technical assessment.

Interaction with other schemes and transboundary effects has also been considered after further detail is provided within *Chapter 21: Cumulative Effects*, of this EAIR.

1.7 Scenarios Assessed

The existing operations at Dublin Airport are described in Chapter 3 of this EIAR. The following sections describe the proposed Relevant Action at Dublin Airport which are the subject of this application.

The assessment focusses on a comparison between the future permitted baseline (2022 constrained) and the proposed (unconstrained) operational scenario relating to the amendment to Condition 3(d) and the replacement of Condition 5. The future years assessed across the technical topics include 2022 and 2025.

The existing baseline (2018), is evaluated as this provides an empirical description of the effects when the airport was close to 32mppa. 2018 is also the existing baseline year examined in detail in the noise chapters.

1.7.1 Permitted / Constrained Scenario

The permitted scenario assessed in this EIAR is that with Conditions 3d and 5 in place in the future years 2022 and 2025 (ie constrained).

1.7.2 Proposed / Unconstrained Scenario

In the proposed scenario, it assumes the planning conditions imposed under the North Runway Permission are implemented at Dublin Airport, with the exception of Condition 3(d) and 5 (ie the proposed / unconstrained scenario).

The year of opening is 2022, the year that North Runway is planned to be operational in; with the future assessment years defined as:

- 2022 – the year in which North Runway is expected to be operational
  - 2022 constrained / permitted; and
  - 2022 unconstrained / proposed
- 2025 – the first year 32 mppa is forecast to be reached with North Runway operations
  - 2025 constrained / permitted; and

– 2025 unconstrained / proposed.

The year of predicted maximum environmental effects during operational phase will consider the year(s) of highest use of the runway system and associated emissions i.e the year when 32mppa will be reached but not exceeded (predicted to be 2025).

Table 1-1 below is taken from the Mott MacDonald Report (Quantification of Impacts on Future Growth, Update 2022 - 2025 Period') which sets out the predicted Annual Traffic Movements (ATMs) and Annual Passengers (PAX) for the future baseline (constrained and unconstrained) ATM and PAX numbers assessed in this EIAR:

Table 1-1 Annual Traffic Impact

Annual Traffic Impact – High Growth Case (Night Restriction constraints)

Annual Passengers (m)

Year	Unconstrained	Constrained	Difference
2018	31.5	31.5	0.0
2019	32.9	32.9	0.0
2020	8.2	8.2	0.0
2021	20.7	20.7	0.0
2022	29.6	28.7	-0.9
2023	30.4	29.3	-1.1
2024	31.2	30.1	-1.1
2025	32.0	30.9	-1.1

Annual ATMs (000s)

Year	Unconstrained	Constrained	Difference
2018	233	233	
2019	241	241	
2020			
2021			
2022	229	223	-5.8
2023	233	226	-7.1
2024	237	229	-7.8
2025	241	233	-7.8

1.8 Format of the EIAR

This EIAR was prepared as part of the EIA process, which includes a baseline assessment to determine the status of the existing receiving environment, impact prediction and evaluation, and determining appropriate mitigation measures, including monitoring and reinstatement where appropriate.

This EIAR has been prepared according to the 'Grouped Format Structure' as outlined in the EPA's 'Guidelines on the information to be contained in Environmental Impact Statements' (EPA, 2002), and as evolved in 'Guidelines on the information to be contained in Environmental Impact Assessment Reports' (EPA, 2017).

The EIAR is divided into 21 chapters as follows:

- Chapter 1: Introduction
- Chapter 2: Characteristics of the Project
- Chapter 3: Background and Need for the Project
- Chapter 4: Examination of Alternatives
- Chapter 5: Consultation
- Chapter 6: Planning and Development
- Chapter 7: Population and Human Health
- Chapter 8: Major Accidents and Disasters
- Chapter 9: Traffic and Transportation
- Chapter 10: Air Quality
- Chapter 11: Climate and Carbon
- Chapter 12: Water
- Chapter 13: Air Noise and Vibration
- Chapter 14: Ground Noise and Vibration
- Chapter 15: Biodiversity (Terrestrial)
- Chapter 16: Biodiversity (Aquatic)
- Chapter 17: Landscape and Visual
- Chapter 18: Land and Soils
- Chapter 19: Material Assets

- Chapter 20: Cultural Heritage
- Chapter 21: Interaction and Cumulative Impact

A Non-Technical Summary of this EIAR has also been prepared.

1.9 Difficulties Encountered

Preparation of this EIAR has been ongoing for many months. In March 2020 it became apparent that the Covid-19 pandemic was having a significant impact on global aviation. The immediate impacts were severe and in the short-medium term these impacts will continue to manifest themselves in reduced air traffic demand in Ireland and globally.

After the severe disruption to air travel in 2020 and anticipated partial recovery in 2021, demand is assumed to recover to 90% of 2019 levels by 2022 and grow to 32m annual passengers by 2025. There is uncertainty with any forecast at this time, however, it is reasonable to plan for a return to pre-Covid air traffic levels by 2025. This is discussed further in Chapter 3: Need for the project.

1.10 The Project Team

This EIAR has been prepared by an EIA team appointed by the Applicant. The EIA process requires a multi-disciplinary approach due to the varied environment topics that could be affected by the proposed Relevant Action. Specialists within each relevant field have contributed to the assessment as set out in Table 1-2 below.

Table 1-2 The Project Team

Role	Organisation
EIAR co-ordination and preparation (Peta Donkin BSc (Hons) AIEMA) Environmental topic specialists: • Population and Human Health (David Widger BSc (Hons) MSc (Econ)) • Traffic and Transport (Colin Acton BEng CEng MIEI MCIHT) • Air Quality (Gareth Hodgkiss BSc MSc MIEnvSc MIAQM) • Climate and Carbon (Ian Davies BA (Hons)) • Landscape and Visual (Jorge Schulze) • Biodiversity, Flora and Fauna (Terrestrial) Tony Marshall BSc (Hons), MCIEEM • Biodiversity (Aquatic) Tony Marshall BSc (Hons), MCIEEM • Water (Drainage) (Anthony Dale BSc (Eng) Dip Eng CEng MIEI) • Land and Soils (Edel O'Hannelly) • Material Assets (Peta Donkin BSc (Hons) AIEMA) • Cultural Heritage (David Kilner) • Interaction and Cumulative Impact (Peta Donkin BSc (Hons) AIEMA)	AECOM Ireland Limited
Planning Consultants (Gavin Casey BSs MRUP MIPI)	Tom Phillips + Associates (TPA)
Air Quality & Odour (Stephen Moorcroft)	AECOM Ireland Limited joint venture with Air Quality Consultants Ltd (AQC)
Hazard and Risk (Dr Mark Eddowes MA DPhil (Oxon))	Eddowes Aviation Safety Ltd
Air Noise and Vibration	Bickerdike Allen Partners LLP

Role	Organisation
Ground Noise and Vibration (Nick Williams BSc (Hons) MSc MIOA and David Charles BSc (Hons) Pg Dip MIOA	
Greenhouse gas modelling	Airport Footprints Ltd
Regulation 598 Assessment and Cost Effectiveness Analysis	Ricondo
Impact on Future Growth	Mott MacDonald
Economic Impact	InterVISTAS
Annual Night Quota System proposals	Anderson Acoustics

Chapter 02: Characteristics of the Project

02

2. Characteristics of the Project

2.1 Project Description

2.1.1 Introduction

This report relates to an application for a proposed Relevant Action to be taken in accordance with Section 34C(1)(a) of the PDA, to amend and replace two planning conditions, namely conditions no. 3(d) and 5 of the North Runway Planning Permission (Fingal County Council Reg. Ref. No. F04A/1755; ABP Ref. No.: PL06F.217429, 'the North Runway Permission'), which limit access or reduces the operational capacity of Dublin Airport. The Aircraft Noise (Dublin Airport) Regulation Act 2019 (the **Aircraft Noise Act**) further implements EU Regulation 598/2014 on the establishment of rules and procedures with regard to the introduction of noise related operating restrictions at European Union Airports within the Balanced Approach. The Aircraft Noise Act amends the Planning and Development Act, as amended (PDA) to cater for revoking, amending or replacing operating restrictions at Dublin Airport.

The Aircraft Noise (Dublin Airport) Regulation Act 2019 also sets out a process of Aircraft Noise Regulation whereby the competent authority shall ensure that the Balanced Approach is adopted where a noise problem at the airport has been identified and to that end further ensure that as appropriate a noise abatement objective (NAO) is defined.

The NAO will be set in due course by the Aircraft Noise Competent Authority (ANCA) established under the 2019 Act. In order to provide the necessary supporting documentation to allow ANCA to carry out their assessment, daa have developed a candidate NAO (cNAO) to provide a basis for assessment of the proposed aircraft noise reduction measures assessed in the Aircraft Noise Regulation assessment that accompanies this Relevant Action application.

A baseline year of 2018 was chosen for the cNAO. The summary objective of the cNAO states:

"To limit and reduce the adverse effects of long-term exposure to aircraft noise, including health and quality of life, so that long-term noise exposure, particularly at night, does not exceed the situation in 2018. This should be achieved through the application of the Balanced Approach"

A "relevant action" is defined in section 34C of the Planning and Development Act 2000 as inserted by section 11 of the Aircraft Noise (Dublin Airport) Regulation Act 2019 as:

a. "*to revoke an operating restriction,*

b. *to amend the terms of an operating restriction in the manner specified in the application,*

c. *to replace an operating restriction with an alternative operating restriction specified in the application,*

d. *To take an action referred to in para (a), (b) or (c) together with introducing new noise mitigation measures or revoking, revoking and replacing, or amending the terms of, existing noise mitigation measures, or a combination thereof,*

e. *if the relevant application relates to 2 or more relevant operating restrictions, to take any combination of any of the actions referred to in paragraphs (a) to (d), or*

f. *to take an action referred to in paragraph (a), (b), (c), (d) or (e) together with revoking, revoking and replacing, or amending the terms of, a condition of the relevant permission*;"

The relevant noise related operating restrictions which currently apply to the North Runway permission are set out in full in paragraphs 2.1.11 to 2.1.15 below. In summary they provide as follows:

- No use of North Runway at night (2300 to 0700). - This is provided for in Condition 3d of the North Parallel Runway Planning Permission (FCC Reg. Ref. F04A/1755; ABP Ref: PL06F.217429).
- The Crosswind runway can be only used for essential purposes. - This is provided for in Condition 4 of the North Parallel Runway Planning Permission (FCC Reg. Ref. F04A/1755; ABP Ref: PL06F.217429).
- A limit on the number of aircraft movements at the airport at night (2300 to 0700) to 65/night. - This is provided for in Condition 5 of the North Parallel Runway Planning Permission (FCC Reg. Ref. F04A/1755; ABP Ref: PL06F.217429).

Section 34C(1)(a) provides that "*The person in whose favour a relevant permission operates may, by virtue of this subsection and notwithstanding any other provision of this Act (including section 34), make an application under section 34 to the planning authority where the application is only for a relevant action to be taken*."

The proposed Relevant Action relates to the night-time use of the runway system at Dublin Airport. It involves the amendment of the operating restriction set out in condition no. 3(d) and the replacement of the operating restriction in condition no. 5 of the North Runway Planning Permission, as well as proposing new noise mitigation measures. Conditions no. 3(d) and 5 have not yet come into effect or operation, as the construction of the North Runway on foot of the North Runway Planning Permission is ongoing.

The proposed relevant action does not seek any amendment of conditions of the North Runway Planning Permission governing the general operation of the runway system (i.e., conditions which are not specific to night-time use, namely conditions no. 3 (a), 3(b), 3(c) and 4 of the North Runway Planning Permission) or any amendment of permitted annual passenger capacity of the Terminals at Dublin Airport. Condition no. 3 of the Terminal 2 Planning Permission (Fingal County Council Reg. Ref. No. F04A/1755; ABP Ref. No. PL06F.220670) and condition no. 2 of the Terminal 1 Extension Planning Permission (Fingal County Council Reg. Ref. No. F06A/1843; ABP Ref. No. PL06F.223469) provide that the combined capacity of Terminal 1 and Terminal 2 together shall not exceed 32 million passengers per annum.

The result of the permitted / constrained scenario coming into effect when North Runway becomes operational in 2022, is a loss of air traffic movements and associated loss of 1.1m passengers per year (-3.5%) and a cumulative loss over the 4-year period 2022-2025 of 4.3m passengers. The net effect of the proposed Relevant Action would be to facilitate an increase in the number of flights permitted to take off from, or land at, Dublin Airport at night, which would enable the lost 1.1million passengers to be regained annually in the post-COVID-19 recovery period.

2.1.2 Proposed Development in Detail

The proposed Relevant Action, if permitted, would be to remove the numerical cap on the number of flights permitted between the hours of 11pm and 7am daily that is due to come into effect in accordance with the North Runway Permission and to replace it with an annual night-time noise quota between the hours of 11.30pm and 6am and also to allow flights to take off from and/or land on the North Runway (Runway 10L 28R) for an additional 2 hours i.e. 2300 hrs to 2400hrs and 0600 hrs to 0700 hrs. Overall, this would allow for an increase in the number of flights taking off and/or landing at Dublin Airport between 2300 hrs and 0700 hrs over and above the number stipulated in condition no. 5 of the North Runway Planning Permission, in accordance with the annual night-time noise quota.

2.1.2.1 Condition 3(d) of the North Runway Permission

The relevant action pursuant to Section 34C(a) is to amend condition no. 3(d) of the North Runway Planning Permission (Fingal County Council Reg. Ref. No. F04A/1755; ABP Ref. No.: PL06F.217429 as amended by Fingal County Council F19A/0023, ABP Ref. No. ABP-305289-19). Condition 3(d) and the exceptions at the end of Condition 3 state the following:

'3(d). Runway 10L-28R shall not be used for take-off or landing between 2300 hours and 0700 hours.

except in cases of safety, maintenance considerations, exceptional air traffic conditions, adverse weather, technical faults in air traffic control systems or declared emergencies at other airports.'

Permission is being sought to amend the above condition so that it reads:

'Runway 10L-28R shall not be used for take-off or landing between 0000 hours and 0559 hours

except in cases of safety, maintenance considerations, exceptional air traffic conditions, adverse weather, technical faults in air traffic control systems or declared emergencies at other airports or where Runway 10L-28R length is required for a specific aircraft type.'

The net effect of the proposed change, if permitted, would change the normal operating hours of the North Runway from the 0700hrs to 2300 hrs to 0600 hrs to 0000 hrs.

2.1.2.2 Condition 5 of the North Runway Permission

The relevant action also is to replace condition no. 5 of the North Runway Planning Permission (Fingal County Council Reg. Ref. No. F04A/1755; ABP Ref. No.: PL06F.217429 as amended by Fingal County Council F19A/0023, ABP Ref. No. ABP-305289-19) which provides as follows:

‘5. On completion of construction of the runway hereby permitted, the average number of night time aircraft movements at the airport shall not exceed 65/night (between 2300 hours and 0700 hours) when measured over the 92 day modelling period as set out in the reply to the further information request received by An Bord Pleanála on the 5th day of March, 2007.

***Reason**: To control the frequency of night flights at the airport so as to protect residential amenity having regard to the information submitted concerning future night time use of the existing parallel runway.’*

With the following:

A noise quota system is proposed for night-time noise at the airport. The airport shall be subject to an annual noise quota of 7990 between the hours of 2330hrs and 0600hrs.

In addition to the proposed night-time noise quota, the relevant action also proposes the following noise mitigation measures:

- A noise insulation grant scheme for eligible dwellings within specific night noise contours
- A detailed Noise Monitoring Framework to monitor the noise performance with results to be reported annually to the Aircraft Noise Competent Authority (ANCA), in compliance with the Aircraft Noise (Dublin Airport) Regulation Act 2019.

2.1.2.3 The Proposed Quota Count System

A Quota Count (QC) system is designed to limit the overall amount of noise produced by aircraft using an airport based on an allowable Annual Noise Quota (ANQ) for a given time period. A QC value is assigned to each individual aircraft movement based on the certified noise level of that aircraft. Lower QC values are attributed to aircraft with lower noise levels, higher values to noisier aircraft. The QC accumulates for each air traffic movement (ATM) against the Annual Night Quota (ANQ) across the chosen time period. As such, the system allows a greater number of quieter aircraft movements within a given quota thereby encouraging the use of quieter aircraft at the airport.

An Annual Night Quota (ANQ) has been developed for the period 23:30 to 06:00 (known as the Night Quota Period (NQP)) consistent with airports operating similar QC based systems. An ANQ of 7,990 is proposed to apply for each year from the opening of the North Runway to 2025 to facilitate growth back to pre-COVID-19 levels up to 32million passengers per annum (mppa). This total ANQ has been derived using a QC value of 0.49 per ATM and based on the number of forecast Air Traffic Movement (ATMs) in 2025. This represents a reduction in QC value per ATM from 2018 which was 0.52 per ATM. Details of the ANQ calculations and methodology are provided in the document, ‘Dublin Airport, Developing a Proposed Night Quota System’ by Anderson Acoustics, which forms part of the planning application package.

The proposed change from the night-time aircraft movement cap of 65 movements per night to the ANQ, will allow growth in overall air traffic movements at night whilst ensuring that the overall effects of aircraft noise do not exceed those in 2018 in accordance with the cNAO. This is the result of airlines updating the fleet operating at Dublin Airport to comprise more quieter aircraft.

In addition to the above, it is proposed that a noise monitoring framework will be put in place at the airport to monitor, assess and report across a number of key noise metrics and to demonstrate ongoing compliance with the Noise Abatement Objective (NAO) for the airport once it has been defined by ANCA.

2.1.2.4 Proposed Noise Mitigation

A separate Regulation 598, Balanced Approach assessment has been undertaken for the Relevant Action and is submitted as part of the planning application.

The Regulation 598 assessment is used to inform the noise measures for the proposed Relevant Action and the Alternatives assessment. daa propose to introduce the following noise mitigation measures:

2.1.2.5 A Night Noise Insulation Scheme

An Insulation Grant of €20,000 for dwellings:

- Forecasted to be exposed to night-time noise levels of at least 55 dB L_{night} in 2025 or

- Forecasted to be exposed to noise levels greater than 50 dB L_{night} in 2022 arising from a change of at least 9 dB when compared with 2018.

Eligibility within the 55 dB L_{night} contour will be reviewed every 2 years with revised forecasts.

The night noise insulation scheme is considered additional to the existing daytime noise insulation scheme currently provided in accordance with Condition 7 of North Runway planning permission.

A detailed framework for monitoring the noise performance with respect to the Noise Abatement Objective (NAO), when it has been defined, will be implemented. Performance will be reported annually to the Aircraft Noise Competent Authority (ANCA), in compliance with the Aircraft Noise (Dublin Airport) Regulation Act 2019.

2.1.2.6 The Balanced Approach

The application as proposed will seek to amend Condition 3d and replace Condition 5 of the North Runway Permission. An assessment of the International Civil Aviation Organisation (ICAO) Balanced Approach is required under the Aircraft Noise (Dublin Airport) Regulation Act 2019. The principle of the “balanced approach” to aircraft noise management was adopted by the ICAO Assembly in 2011. The Balanced Approach consists of identifying any noise problem that may exist at a specific airport and analysing various measures available to reduce noise through the exploration of various measures which can be classified into four principal elements, described in Figure 2-2 below. The process of identifying a noise problem and developing a Noise Abatement Objective (NAO) under the 2019 Noise Regulations will be undertaken by the competent authority (ANCA) in due course.

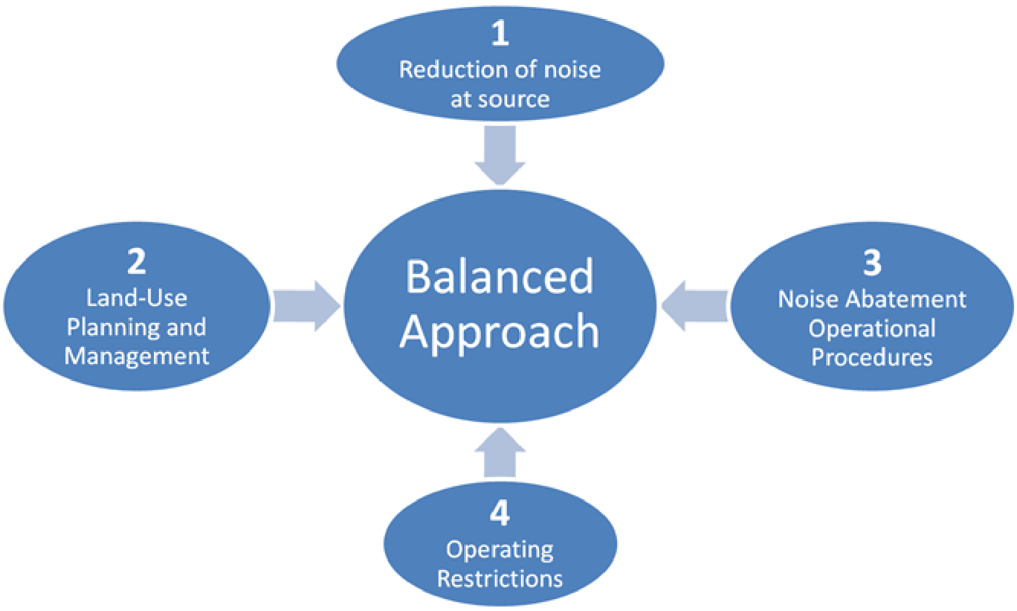


Figure 2-1 The four principal elements of the Balanced Approach to Aircraft Noise Management

The proposed Relevant Action relates to the night-time use of the runway system at Dublin Airport. It involves the amendment of the operating restriction set out in condition no. 3(d) and the replacement of the operating restriction in condition no. 5 of the North Runway Planning Permission, with no changes to the permitted infrastructure of North Runway which is under construction. The design and construction of North Runway will be as consented in 2007 and as amended in 2019. The proposed Relevant Action is therefore best considered within the focus of the use of the runway system and in particular the use of the runways during the night period of 2300 to 0700.

During the operational phase, it is intended that the crosswind runway (16/34) will predominantly be used as a taxiway. The existing ‘Dual Runway Operations’ (i.e. departures from both the existing main runway (28) and the crosswind runway (34) when weather conditions allow during the hours of 0630 – 0800 local time) will cease. The use of crosswind runway (16/34) for take-offs and landings will be for essential use only, as specified by Condition 4. There is no intention to review this operating restriction or to amend condition 4, in the Relevant Action application.

2.2 Construction Phase

The proposed Relevant Action comprises a change in operating restrictions and will involve no construction works or changes to the consented physical infrastructure of North Runway or any other areas of the airport. This application for the proposed Relevant Action has no construction phase element for assessment.

2.3 Operational Phase

The proposed Relevant Action involves amendment or replacement of the operating restrictions on the use of runway system at night, which would result in additional night flights above the number permitted under Condition 5 of the North Runway permission. The use of the runway system during the daytime will be as per Condition 3a-c of the North Runway permission.

2.4 Main Scenarios Assessed

The existing operations at Dublin Airport are described in Chapter 3 of this EIAR. The following sections describe the proposed Relevant Action at Dublin Airport which are the subject of this application.

The assessment focusses on a comparison between the future permitted baseline (2022 constrained) and the proposed (unconstrained) operational scenario relating to the amendment to Condition 3(d) and the replacement of Condition 5. The future years assessed across the technical topics include 2022 and 2025.

The existing baseline (2018), is evaluated as this provides an empirical description of the effects when the airport was close to 32mppa. 2018 is also the existing baseline year examined in detail in the noise chapters.

2.4.1 Permitted / Constrained Scenario

The permitted scenario assessed in this EIAR is that with Conditions 3d and 5 in place in the future years 2022 and 2025 (i.e. constrained).

2.4.2 Proposed/Constrained Scenario

In the proposed scenario, it assumes the planning conditions imposed under the North Runway Permission are implemented at Dublin Airport, with the exception of Condition 3(d) and 5 (i.e. the proposed / unconstrained scenario).

The year of opening is 2022, the year that North Runway is planned to be operational in; with the future assessment years defined as:

- 2022 – the year in which North Runway is expected to be operational
  - 2022 constrained / permitted; and
  - 2022 unconstrained / proposed
- 2025 – the first year 32 mppa is forecast to be reached with North Runway operations
  - 2025 constrained / permitted; and
  - 2025 unconstrained / proposed.

The year of predicted maximum environmental effects during operational phase will consider the year(s) of highest use of the runway system and associated emissions i.e the year when 32mppa will be reached but not exceeded (predicted to be 2025).

2.5 Description of Operations

Permitted Runway Usage (as per the North Runway Permission Fingal County Council Reg. Ref. No. F04A/1755; ABP Ref. No.: PL06F.217429**)**

Future Runway usage is determined by Conditions 3 (a-d), 4 and 5 of the North Runway planning permission, which dictates the usage of runway system. These conditions state:

Condition 3 - On completion of construction of the runway hereby permitted, the runways at the airport shall be operated in accordance with the mode of operation Option 7b as detailed in the Environmental Impact Statement Addendum, Section 16 as received by the planning authority on the 9th day of August, 2004 and shall provide that:

- (a) the parallel runways (10R -28L and 10L-28R) shall be used in preference to the cross runway, 16-34,
- (b) when winds are westerly, Runway 28L shall be preferred for arriving aircraft. Either Runway 28L or 28R shall be used for departing aircraft as determined by air traffic control,
- (c) when winds are easterly, either Runway 10L or 10R as determined by air traffic control shall be preferred for arriving aircraft. Runway 10R shall be preferred for departing aircraft, and
- (d) Runway 10L-28R shall not be used for take-off or landing between 2300 hours and 0700 hours, except in cases of safety, maintenance considerations, exceptional air traffic conditions, adverse weather, technical faults in air traffic control systems or declared emergencies at other airports.
- Reason: In the interest of clarity and to ensure the operation of the runways in accordance with the mitigation measures set out in the Environmental Impact Statement in the interest of the protection of the amenities of the surrounding area.

Condition 4 - The crosswind runway (16-34) shall be restricted to essential occasional use on completion of the new runway in accordance with Objective DA03 of the Fingal County Development Plan, 2005-2011 - international regulations for safety reasons.

- Reason: In the interest of public safety, residential amenity and the proper planning and sustainable development of the area

Condition 5 - On completion of construction of the runway hereby permitted, the average number of night time aircraft movements at the airport shall not exceed 65/night (between 2300 hours and 0700 hours) when measured over the 92 day modelling period as set out in the reply to the further information request received by An Bord Pleanála on the 5th day of March, 2007.

- Reason: To control the frequency of night flights at the airport so as to protect residential amenity having regard to the information submitted concerning future night time use of the existing parallel runway.

Two of these planning conditions (Conditions 3(d) and 5) related to operating restrictions on the use of the runways and overall airport operations at night. Condition 4 of the permission introduces a restriction on the use of the crosswind runway (16/34). For avoidance of doubt there is no intention to apply to amend or replace Condition 4.

Once North Runway is operational, the crosswind runway (16/34) will be used but only for essential use. For the purposes of this EIAR an assumption of use for 1% of aircraft movements was used which is based on the percentage of time it is likely to be essential for use i.e when the crosswind component requires its use. The assumed future runway usage over a given year is summarised in Table 2-1, based on the average runway usage over the last 10 years allowing for the expected reduction in cross runway usage.

Table 2-1 Future Runway Usage

Runway	Arrivals	Departures
10L/10R	29.0%`	29.0%
28L/28R	70.0%	70.0%
16	0.75%	0.75%
34	0.25%	0.25%

2.7 Description of Proposed Operations

The following sections outline the proposed operations at Dublin Airport:

2.7.1 Proposed Runway Usage

Once North Runway is operational the parallel runway will predominately be operated in segregated mode, i.e. one runway for all arrivals, the other for all departures. However, in peak periods, the runways will operate in semi-mixed mode, i.e. one runway used for both arrivals and departures simultaneously and the other runway for arrivals or departures depending on the wind direction. It is not expected that full mixed mode would be required in the assessment years of 2022 and 2025 i.e. both runways used for arrivals and departure at the same time.

Condition 3 a-c states that;

> *On completion of construction of the runway hereby permitted, the runways at the airport shall be operated in accordance with the mode of operation – Option 7b – as detailed in the Environmental Impact Statement Addendum, Section 16 as received by the planning authority on the 9 th day of August, 2005 and shall provide that –*
>
> *(a) the parallel runways (10R-28L and 10L-28R) shall be used in preference to the cross runway, 16-34,*
>
> *(b) when winds are westerly, Runway 28L shall be preferred for arriving aircraft. Either Runway 28L or 28R shall be used for departing aircraft as determined by air traffic control,*
>
> *(c) when winds are easterly, either Runway 10L or 10R as determined by air traffic control shall be preferred for arriving aircraft. Runway 10R shall be preferred for departing aircraft"*

Permission is being sought to amend condition 3 (d) so that it reads:

> *'Runway 10L-28R shall not be used for take-off or landing between 0000 hours and 0559 hours*
>
> *except in cases of safety, maintenance considerations, exceptional air traffic conditions, adverse weather, technical faults in air traffic control systems or declared emergencies at other airports or where Runway 10L-28R length is required for a specific aircraft type.'*

The net effect of the proposed change, if permitted, would change the normal operating hours of the North Runway from the 0700hrs to 2300 hrs to 0600 hrs to 0000 hrs.

Option 7b shall be achieved primarily by segregated mode of operation as follows and illustrated in Figure 2-2:

When winds are westerly (approximately 70% of the time), Runway 28L shall be preferred for arriving aircraft. Runway 28R shall be used for departing aircraft.

When winds are easterly (approximately 30% of the time), Runway 10R shall be preferred for departing aircraft. Runway 10L shall be used for arriving aircraft.

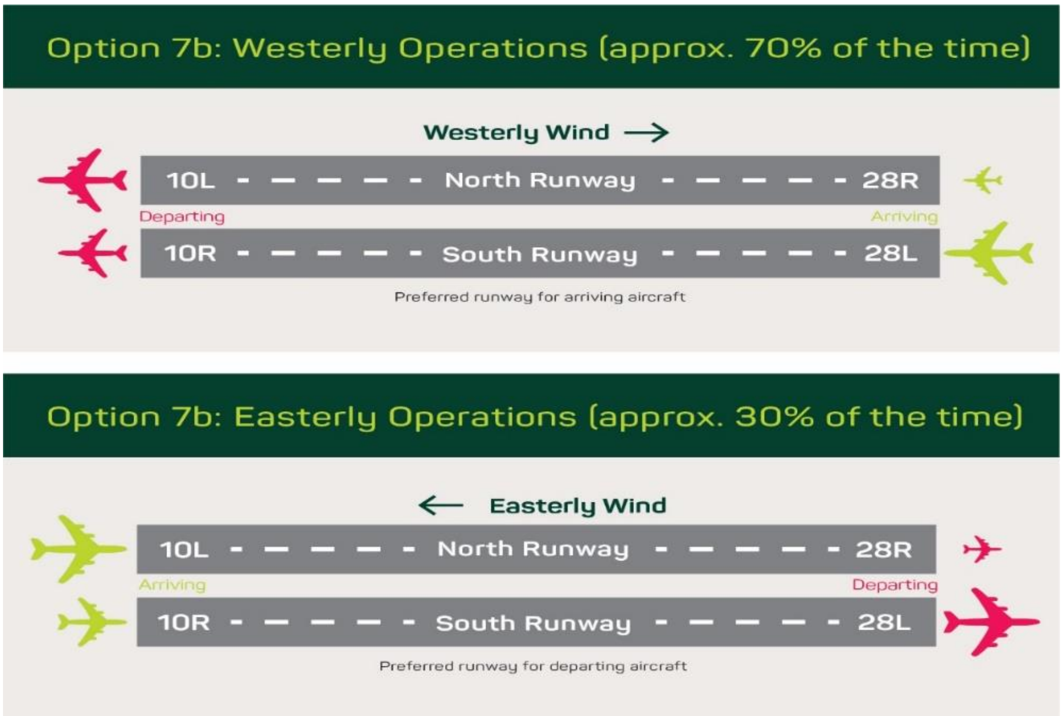


Figure 2-2 Operating Mode 7b

The relevant action also is to replace condition no. 5 of the North Runway Planning Permission which provides as follows:

> *'5. On completion of construction of the runway hereby permitted, the average number of night time aircraft movements at the airport shall not exceed 65/night (between 2300 hours and 0700 hours) when measured over the 92 day modelling period as set out in the reply to the further information request received by An Bord Pleanála on the 5th day of March, 2007.*
>
> ***Reason**: To control the frequency of night flights at the airport so as to protect residential amenity having regard to the information submitted concerning future night time use of the existing parallel runway.'*

With the following:

> *A noise quota system is proposed for night time noise at the airport. The airport shall be subject to an annual noise quota of 7990 between the hours of 2330hrs and 0600hrs.*

In addition to the proposed night time noise quota, the relevant action also proposes the following noise mitigation measures:

- A noise insulation grant scheme for eligible dwellings within specific night noise contours
- A detailed Noise Monitoring Framework to monitor the noise performance with results to be reported annually to the Aircraft Noise Competent Authority (ANCA), in compliance with the Aircraft Noise (Dublin Airport) Regulation Act 2019.

The proposed relevant action does not seek any amendment of conditions of the North Runway Planning Permission governing the general operation of the runway system (i.e., conditions which are not specific to night time use, namely conditions no. 3 (a), 3(b), 3(c) and 4 of the North Runway Planning Permission) or any amendment of permitted annual passenger capacity of the Terminals at Dublin Airport.

Condition no. 3 of the Terminal 2 Planning Permission (Fingal County Council Reg. Ref. No. F04A/1755; ABP Ref. No. PL06F.220670) and condition no. 2 of the Terminal 1 Extension Planning Permission (Fingal County Council Reg. Ref. No. F06A/1843; ABP Ref. No. PL06F.223469) provide that the combined capacity of Terminal 1 and Terminal 2 together shall not exceed 32 million passengers per annum.

Further details around the need for the project are contained within *Chapter 3: The Need for the Project*.

Chapter 03:

Need for the Project

03

3. Need for the Project

3.1 Background

This report relates to an application for a proposed Relevant Action to be taken in accordance with Section 34C(1)(a) of the PDA, to amend and replace two planning conditions, namely conditions no. 3(d) and 5 of the North Runway Planning Permission.

Mott MacDonald was appointed by daa to assess and quantify the traffic impacts of the operating restrictions. The resulting report entitled 'Quantification of Impacts on Future Growth, Update 2022 - 2025 Period' was prepared in September 2020 and informs the following sections of this chapter. The full report is included as part of the planning application for the proposed Relevant Action.

The airport has two main airlines providing the majority of flights: Ryanair (35% share) and Aer Lingus (29% share), based on the Summer 2019 schedule. The airport serves mostly short haul services (90% of flights) to points in the UK and Europe. Long haul services are mainly to North America, plus some services to the Middle East, Asia and Africa.

Demand for night flights between 23:00-07:00 is driven mainly by short haul services operated by aircraft based at Dublin. In order to achieve the high levels of aircraft utilisation necessary for airline competitiveness, based aircraft such as Aer Lingus and Ryanair tend to operate with first departure between 06:00-07:00 and last arrival after 23:00. Other 23:00-07:00 period flights are long haul arrivals in the early morning, and a small number of cargo flights mainly operated by the time-critical package delivery integrators (FedEx, DHL, TNT and UPS).

The 1h time difference between Ireland and mainland Europe means that flights need to leave early (before 07:00) to arrive in time for business passengers to have a full working day at their destination. The geographical position of Dublin Airport means that there are longer sector distances to many European destinations than from other competing airports. This means that Dublin Airport requires longer operating days than competing European hubs. Similarly, Dublin Airport's proximity to North America compared to the rest of Europe means that transatlantic flights arrive earlier in Dublin than at other European airports.

The Dublin night restrictions (Conditions 3d and 5) time period is also unusual in that it includes a peak hour of demand at the airport – 06:00-07:00. Therefore, the impact of the restriction on air traffic as defined under the North Runway Permission and potential future growth is significant.

Pre-COVID 19 levels of demand for night flights (23:00-07:00) was over 100/night, with 113/night associated with regularly scheduled services on a typical busy day in Summer 2019. This is well in excess of 65/night (measured as an average over the 92-day modelling period) that would come into effect under condition 5 of the North Runway Permission.

Demand for 23:00-07:00 night flights is not expected to reduce significantly during the post COVID-19 recovery. The forecast schedules analysed for the Mott MacDonald study require 108/night movements in 2022/23, rising to 113/night when the airport returns to 32m annual passenger traffic levels in around 2025.

The need for night flights at Dublin – driven by the need for airlines to achieve competitive levels of aircraft utilisation, flight connection connectivity, and to support timely air freight services into Ireland – is not diminished for the post COVID air transport scenario.

The Mott MacDonald 2020 study created busy day schedules for the years 2022 and 2025 (when the 32m passenger level is likely to be reached). It modelled the impact of the North Runway operating restrictions (Conditions 3d and 5) and overall runway capacity (operating in compliance with the North Runway Permission on airline schedules, taking into account the impacts on aircraft rotations throughout the day.

The assessed impact is a loss of 3.2% of total air traffic movements in the 24-hour period and associated 1.1m passengers per year (-3.5%) and a cumulative loss over the 4-year period 2022-2025 of 4.3m passengers when compared with the proposed / unconstrained scenario.

The operating restrictions particularly impact on the recovery and growth of the Dublin-based Irish carriers Aer Lingus and Ryanair. The Dublin-based carriers require early morning departures and late evening arrivals for their short haul operations, and Aer Lingus requires early morning arrivals for its transatlantic operations. Non-Irish carriers are less affected by the restrictions as they have proportionately fewer operations in the restricted 23:00-07:00 period.

The operating restrictions constrain growth in short haul operations throughout the day, as the lack of night slots limits the number of Dublin based aircraft that can be accommodated, with each aircraft performing multiple flights during the operating day.

In summary, in the constrained scenario (i.e the North Runway Permission), there is a forecasted 3.2% decrease in flights across a 24-hour period in 2025 and a significant reduction in available night time slots at the airport and associated impacts on air connectivity for Ireland.

The net effect of the proposed relevant action would be to facilitate an increase in the number of flights permitted to take off from, or land at, Dublin Airport at night and enable a return to growth at the airport post Covid-19.

3.2 Need for the Project

3.2.1 General

3.2.1.1 Aircraft Noise (Dublin Airport) Regulation Act 2019

The Aircraft Noise (Dublin Airport) Regulation Act 2019 (the **Aircraft Noise Act**) further implements EU Regulation 598/2014 on the establishment of rules and procedures with regard to the introduction of noise related operating restrictions at European Union Airports within the Balanced Approach. The Aircraft Noise Act amends the Planning and Development Act, as amended (PDA) to cater for revoking, amending or replacing operating restrictions at Dublin Airport.

Fingal County Council has been designated as the competent authority for the purposes of aircraft noise regulation at Dublin Airport by section 3(1) of the Aircraft Noise (Dublin Airport) Regulation Act 2019.

The Aircraft Noise Act amends the PDA by inserting a number of new sections in Part 3 of the PDA, which deals with Control of Development.

3.2.2 Growth in Passenger and Aircraft Numbers

Following a long period of growth between 2000 and 2008, with an average growth rate of 6.9%, the airport experienced significant declines in air travel in 2009 and 2010 due to the global economic downturn. However, since 2010, traffic growth has averaged 6.9% per annum, reaching 31.5 million in 2018 (Figure 3-2).

Passenger traffic at Dublin Airport can be broken down into five categories:

- Domestic;
- United Kingdom;
- Continental Europe;
- Transatlantic; and
- Other International.

The total passenger traffic at Dublin Airport has seen an increase of nearly 53.6% since 2010. As shown in Figure 3-1, of the five areas, the region which has seen the largest growth in passenger traffic since 2010 is Other International - this includes traffic to China, the rest of Asia, Middle East and Africa. Over the past eight years, the passenger traffic on these routes has increased by over 359%, from a small base. Transatlantic traffic has seen a growth of 155% from increased service to the United States and Canada. European and United Kingdom passenger traffic have both increased by 70% and 50% respectively. Domestic traffic, which makes up less than 1% of traffic, has seen a decrease in volume by 83%. This drop is attributable to the fact that the road network within Ireland has seen significant advancements over recent years.

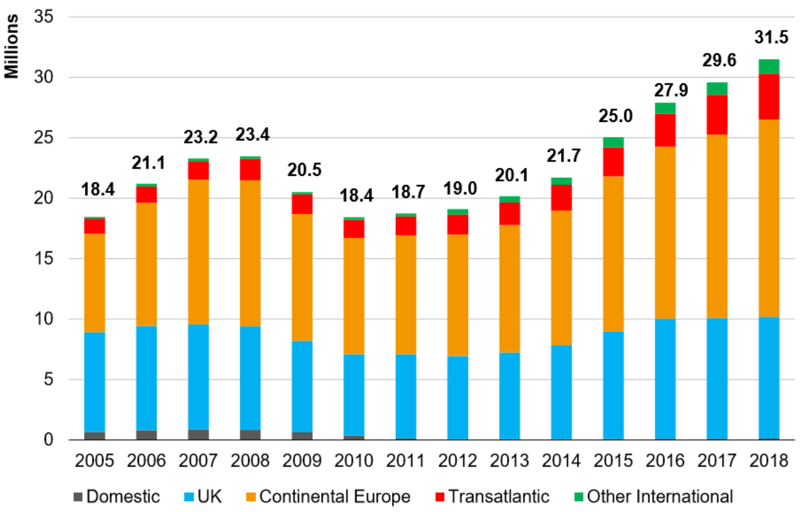


Figure 3-1 Annual Passenger Movements at Dublin International Airport, 2005-2018 (Source 'Dublin Airport Economic Impact of Operating Restrictions', InterVISTAS, 2019)

Figure 3-2 below shows the percentage share of passenger traffic by region in 2018. In terms of the share of passenger traffic by world region, Continental European traffic comprised 52% of all passengers in 2018. The United Kingdom represented 36% of total passengers, followed by Transatlantic at 10%, Other International at 3% and Domestic passenger traffic at less than 1%. Long haul passengers accounted for 15.8% of traffic in 2018 compared with 6.9% in 2015, reflecting the increasing range of destinations served from Dublin Airport.

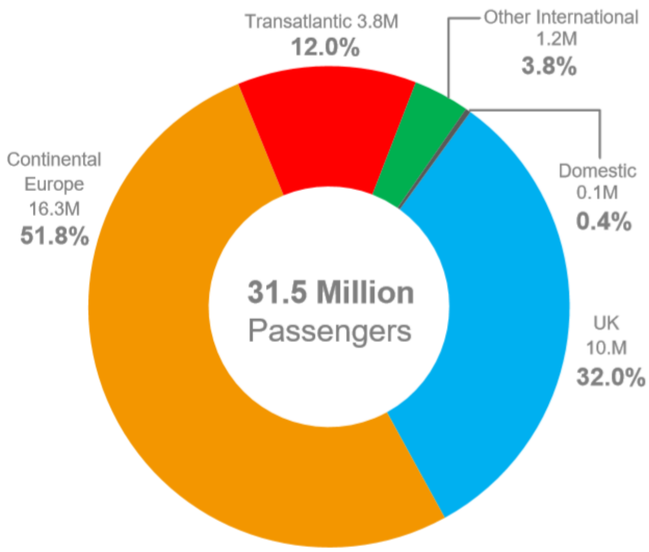


Figure 3-2 Passenger Movements by Region at Dublin Airport, 2018 (Source 'Dublin Airport Economic Impact of Operating Restrictions', 2019 InterVISTAS)

3.2.3 Impacts of Restrictions

Preparation of this EIAR has been ongoing for many months. In March 2020, it became apparent that the Covid-19 crisis was having a significant impact on global aviation. The immediate impacts were severe, and in the short-medium term these impacts will continue to manifest themselves in reduced air traffic demand in Ireland and globally.

The anticipated negative implications of conditions 3(d) and 5 being implemented when North Runway becomes operation in 2022 fall into the following categories:

- Constrained traffic impacts at Dublin Airport;
- Implications for achieving the objectives set in the National Aviation Policy; and

- Forgone economic impacts for the airport and the regional and national economies

3.2.4 Constrained Traffic Impacts at Dublin Airport

The Mott MacDonald study simulated the slot coordination process to create constrained busy day schedules from 2022 (representing when the North Runway is likely to be operational) to 2025 (when the 32m passenger level is assumed to be reached). It modelled the impact of the North Runway operating restrictions (Conditions 3d and 5) and overall runway capacity (operating in compliance with the planning conditions) on airline schedules, taking into account the impacts on aircraft rotations throughout the day.

The assessed impact is a loss of air traffic movements and associated loss in 1.1m passengers per year (-3.5%) and a cumulative loss over the 4-year period 2022-2025 of 4.3m passengers. It should be noted that this estimated impact is a conservative assessment. It assumes that airlines are willing and able to accept alternative slot times outside of the 23:00-07:00 night period, which would be commercially and/or operationally suboptimal. In a post COVID crisis environment, weak passenger demand will mean that airline flexibility is reduced.

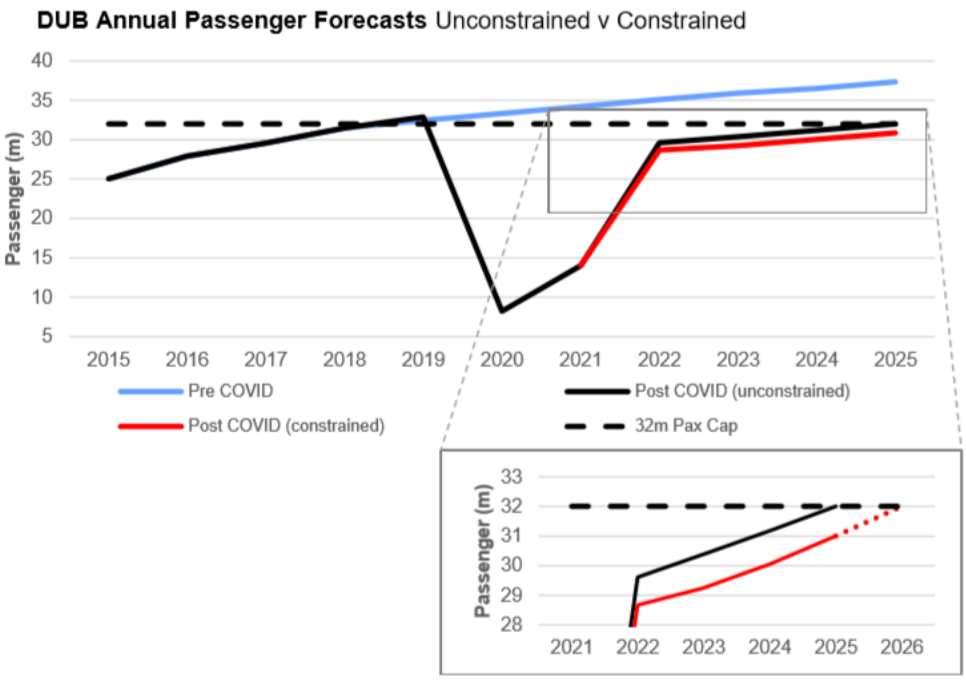


Figure 3-3 Annual Traffic Impact Summary (millions of passengers) (Mott McDonald, 2020)

Dublin Airport is the busiest airport in the Republic of Ireland. In 2018, the airport welcomed 44 airlines which offered scheduled and charter service to over 180 destinations in 40 countries on four continents, and in 2019 the airport welcomed 47 airlines and flights to over 200 destinations. The airport has two main airlines providing the majority of flights: Ryanair (35% share) and Aer Lingus (29% share), based on the Summer 2019 schedule. The airport serves mostly short haul services (90% of flights) to points in the UK and Europe. Long haul services are mainly to North America, plus some services to the Middle East, Asia and Africa.

The night restrictions would slow growth in long haul services for two reasons:

- Many long-haul routes require early morning arrivals in the night restrictions period
- Retiming of flights to avoid the night restrictions period would reduce flight connection possibilities, making some new long-haul services unviable without enough connecting feed traffic.

3.2.5 Implications for Irish National Aviation Policy

The Department of Transport, Tourism and Sport (DTTAS) published a National Aviation Policy (NAP) for Ireland in August 2015. The principal goals of the NAP are:

- Enhance Ireland's connectivity – respond to the needs of businesses, tourism and consumers through safe, secure and competitive access;

- Foster growth of aviation enterprise – support employment in the sector and maintain Ireland's strong tradition and reputation in aviation; and
- Maximise economic contribution of aviation sector – commit to maximising the benefits of aviation to Ireland's economic growth and development.

With regard to the second runway at Dublin Airport, the NAP specifically states that:

> "*The process to develop the second runway at Dublin Airport will commence, to ensure the infrastructure necessary for the airport's position as a secondary hub and operate to global markets without weight restrictions is available when needed*".
>
> (A National Aviation Policy for Ireland, August 2015, Action 4.5.1, page 50).

Results from the assessment carried out by InterVISTAS (discussed further below) found the operating restrictions on passenger traffic and air services at Dublin Airport, which come into force when the North Runway is fully operational, will contradict the aims and commitments of the NAP. The negative effects on both long haul and short haul flights in the constrained schedule will reduce the connectivity and competitiveness of Dublin Airport.

The assessment concluded that, consequently, the decreased traffic and air services result in a reduced economic contribution to the national economy, as documented in Section 3.2.6 below.

3.2.6 Forgone Economic Impacts

As noted earlier, daa appointed InterVISTAS to conduct a study (October 2020) on the overall economic impact of the restrictions on permitted operations, building on work completed by Mott McDonald to assess and quantify the overall traffic impacts of the operating restrictions at Dublin Airport. In its analysis, InterVISTAS considered four distinct categories:

- Direct Economic Impact. The employment, income and economic output associated with the operation and management of activities at the airport including firms on-site at the airport and airport-related businesses located elsewhere near the airport.
- Indirect Economic Impact. The employment, income and economic output generated by industries that supply and support the activities at the airport, such as food wholesalers, fuel refiners, etc.
- Induced Economic Impact. This captures the economic activity generated by the employees of firms directly or indirectly connected to the airport spending their income in the national economy.
- Catalytic Impacts. These capture the way in which the airport facilitates the business of other sectors of the economy. As such, air transportation facilitates employment and economic development in the national economy by facilitating trade, tourism, investment and productivity growth.

The forgone economic impact of the permitted / constrained scenario (the North Runway Permission) in 2022and 2025 are presented in Figure 3-4. The analysis suggests that as a result of the operating restrictions, the Irish economy could forgo an additional 3,430 jobs and €262 million in GVA by 2025, relative to proposed Relevant Action. The majority of this forgone economic impact is expected to occur outside of the aviation sector: 62% of the total impact is catalytic impacts (tourism, trade, investment, etc.) and another 21% are indirect and induced impacts (supplier and spending in the wider economy).

Impact	Number of Jobs	Full-Time Equivalents (FTEs)	Wages (€ Millions)	GVA (€ Millions)
2022 Impact				
Direct	440	390	18	36
Indirect	250	220	10	20
Induced	310	270	11	21
Catalytic	1,810	1,600	69	136
Total	**2,810**	**2,480**	**108**	**213**
2023 Impact				
Direct	540	480	22	45
Indirect	300	270	13	24
Induced	380	330	13	26
Catalytic	1,910	1,690	73	143
Total	**3,130**	**2,770**	**121**	**238**
2024 Impact				
Direct	550	490	23	46
Indirect	330	290	14	26
Induced	390	340	13	27
Catalytic	2,030	1,790	77	151
Total	**3,300**	**2,910**	**127**	**250**
2025 Impact				
Direct	580	520	24	49
Indirect	340	300	14	27
Induced	400	360	14	28
Catalytic	2,110	1,860	81	158
Total	**3,430**	**3,040**	**133**	**262**

All financial figures are in 2020 prices.
Numbers may not add up due to rounding.

Figure 3-4 Foregone Economic Impact resulting from Operating Restrictions

3.3 Patterns of Demand

The analyses of the InterVISTAS study are based on unconstrained forecast busy day schedules. The forecast schedules represent expected traffic in 2022 (shortly after the opening of the new North Runway) and in each year to 2025, when traffic is expected to reach 32m annual passengers again after the COVID-19 traffic disruption.

This pattern of demand provides improved connectivity for the development of Dublin Airport, as well as providing for efficient point-to-point short haul services.

Permitted schedules are constrained by the airport's single runway capacity. With the opening of the North Runway, a greater pattern of demand is expected in the peak 06:00 departures hour (reflecting airlines' commercially and operationally ideal operating times).

Meeting this level of departures demand in the 06:00 hour requires use of the North Runway in the 06:00-06:59 hour.

3.3.1 Current Night Movements

In Summer 2019, there were 113 regularly scheduled flights during the 23:00-07:00 period. Short haul scheduled services make up the bulk of these night flights, with departures between 06:00-07:00 and arrivals after 23:00. There are 17 long haul night arrivals in the early morning. The night cargo operations are primarily flights by the package integrators DHL, FedEx, TNT and UPS operating to their main sortation hubs. These operations are very time-critical in order to connect at these hubs and to achieve an overnight package delivery service.

3.3.2 Future Night Movement Demand

Busy day night movements are expected to decrease slightly with the post COVID-19 traffic downturn, but recover to pre-COVID-19 levels by the time Dublin reaches 32m annual passenger throughput again in 2025. In the Mott McDonald forecast, by 2022, Dublin aircraft movements are assumed to have recovered to 95% of 2019 levels, although passengers have only recovered to around 90% due to reduced load factors and aircraft size in the post COVID recovery period. According to the Mott McDonald Report aircraft movements are forecast to recover fully to 2019 levels by 2025. Night movement demand is reduced in 2022 (compared with 2019) and recovers in line with Dublin aircraft movements.

3.3.3 Summary of Schedule Adjustments

Figure 3-4 and Figure 3-5 below provide a summary of the required schedule adjustments for 2025, when traffic is assumed to return to the 32m annual passenger level.

The reasons for schedule adjustments are detailed in the table below. The primary reason for timing adjustment was the night operating restriction and the knock-on impacts on aircraft rotations, with the volume of such adjustments increasing during the forecast period 2022-2025 as unconstrained demand grows. There are also a number of flights removed from the schedule (‘no slots’) due to the night constraints and knock-on rotational issues.

Slot Allocation Summary
(excl GA flights)

	2025 (32m)Summary	
Cleared OK	525	*70.9%*
Retimed due night	36	*4.9%*
Retimed due a/c rotations	121	*16.4%*
Runway 10min limit	22	*3.0%*
Runway 60min limit	12	*1.6%*
Allocated sub total	716	*96.8%*
No slot due Night	12	*1.6%*
No slot due to a/c rotation	12	*1.6%*
Total	740	*100.0%*

Note: A 'no slot' flight is a flight in the unconstrained demand forecast schedule that cannot be accommodated within the airport's operational constraints, and is thus removed from the constrained forecast schedule.

Figure 3-5 Site Allocation Summary

Timing Adjustment Summary (of flights with slot allocated)

	2025 (32m)
Cleared OK	73.6%
±5 min	2.4%
±10 min	3.8%
±15 min	2.2%
±20-30 min	8.5%
±35-60 min	5.9%
more than ±60 min	3.6%

Figure 3-6 Timing Adjustment Summary (of flights with slot allocated

3.3.4 Conclusion of the need for the project

The proposed Relevant Action relates to the night-time use of the runway system at Dublin Airport. It involves the amendment of the operating restriction set out in condition no. 3(d) and the replacement of the operating restriction in condition no. 5 of the North Runway Planning Permission, as well as proposing new noise mitigation measures. Conditions no. 3(d) and 5 have not yet come into effect or operation, as the construction of the North Runway on foot of the North Runway Planning Permission is ongoing.

The proposed relevant action does not seek any amendment of conditions of the North Runway Planning Permission governing the general operation of the runway system (i.e., conditions which are not specific to night-time use, namely conditions no. 3 (a), 3(b), 3(c) and 4 of the North Runway Planning Permission) or any amendment of permitted annual passenger capacity of the Terminals at Dublin Airport. Condition no. 3 of the Terminal 2 Planning Permission (Fingal County Council Reg. Ref. No. F04A/1755; ABP Ref. No. PL06F.220670) and condition no. 2 of the Terminal 1 Extension Planning Permission (Fingal County Council Reg. Ref. No. F06A/1843; ABP Ref. No. PL06F.223469) provide that the combined capacity of Terminal 1 and Terminal 2 together shall not exceed 32 million passengers per annum.

The result of the permitted / constrained scenario coming into effect when North Runway becomes operational in 2022, is a loss of air traffic movements and associated loss of 1.1m passengers per year (-3.5%) and a cumulative loss over the 4-year period 2022-2025 of 4.3m passengers. The net effect of the proposed Relevant Action would be to facilitate an increase in the number of flights permitted to take off from, or land at, Dublin Airport at night, which would enable the lost 1.1million passengers to be regained annually in the post-COVID-19 recovery period.

In short, the proposed Relevant Action is required to amend two operating restriction which will come into force once North Runway becomes operational, to enable Dublin Airport to facilitate growth back to pre-COVID-19 levels of operation.

Chapter 04: Examination of Alternatives

04

4. Examination of Alternatives

4.1 Introduction

Directive 2014/52/EU of the European Parliament and of the Council of 16 April 2014 which amends Directive 2011/92/EU on the assessment of the effects of certain public and private projects on the environment states an EIAR should contain:

'*A description of the reasonable alternatives (for example in term of project design, technology, location, size and scale) studied by the developer, which are relevant to the proposed project and its specific characteristics, and an indication of the main reasons for selecting the chosen option, including a comparison of the environmental effects*.'

This section outlines the main alternatives considered for the proposed Relevant Action to meet the identified needs outlined in EIAR Chapter 3: Background and Need for the Project. It then gives the main reasons why the final proposal was chosen.

It is important to note that the proposed Relevant Action application relates only to change in operating restrictions, and does not comprise the delivery of any physical infrastructure or construction works Therefore, this EIAR chapter only considers alternatives to the operation of the North Runway and wider runway system.

4.2 Legislative Context

The 2014 EIA Directive was transposed into domestic Irish law on the 1st September 2018 in the form of the European Union (Planning and Development) (Environmental Impact Assessment) Regulations 2018 (hereafter referred to as 'the EIA Regulations').

4.3 Methodology

As mentioned above in *Section 4.1: Introduction,* the EU Directive 2014/52/EU requires the EIAR to provide an assessment of the reasonable alternatives considered. This chapter meets this requirement through the use of the EPA's draft 'Guidelines on the information to be contained in Environmental Impact Assessment Reports' (2017) (hereafter referred to as 'the EPA Draft Guidelines') which outlines different types of alternative that should be considered in an EIAR. These include:

- Do nothing scenario;
- Alternative locations;
- Alternative layouts;
- Alternative designs;
- Alternative processes; and
- Alternative mitigation measures.

The different types of alternatives stated in the EPA Draft Guidelines are used within this chapter and discussed below.

The reasonable alternatives considered by the developer depend on the nature and extent of the project and the objective which the project seeks to achieve, as a result not all of the different types of alternative are considered relevant to the proposed Relevant Action, their relevance and further consideration is detailed in *Section 4.4: Scope of Alternatives to be Considered*.

4.4 Scope of Alternatives to be Considered

4.4.1 Do Nothing Scenario

The do-nothing scenario is the North Runway Permission i.e the permitted / constrained scenario. The North Runway Permission contains 31 planning conditions. Two of these planning conditions (Conditions 3(d) and 5) relate to operating restrictions on the use of the runways and overall number of permitted flights at night, and these are due to come into force once the North Runway is operational in 2022.

Since the North Runway Permission was granted, there was rapid growth in passenger numbers, and the current runway infrastructure was already at capacity at peak times in 2018 and 2019.

Notwithstanding the current situation with Covid-19, there is still a need to safeguard the return to growth in air traffic movements at the airport which means addressing the night-time operating restrictions attached to the North Runway permission.

In summary, in the constrained scenario (i.e the North Runway Permission), there is a forecasted 3.2% decrease in flights across a 24-hour period in 2025 and a significant reduction in available night time slots at the airport and associated impacts on air connectivity for Ireland.

4.4.2 Reasonable Alternative Locations

As the proposed Relevant Action relates only to a change in operating restrictions, and does not comprise the delivery of any physical infrastructure or construction works, it has not been relevant to consider reasonable alternative locations.

4.4.3 Reasonable Alternative Layouts

As the proposed Relevant Action relates only to a change in operating restrictions, and does not comprise the delivery of any physical infrastructure or construction works, it has not been relevant to consider reasonable alternative layouts.

4.4.4 Reasonable Alternative Designs

As the proposed Relevant Action relates only to a change in operating restrictions, and does not comprise the delivery of any physical infrastructure or construction works it has not been relevant to consider reasonable alternative designs.

Alternative flight paths have been assessed, and these are included within the ‘Alternative Processes’ sub-section of this EIAR chapter.

4.4.5 Reasonable Alternative Processes

For alternative processes, the EPA Draft Guidelines, *Section 3.4.6 Alternative processes* state:

“*Within each design solution there can be several different options as to how the processes or activities of the project can be carried out.”*

The following options have been considered by daa under the Regulation 598 Assessment process:

- **Permitted mode of operation:** Alternative modes of operation considered are described further in this EIAR chapter.
- **Alternative flight paths:** Departing aircraft follow specific paths at take-off. Alternative flight paths considered are described further in this EIAR chapter.

Alternatives to restrictions: on operating hours for the night-time period (permitted operations currently prevent the use of the North Runway between 23:00-07:00 hours).

4.4.6 Alternative Mitigation Measures

Section 3.4.7 of the EPA Draft Guidelines also note that: *‘it may be possible to mitigate environmental effects in different ways’*. The proposed Relevant Action relates only to a change in operating restrictions at night time, and does not comprise the delivery of any physical infrastructure or construction works. The consideration of Noise mitigation is also a requirement within Part 2 of the Aircraft Noise (Dublin Airport) Regulation Act 2019, which requires that the competent authority adopt a “Balanced Approach” with regards to noise impacts in particular.

Mitigation measures are discussed by each individual specialist topic throughout this EIAR and discussed in detail in the Dublin Airport North Runway, Regulation 598/2014 (Aircraft Noise Regulation) Forecast Without New Measures and Additional Measures Assessment Report (Hereafter referred to as the Aircraft Noise Regulation 598 Assessment) which will accompany this application for a proposed Relevant Action. The most effective mitigation has been proposed. These measures and the preferred option are outlined in detail the EIAR Chapter 13: Aircraft Noise and Vibration.

4.5 Limitations

As noted above, the proposed Relevant Action relates only to change in operating restrictions. There is no requirement for additional or relocated physical infrastructure or for construction works beyond that already consented by the North Runway Permission. The North Runway is currently being constructed.

In addition to the above, aviation policy, specific aircraft noise regulation (such as the Aircraft Noise (Dublin Airport) Regulation Act 2019), aviation industry requirements and national economics can affect the consideration and viability of alternatives.

4.6 Reasonable Alternatives Considered

4.6.1 Do Nothing Scenario

The first step in considering alternatives is the analysis of the Permitted (Do Nothing) versus Proposed (Do Something) scenarios.

As described in more detail in EIAR Chapter 3: Background and Need for the Project, it is considered that a Do Nothing Scenario would inhibit economic growth, the following distinct categories are highlighted as areas which may be affected by the Do Nothing scenario:

- Direct Economic Impact. The employment, income and economic output associated with the operation and management of activities at the airports including firms located on-site at Dublin Airport and Airport-related businesses located elsewhere.
- Indirect Economic Impact. The employment, income and economic output generated by industries that supply and support the activities at Dublin Airport, such as food wholesalers, fuel refiners, etc.
- Induced Economic Impact. The economic activity generated by the employees of firms directly or indirectly connected to Dublin Airport spending their income in the national economy.
- Catalytic Impacts. These capture the way in which Dublin Airport facilitates the business of other sectors of the economy. Air transportation supports employment and economic development in the national economy by facilitating trade, tourism, investment, and productivity growth.

daa appointed InterVISTAS to conduct a study (October 2020) on the overall economic impact of the restrictions on permitted operations (i.e the North Runway Permission), building on work completed by Mott McDonald to assess and quantify the overall traffic impacts of the operating restrictions at Dublin Airport. The analysis suggests that as a result of the permitted / constrained scenario, the Irish economy could forgo an additional 3,430 jobs and €262 million in GVA by 2025. It should also be noted that the compounding impact of the COVID19 pandemic in combination with the permitted / constrained scenario could increase this economic pressure on the Irish Economy further, for this reason <u>the Do Nothing scenario will not meet the objective of the proposed Relevant Action and is not considered as a feasible alternative scenario.</u>

4.6.2 Alternative Processes and Mitigation

This section briefly describes the various assessment scenarios that have been considered, and any scenario-specific modelling assumptions that have been used.

The modelling of alternatives has focused on the noise from airborne aircraft and aircraft on the runways, which is the main source of noise related to the airport. This is the source of noise that has routinely been modelled in response to the noise mapping requirements of EU Directive 2002/49/EC and informs the Noise Action Plan for the airport. Ground noise has also been assessed for the do nothing scenario and the resulting preferential runway use scenario, and the results of this assessment confirms the relative importance of the noise from airborne aircraft and aircraft on the runways when considering the noise impacts of the airport. These sources are therefore considered sufficient to provide the main reasons for selecting the option chosen.

The methods adopted for the assessment of noise from airborne aircraft and aircraft on the runways are in accordance with the European Civil Aviation Conference Report Doc 29 entitled “Standard Method of Computing Noise Contours around Civil Airports”, 4th Edition.

The Aircraft Noise Regulation 598 Assessment appraised the different noise measures and scenarios available to the airport to determine the feasibility of alternative operations of the runway system at night at Dublin Airport. Mitigation measures that already exist, are currently planned, or are determined not to be practical and/or safe are not considered further as feasible additional scenarios. As a result, the qualitative screening analysis identified three potential additional measures that are recommended for continued evaluation: preferential runway use, respite / alternate runway use and a residential dwelling unit sound insulation grant scheme.

The types found to be feasible were retained for further assessment within the defined specific scenarios that follow in this chapter.

The Aircraft Noise Regulation 598 Assessment identified eight feasible preferential runway use measures. As the proposed Relevant Action does not propose to alter the operation of the runway system during the daytime, all the measures share a common runway use configuration between 07:00 and 22:59:

- When winds are westerly, Runway 28L shall be preferred for arriving aircraft. Either Runway 28L or 28R shall be used for departing aircraft as determined by air traffic control.
- When winds are easterly, either Runway 10L or 10R as determined by air traffic control shall be preferred for arriving aircraft. Runway 10R shall be preferred for departing aircraft.
- The parallel runways (10R-28L and 10L-28R) shall be used in preference to the cross runway, 16-34.

This use pattern is referred to as Option 7b.

Forecast schedules have been produced by daa for both “proposed / unconstrained” and “permitted / constrained” operations for the two future years (2022 and 2025) and form part of this planning application package. These have been processed by the noise consultant (Bickerdike Allen Partners (BAP) and assumptions made where relevant in relation to aircraft type, route usage, dispersion, flight profiles, and performance of future aircraft types. These assumptions are the same for all scenarios assessed. The only difference between the scenarios is the mode of operation on the runway system at night.

In addition to the future scenarios the assessment has been extended to include a comparison with current (2018) activity.

Regarding the split by runway there are a few general terms that it is useful to define at this juncture:

- **Segregated Mode**: Most of the time the airport will operate in segregated mode, i.e. one runway for all arrivals, and the other for all departures.
- **Semi-mixed and Mixed Mode**: In peak hours operating in segregated mode does not provide enough capacity, and therefore semi-mixed or mixed mode may be required. In mixed mode both runways can be used for arrivals and departures. In semi-mixed mode 2 runways are used for departures and one for arrivals.
- **Option 7b**: This is the preferential use of runways. It relates to segregated mode and generally provides that westerly arrivals will use the south runway and easterly arrivals will use the north runway, with departures using the opposite runway.

During semi-mixed mode operations, the choice of runway for departures is based on their departure route. Arrivals will still operate as per Option 7b as much as possible.

The runways use permitted is in accordance with Option 7b when North Runway is operational. As a result, the current operating conditions will result in both runways operating in a segregated mode i.e. one runway will be used for arrivals and the other runway will be used for departures but in semi-mixed mode where required (as per Option 7b).

This mode of operation was assessed in the 2004 EIS as part of the initial North Runway application and subsequently was conditioned by Condition 3 of the North Runway Permission.

A number of alternative modes of operation have been assessed under the Regulation 598 Assessment, in order to determine the optimum scenario.

Because the measures are designed to address night-time noise effects, the difference among the eight measures is the preferred runway use configuration at night. Three preferential runway use scenarios (Scenarios 2, 9 and 10) provide access to both runways between 23:00 and 23:59, and between 06:00 and 06:59 and prefer use of one runway between 00:00 and 05:59. Scenario 10 suggests switching between North Runway and South Runway to provide respite between 00:00 and 05:59. Two preferred runway use scenarios operate in semi-mixed mode (mixed mode for arrivals or departures only) between 23:00 and 06:59 (Scenarios 7 and 8). One scenario maintains Option 7b for 24-hours (Scenario 3), and another proposes Reverse Option 7b during night-time hours (Scenario 4). Scenario 5 suggests alternating between Option 7b and Reverse Option 7b during night-time hours to provide respite.

Table 4-1 below summarises each preferential runway use measure assessed in the Aircraft Noise Regulation 598 Assessment

Table 4-1 Feasible preferential runway use measures

Scenario	Title	Description
Scenario 2	Option 7b and South Runway Only between 00:00 and 05:59	06:00 to 23:59: When winds are westerly, Runway 28L shall be preferred for arriving aircraft. Either Runway 28L or 28R shall be used for departing aircraft as determined by air traffic control. When winds are easterly, either Runway 10L or 10R as determined by air traffic control shall be preferred for arriving aircraft. Runway 10R shall be preferred for departing aircraft. 00:00 to 05:59: Movements preferred on the South Runway only (single runway).
Scenario 3	Option 7b for 24-Hours	24 hours: When winds are westerly, Runway 28L shall be preferred for arriving aircraft. Either Runway 28L or 28R shall be used for departing aircraft as determined by air traffic control. When winds are easterly, either Runway 10L or 10R as determined by air traffic control shall be preferred for arriving aircraft. Runway 10R shall be preferred for departing aircraft.
Scenario 4	Option 7b and Reverse Option 7b between 23:00 and 06:59	07:00 to 22:59: When winds are westerly, Runway 28L shall be preferred for arriving aircraft. Either Runway 28L or 28R shall be used for departing aircraft as determined by air traffic control. When winds are easterly, either Runway 10L or 10R as determined by air traffic control shall be preferred for arriving aircraft. Runway 10R shall be preferred for departing aircraft. 23:00 to 06:59: When winds are westerly, Runway 28R shall be preferred for arriving aircraft. Either Runway 28L or 28R shall be used for departing aircraft as determined by air traffic control. When winds are easterly, either Runway 10L or 10R as determined by air traffic control shall be preferred for arriving aircraft. Runway 10L shall be preferred for departing aircraft.
Scenario 5	Option 7b and Alternate Option 7b and Reverse Option 7b between 23:00 and 06:59	07:00 to 22:59: When winds are westerly, Runway 28L shall be preferred for arriving aircraft. Either Runway 28L or 28R shall be used for departing aircraft as determined by air traffic control. When winds are easterly, either Runway 10L or 10R as determined by air traffic control shall be preferred for arriving aircraft. Runway 10R shall be preferred for departing aircraft. 23:00 to 06:59: Preferred arrival runway will alternate between North and South Runways while either Runway 28L or 28R shall be used for departing aircraft as determined by air traffic control in westerly and preferred departure runway will alternate between North and South Runways while either Runway 10L or 10R as determined by air traffic control shall be preferred for arriving aircraft in easterly wind conditions each day.
Scenario 7	Option 7b and Semi-Mixed Mode – Mixed Mode for Departures and Option 7b for Arrivals between 23:00 and 06:59	07:00 to 22:59: When winds are westerly, Runway 28L shall be preferred for arriving aircraft. Either Runway 28L or 28R shall be used for departing aircraft as determined by air traffic control. When winds are easterly, either Runway 10L or 10R as determined by air traffic control shall be preferred for arriving aircraft. Runway 10R shall be preferred for departing aircraft. 23:00 to 06:59: Both North and South Runways available for departures (runway used depends on whether turn to the north or south is required based on destination); prefer arrivals landing on the South Runway in westerly conditions and the North Runway in easterly conditions unless this exceeds the single-runway capacity for a given hour. If single-runway capacity is exceeded, then arrivals are moved to the other runway.
Scenario 8	Option 7b and Semi-Mixed Mode – Mixed Mode for Arrivals and Option 7b for Departures between 23:00 and 06:59	07:00 to 22:59: When winds are westerly, Runway 28L shall be preferred for arriving aircraft. Either Runway 28L or 28R shall be used for departing aircraft as determined by air traffic control. When winds are easterly, either Runway 10L or 10R as determined by air traffic control shall be preferred for arriving aircraft. Runway 10R shall be preferred for departing aircraft 23:00 to 06:59: Both North and South Runways available for arrivals (assumed 50/50 split); prefer departures take off on the North Runway in westerly conditions and the South Runway in easterly conditions.
Scenario 9	Option 7b and North Runway Only between 00:00 and 05:59	06:00 to 23:59: When winds are westerly, Runway 28L shall be preferred for arriving aircraft. Either Runway 28L or 28R shall be used for departing aircraft as determined by air traffic control. When winds are easterly, either Runway 10L or 10R as determined by air traffic control shall be preferred for arriving aircraft. Runway 10R shall be preferred for departing aircraft. 00:00 to 05:59: Movements preferred on the North Runway only (single runway).
Scenario 10	Option 7b and Alternate Use of North and South Runway between 00:00 and 05:59	06:00 to 23:59: When winds are westerly, Runway 28L shall be preferred for arriving aircraft. Either Runway 28L or 28R shall be used for departing aircraft as determined by air traffic control. When winds are easterly, either Runway 10L or 10R as determined by air traffic control shall be preferred for arriving aircraft. Runway 10R shall be preferred for departing aircraft. 00:00 to 05:59: Alternate each night between movements on the North Runway only and the South Runway only.

Scenario	Title	Description

The assessment that was carried out found that all but Scenario 7 were effective in reducing the highly annoyed (HA) and highly sleep disturbed (HSD) populations below the Forecast without New Measures scenario and the 2018 situation. The 'Forecast without new measures scenario' is described in the Aircraft Noise Regulation 598 Assessment as:

"Revoking North Runway Permission, Condition 5 and replacing North Runway Permission, Condition 3(d) with a fully mixed mode runway use configuration, while retaining multiple existing and planned noise management measures, would prevent the forgone economic impact and meet the cNAO[1]."

The preferential runway use scenario with the lowest number of people exposed to changes that potentially causes significant adverse effects caused by the change in noise levels for both L_{night} and L_{den} levels is Scenario 2.

In the order of completeness, high level environmental appraisals that assessed the scenarios presented in the Aircraft Noise Regulation 598 Assessment were undertaken, and concluded that the anticipated order of magnitude is the same or similar in all scenarios except for aircraft noise which is seen as the key differentiator (i.e. most important factor).

The EPA Draft Guidelines state that "*it is generally sufficient to provide a broad description of each main alternative and the key issues associated with each, showing how environmental considerations were taken into account in deciding on the selected option. A detailed assessment (or 'mini-EIA' of each alternative is not required*."

It is important to note that none of the scenarios would require any amendment of conditions of the North Runway Planning Permission governing the daytime operation of the runway system (i.e., conditions which are not specific to night-time use, namely conditions no. 3 (a), 3(b), 3(c) and 4 of the North Runway Planning Permission) or any amendment of permitted annual passenger capacity of the Terminals at Dublin Airport. Condition no. 3 of the Terminal 2 Planning Permission (Fingal County Council Reg. Ref. No. F04A/1755; ABP Ref. No. PL06F.220670) and condition no. 2 of the Terminal 1 Extension Planning Permission (Fingal County Council Reg. Ref. No. F06A/1843; ABP Ref. No. PL06F.223469) provide that the combined capacity of Terminal 1 and Terminal 2 together shall not exceed 32 million passengers per annum.

All of the scenarios appraised relate to the operation of the airport at night time only, and do not require the development of any physical or other infrastructure. Simply put, all of the scenarios comprise the same number of Air Traffic Movements (ATMs), the same use of the flight paths and do not require the amendment of the permitted annual passenger capacity of the terminals at Dublin Airport. Therefore, the anticipated environment effects across all environmental factors are assessed as being in the same order of magnitude in all scenarios. This is different for the environment factor of Noise, which is therefore seen as the key differentiator as this is the only environmental factor that will experience different effects in the different scenarios due to the uses of the runway system under each scenario.

Table 4-2 below shows the summary of the high-level environmental appraisal undertaken of the scenarios above and details whether the environmental topic areas are likely to result in differences in the magnitude of effect.

[1] cNAO: To limit and reduce the adverse effects of long-term exposure to aircraft noise, including health and quality of life, so that long-term noise exposure, particularly at night, does not exceed the situation in 2018. This should be achieved through the application of the Balanced Approach.

Table 4-2 Environmental Topic Area Summary Appraisal

Anticipated Order of Magnitude of Effect Between Scenarios												
Scenario	Population and Human Health	Major Accidents and Disasters	Transport and Transportation	Air Quality	Climate and Carbon	Water	Air and Ground Noise and Vibration	Biodiversity (Terrestrial & Aquatic)	Landscape and Visual	Land and Soils	Material Assets	Cultural Heritage
Scenario 1	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible	Potential for significant effects	Negligible	No Change	No Change	No Change	No Change
Scenario 3	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible	Potential for significant effects	Negligible	No Change	No Change	No Change	No Change
Scenario 4	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible	Potential for significant effects	Negligible	No Change	No Change	No Change	No Change
Scenario 5	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible	Potential for significant effects	Negligible	No Change	No Change	No Change	No Change
Scenario 6	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible	Potential for significant effects	Negligible	No Change	No Change	No Change	No Change
Scenario 7	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible	Potential for significant effects	Negligible	No Change	No Change	No Change	No Change
Scenario 8	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible	Potential for significant effects	Negligible	No Change	No Change	No Change	No Change
Scenario 9	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible	Potential for significant effects	Negligible	No Change	No Change	No Change	No Change
Scenario 10	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible	Potential for significant effects	Negligible	No Change	No Change	No Change	No Change

The modelling of alternatives has focused on the noise from airborne aircraft and aircraft on the runways, which is the main source of noise related to the airport. This is the source of noise that has routinely been modelled in response to the noise mapping requirements of EU Directive 2002/49/EC and informs the Noise Action Plan for the airport. Ground noise has also been assessed for the do nothing (permitted / constrained) scenario and the resulting preferential runway use scenario, and the results of this assessment confirms the relative importance of the noise from airborne aircraft and aircraft on the runways when considering the noise impacts of the airport. These sources are therefore considered sufficient to provide the main reasons for selecting the option chosen.

The methods adopted for the assessment of noise from airborne aircraft and aircraft on the runways are in accordance with the European Civil Aviation Conference Report Doc 29 entitled "*Standard Method of Computing Noise Contours around Civil Airports*", 4th Edition.

Table 4-2 presents a summary of the results from the desktop appraisal undertaken by the technical environmental specialists to determine the order of magnitude of effect between the scenarios provided in Table 4-1. As seen in Table 4-2 above, the anticipated order of magnitude is considered to be the same or similar in all scenarios across the different environmental topic areas except for Noise which is seen as the key differentiator (most important factor) and so is considered in detail within the Aircraft Noise Regulation 598 Assessment and within Chapters 13: Air Noise and Vibration and Chapter 14: Ground Noise and Vibration as it is the only aspect of the project with the likelihood of potential significant effects.

4.7 Conclusions

It is has been determined that consideration of reasonable alternative locations, alternative layouts and alternative designs of the proposed Relevant Action are not relevant as the application only relates to a change in operating restrictions, and does not comprise the delivery of any physical infrastructure or construction works.

The Do Nothing scenario is also not considered as a feasible option due to the extent to which leaving the permitted / constrained scenario in place will inhibit economic growth. The assessed impact is a loss of air traffic movements and associated loss in 1.1m passengers per year (-3.5%) and a cumulative loss over the 4-year period 2022-2025 of 4.3m passengers.

Scenario 2 was assessed as the preferential runway use scenario with the lowest number of people exposed to changes that potentially cause significant adverse effects caused by the change in noise levels for both L_{night} and L_{den} levels. For all environmental topics in the EIAR the difference between each of the alternative scenarios is negligible.

Chapter 05: Consultation

05

5. Consultation

5.1 Introduction

As set out in Chapter 1 of this EIAR, planning permission was granted for North Runway in 2007. In 2016 daa commenced a process of consultation relating to proposals to address the restrictive night-time conditions 3d and 5. This was in anticipation of a planning process that would seek to amend the conditions. The overall approach to consultation and information sharing is related to the North Runway project and operation of the Dublin Airport runway system at night in its entirety. Due to the nature of the project, construction activity was ongoing at the same time that daa was consulting on changes to night-time operational conditions (Condition 3d and 5). Therefore, the overall consultation and stakeholder engagement process included elements relating to the construction of North Runway and proposals to change the operational conditions (3d and 5).

daa had always indicated its intent to seek a review of Condition 3d and 5 when the legislation enabling such a review was enacted. The early consultation on the project was in anticipation of such legislation. However, there was a significant delay in the introduction of the legislation giving effect to Regulation 598/2014 in national law, designating the Airport Noise Competent Authority, and amending planning legislation. This legislation, the Aircraft Noise (Dublin Airport) Regulation Act 2019, allows for the airport to apply for a Relevant Action to amend, revoke or replace operating restrictions.

The 2016 consultations made clear that daa would seek a review of Condition 3d and 5. The main focus of the consultations at that time was proposals on runway use and flight paths, and related effects (including noise) and mitigation measures. The feedback from these consultations where relevant has been taken on board when developing this Relevant Action application.

Consultation on proposals that daa would seek on changes to Condition 3d and 5 of the North Runway planning permission was undertaken in June and December 2016. The similarities between these proposals in 2016 and the proposed Relevant Action relate to the proposed use of the runway system at night time and that there are no proposals to change the day time operation. The similarities also relate to the proposals on the degree of divergence for departing aircraft from the North Runway as well as proposals on the eligibility threshold for any future night time insulation offers that might be incorporated into the final planning application, in this case, the proposed Relevant Action.

During that time daa also established a community engagement team which works closely with the wider Dublin Airport business to provide information of interest to local residents and other parties. In addition, a Community Liaison Group was established in accordance with Condition 28 of the An Bord Pleanála Decision to Grant Permission (PL06F.217429) with representation from Fingal County Council, daa and the St. Margaret's Community. Briefings and update on the North Runway project were provided to these groups.

5.2 Consultation Approach

Consultation on proposals that daa would plan to make to seek changes to Condition 3d and 5 of the North Runway planning permission was undertaken in June and December 2016.

The consultation approach at the time included a combined strategy involving direct face-to-face events with members of the public and other relevant stakeholders, a feedback facility to provide comments on the proposal as well as a broader social media base to promote engagement, provide information and keep communities informed.

The overall consultation was underpinned by two specific phases of public consultation:

- Consultation Phase 1 Introduction to the project and EIAR Scoping (2016)
- Consultation Phase 2 Consultation on flight paths and change to permitted operations

In preparing this Relevant Action application, daa has taken on board elements of the Phase 2 2016 consultation and in particular the outcomes from consultation which focussed on the proposed flight paths and noise mitigation proposals associated with proposals to change Condition 3d and 5.

5.3 Context of Public and Stakeholder Engagement

In compliance with the Aarhaus Convention, public participation has been a part of the North Runway Project which includes the construction phase and the planning process relating to proposals to change the runway operating conditions. A guide to the requirements of the Convention was published by UNECE in 2014 entitled The Aarhus Convention: An Implementation Guide.

The Aarhus Convention sets down basic rules to promote the involvement of the public in environmental matters and to improve the enforcement of environmental law. The European Union has been a party to the Aarhus Convention since May 2005 and the Aarhus Convention is now an integral part of the EU legal order. Ireland ratified the Aarhus Convention in June 2012.

The provisions of the Aarhus Convention are divided into three pillars as follows:

- **Access to Environmental Information**: the right of members of the public to request environmental information that is held by public bodies and these bodies are obliged to maintain this information. The Access to Information pillar has been implemented in EU Directive 2003/4/EC on Public Access to Environmental Information and in Ireland by the European Communities (Access to Information on the Environment) Regulations 2007-2014.
- **Public Participation in Environmental Decision-Making**: the right of the public to participate in decision-making in environmental matters and for public authorities to enable the public to comment on proposals which affect the environment. Article 6 of the Aarhus Convention sets out detailed rules governing public participation in decision making involving the activities listed in Annex I to the Convention and activities that are not listed in the Annex but may have a significant effect on the environment. In the European Union, this part of the Aarhus Convention has been implemented by Directive 2003/35/EC on public participation (Directive, inter alia, the Consolidated EIA Directive 2011/92/EU). The requirements of the Public Participation Directive have been transposed into Irish law, including the integration of its requirements into the Planning and Development Act 2000, as amended.
- **Access to Justice**: the right of members of the public to review procedures to challenge decisions relating to the environment, made by public bodies or private persons that have been made without regard to the two aforementioned pillars of the Convention.

The consultation approach for the North Runway project was drawn up in the context of the three pillar concepts and aimed to ensure that the public participation activities devised for the project were accessible, meaningful and accountable. To achieve this the Applicant adopted a wide variety of communications methods and tools and further details on these are outlined in Section 5.4 below.

5.4 Consultation Tools

A range of communications tools were employed for the North Runway project consultation process in order to raise levels of awareness of the project and to facilitate participation in the consultation process. Key components of that consultation are:

- Public consultation events.
- Meetings with a range of resident groups and individuals.
- Regular meetings with Dublin Airport Environmental Working Group (DAEWG), St. Margaret's Community Liaison Group, residents associations, airport staff, airlines and businesses;
- Bimonthly drop-in clinics at various community locations at which local residents and interested parties can seek information regarding North Runway and other airport operations;
- Home visits to those local residents who are unable to attend consultations or drop-in clinics;
- A series of dedicated meetings and home visits with participants in the project's noise mitigation schemes;
- In collaboration with a local social services agency, undertook a roadshow in various North Dublin locations to promote the project's Local Employment Initiative (which won the Fingal Chamber Best Community Involvement award in 2019);
- Fully-manned dedicated project freephone and email channels;
- A dedicated project webpage hosted on the Dublin Airport website, https://www.dublinairport.com/corporate/north-runway

- Up-to-date project information via a subscriber-based Project Update;
- Press releases and media coverage;
- Social media;
- Communication materials including leaflets, posters, brochures and display materials for consultation events.
- Mail-outs and briefings to Elected Representatives of Fingal County Council, Dublin City Council, Dail Eireann and Seanad Eireann;
- Mail-outs to key environmental stakeholders;
- Dedicated Red C Survey on flightpaths options and community funding as part of the consultation on Change to Permitted Operations and Flightpaths https://www.dublinairport.com/docs/default-source/resources/view-red-c-research-report.pdf?sfvrsn=2ab85915_2

A bespoke Virtual Reality Platform which provides virtual materials and information as would appear at a public event has been devised as a means of informing the public about this Relevant Action application once lodged. This was developed in order to continue meaningful engagement with local residents despite the current Covid crisis.

5.5 Consultation Summary

The proposed Relevant Action application relates to proposals to amend and replace Condition 3d and 5 of the North Runway planning permission. The focus of the Phase 2 Consultation in 2016 was similar except at that time daa was proposing to remove both conditions and the proposals would have resulted in a greater number of aircraft flight movements on the runway system than now being proposed in the Relevant Action application. The key elements from the 2016 consultation that are carried forward into the Relevant Action application are the details of the proposed flights paths and some of the noise mitigation proposals.

5.6 Stakeholder Engagement

The Applicant has, and continues to engage with a variety of stakeholders, and will continue to manage effective relationships with a wide array of stakeholders. Successful delivery of the Relevant Action requires constructive consultation with several statutory and non-statutory bodies which include:

- The competent authority: Fingal County Council (FCC) and all its relevant departments, officers and representatives among which:
  - Planning Dept
  - Transportation Dept
  - Water Service Dept
  - Conservation Dept
  - Architecture Dept
  - Parks Dept
  - Environmental Services Dept
  - FCC Chief Executive
  - FCC Heritage Officer
  - FCC Director of Planning and Strategic Infrastructure
- Airport Stakeholders:
  - Irish Aviation Authority (IAA)
  - Commission for Aviation Regulation (CAR)
  - Airline Operators
- Public:
  - The Local Community
  - Elected Representatives

5.7 Incorporation into EIAR

The information contained in this chapter, and the feedback from previous consultation exercises, has been considered by the wider project team and has been integrated, where relevant to the current proposed Relevant Action application.

Chapter 06: Planning and Development Context

06

6. Planning and Development Context

6.1 Introduction

This EIAR chapter sets out the legislative and planning policy context for the proposed Relevant Action. It includes reference to relevant national and local planning policies, including those that have been considered when determining the EIAR scope, method and mitigation.

6.2 Strategic Planning Context

daa has a number of obligations to fulfil with regard to the management of Dublin Airport. Pursuant to Section 23(1) of the Air Navigation and Transport (Amendment) Act 1998, the principal objectives of the daa include:

- to own, either in whole or in part, or manage, alone or jointly with another person, airports whether within the State or not,
- to take all proper measures for the safety, security, management, control, regulation, operation, marketing and development of its airports,
- to provide such facilities, services, accommodation and lands at airports owned or managed by the company for aircraft, passengers, cargo and mail as it considers necessary,
- to promote investment at its airports,
- to engage in any business activity, either alone or in conjunction with other persons and either within or outside the State, that it considers to be advantageous to the development of the company, and
- to utilise, manage and develop the human and material resources available to it in a manner consistent with the objects aforesaid.

In 2009, pursuant to Section 10 of the Aviation Regulation Act 2001, the Minister for Transport issued a statutory direction to the Commission for Aviation Regulation (CAR) stating *"The desirability that Dublin Airport should have the terminal and runway facilities to promote direct international air links to key world markets, such as new and fast-developing markets in the Far East and the importance of ongoing and planned infrastructure development in this context." In* this regard it is considered that North Runway forms part of the 'runway facilities' identified as being required to promote direct international air links.

In addition, the National Aviation Policy (2015) includes Action 4.5.1 which states the following:

"*The process to develop the second runway at Dublin Airport will commence, to ensure the infrastructure necessary for the airport's position as a secondary hub and operate to global markets without weight restrictions is available when needed*."

It is considered that the strategic planning context is clear in providing overarching support for ongoing investment in Dublin Airport and that North Runway provides the necessary infrastructure to ensure that the airport can become a secondary hub.

6.2.1 Aircraft Noise (Dublin Airport) Regulation Act 2019 – Application of EU Regulation 598 – The Balanced Approach

The Aircraft Noise (Dublin Airport) Regulation Act 2019 (The Aircraft Noise Act), implements EU Regulation 598/2014 on the establishment of rules and procedures with regard to the introduction of noise related operating restrictions at European Union Airports within the Balanced Approach.

The Aircraft Noise Act amends the Planning and Development Act 2000, as amended, to cater for the situation where development at Dublin Airport may give rise to an aircraft noise problem and where an airport wishes to apply to revoke, amend or replace operating restrictions at the airport.

The Aircraft Noise Act was enacted on 22nd May 2019. It was subsequently amended on 1st September 2019, following the removal of Airport infrastructure from the Seventh Schedule of the PDA and thus the strategic infrastructure development planning process is no longer applicable to it.

Fingal County Council has been designated as the competent authority for the purposes of aircraft noise regulation at Dublin Airport by section 3(1) of the Aircraft Noise (Dublin Airport) Regulation Act 2019.is

The Aircraft Noise Act amends the PDA by inserting a number of new sections in Part 3 of the PDA, which deals with control of development. These sections introduce a number of new measures for planning applications at Dublin Airport that may necessitate noise-related actions or that may require a new operating restriction.

Section 34C of the PDA permits an applicant who is currently subject to a planning permission for development at the airport that includes an operating restriction, to make an application under Section 34C of the PDA to revoke, amend, replace or take other action in respect of the operating restriction. Pursuant to Section 34C (23) of the PDA this is defined as a proposed 'Relevant Action'. In this regard, daa is enabled to make this application for a proposed relevant action as it seeks to make changes to the operating restrictions imposed by the North Runway Permission.

A separate Regulation 598/2014 Assessment has been prepared by Ricondo and is submitted with the Relevant Action application and this EIAR.

6.3 National and Regional Planning Policy

6.3.1 National Policy

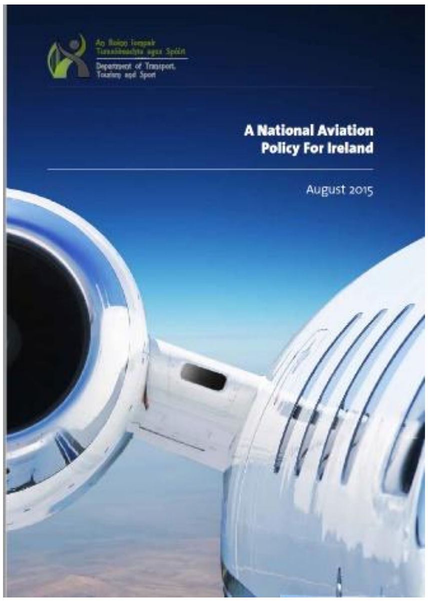
Dublin Airport is a growing airport that serves as a major transport hub for millions of business and leisure travellers, a gateway for tourism and foreign direct Investment (FDI) and a critical facilitator of connectivity for an island nation. Passenger traffic through Dublin Airport has grown exponentially since the economic recovery. Notwithstanding this, as a result of the Covid-19 Pandemic, as per all other international airports, Dublin Airport has seen a significant drop in air traffic movements and passenger numbers. However, strong sustained growth is expected to return post pandemic. Preparation of this EIAR has been ongoing for many months and includes detailed environmental modelling and assessment based on air traffic forecasts prepared in 2019. In March 2020, it became apparent that the Covid-19 pandemic was having a significant impact on global aviation. The immediate impacts were severe, and in the short-medium term these impacts will continue to manifest themselves in reduced air traffic demand in Ireland and globally. For the purposes of this EIAR the long-term impact (2025 and beyond) of the operating restrictions[2] is assessed, and it is expected that air traffic will recover over this longer period, so it is reasonable to show the environmental and economic effects over the longer term. For these reasons the conclusions of these pre-Covid 19 air traffic forecasts prepared in 2019 are reasonable and thus included.

Notwithstanding the above referenced impact of Covid-19 on current demand for travel, as highlighted below, it is imperative that Dublin Airport is provided with the necessary infrastructure and facilities to support future growth at the airport in line with National Policy direction.

6.3.2 National Aviation Policy 2015 (NAP)

The Department of Transport, Tourism and Sports published the National Aviation Policy for Ireland in August 2015 (NAP). The NAP acknowledges the importance of the aviation sector to the Irish economy and advocates the development of a secondary hub at Dublin Airport. Section 4.3 of the NAP describes this as follows:

[2] Operating restrictions refer to the restrictions imposed under conditions 3(d) and 5 of the North Runway permission.



"*The size and location of Dublin Airport distinguishes it from the other State airports. Dublin Airport has seen a major increase in the numbers of transfer passengers in recent years with significant benefits to the broader economy. An opportunity now exists to develop Dublin as a vibrant secondary hub, competing effectively with the UK and other European airports for the expanding global aviation services market. A hub combines local passengers with transfer passengers enabling airlines to operate services to more destinations and more frequently than could be supported by local demand alone. This allows airport operators to utilise airport assets more efficiently, to exploit economies of scale and to drive down per passenger airport charges to the benefit of airport users and passengers. In this context, the support and promotion of Dublin as a hub airport is an important means of maximising air access for the Irish economy. Dublin Airport is currently (summer 2015) ranked fifth in Europe in terms of weekly transatlantic seats, and is therefore well placed for further development as a hub for global business.”*

In relation to the future capacity needs of the State Airports, the plan states under Section 4.5:

‘It is recognised that European airports are currently facing capacity constraints and that this situation will worsen in the context of expanding aviation services markets. While existing capacity at Irish State airports is adequate for current demands, it is essential that Ireland is equipped to exploit emerging opportunities to expand air service connections for business, tourism, cultural and educational purposes, and thus to deliver economic benefits at the national level. These opportunities exist not just for new emerging markets in the Asia Pacific region, but also with our traditional trading partners in Europe and North America. Air transport requires a specific level of airport infrastructure, both in terms of quantity and quality, to facilitate the optimum level of air services for Ireland. This includes terminal and runway capacity as well as surface access to airports, and is particularly relevant to the development of Dublin Airport as a secondary hub.

To ensure future connectivity and to deliver growth, it will be important that the State airports, and Dublin Airport in particular, have sufficient capacity and runways of sufficient length to enable services to operate to global emerging markets without weight restriction. It is important that regular reviews are conducted to ensure that all of the main airports are well placed to accommodate passenger growth, changing passenger and air-cargo needs and carrier needs.’

In relation to capacity needs at Dublin Airport, a review was carried out in August 2018 by the Department of Transport, Tourism and Sport entitled ‘Review of Future Capacity Needs at Irelands State Airports’. The Review states on page 33:

‘The 2015 National Aviation Policy highlights that Dublin will be promoted as a secondary hub airport to support services to global markets. If Dublin Airport can provide facilities to enable airlines to compete effectively with airlines operating at UK and other European hub airports, it may further increase the level of transfer business, which has already grown strongly in recent years. This could enable airlines operating at Dublin to run more frequent flights to existing destinations and offer direct flights to a larger number of destinations than would be possible if services at the airport were entirely reliant on travellers whose ultimate origin or destination was Ireland.’

Section 4.5 of the NAP concerns the future capacity needs of the State Airports and states the following:

“Air transport requires a specific level of airport infrastructure, both in terms of quantity and quality, to facilitate the optimum level of air services for Ireland. This includes terminal and runway capacity as well as surface access to airports, and is particularly relevant to the development of Dublin Airport as a secondary hub.”

The NAPs policy position on existing capacity at State airports is discussed in Section 4.5 and highlights that:

‘Existing capacity at State airports should be optimised in conjunction with timely planning to enable expansion of air service connections in all relevant markets delivering wider economic benefits for Ireland’.

In addition, the NAP includes Action 4.5.1, which states the following:

"The process to develop the second runway at Dublin Airport will commence, to ensure the infrastructure necessary for the airport's position as a secondary hub and [ability to][3] *operate to global markets without weight restrictions is available when needed."*

The proposed relevant action is consistent with the NAP in that it supports continued growth at Dublin Airport. In this regard the proposed relevant action to amend and replace the existing operating restrictions will optimise the ability of the airport to utilise its infrastructure, being the runway system, to support Dublin Airport's position as a secondary hub airport and its ability to cater for capacity demands.

6.3.3 Project Ireland 2040: National Planning Framework (NPF)

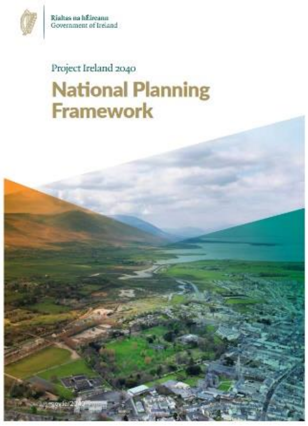
The Department of Housing, Planning and Local Government published Project Ireland 2040: National Planning Framework (NPF) in February 2018. The National Planning Framework (NPF) is:

"the Government's high-level strategic plan for shaping the future growth and development of our country out to the year 2040".

"It is a framework to guide public and private investment, to create and promote opportunities for the people of Ireland, and to protect and enhance the environment- from villages to cities and everything in between." (NPF p10)

It replaces the previous National Spatial Strategy (NSS) as the primary national policy framework. Adopted in 2018, the NPF is designed to improve the effectiveness of public investment in infrastructure and other relevant services around the county, including the enhancement of regional and international connectivity.

Dublin Airport is identified as key infrastructure for national development in the NPF as follows:



"The main airports including Dublin, Cork, Shannon and Ireland West - Knock, together with smaller regional airports, are a key infrastructure for national and regional development." (NPF p145)

The NPF identifies 'High Quality International Connectivity' as a primary National Strategic Outcome of the NPF. Specifically, it states;

"*High-Quality International Connectivity is crucial for overall international competitiveness and addressing opportunities and challenges from Brexit through investment in our ports and airports in line with sectoral priorities already defined through National Ports Policy and National Aviation Policy and signature projects such as the second runway for Dublin Airport and the Port of Cork - Ringaskiddy Redevelopment."* (NPF p14)

The NPF also notes the following under National Strategic Outcome 6: High Quality International Connectivity:

"As an island, the effectiveness of our airport and port connections to our nearest neighbours in the UK, the EU and the wider global context is vital to our survival, our competitiveness and our future prospects." (NPF p145) and further states in relation to the North Runway;

'The development of additional runway and terminal facilities such as the second runway for Dublin Airport for which planning permission has been approved'

Page 37 of the NPF emphasises how Dublin Airport can enable growth within Dublin City and Metropolitan Area, in this regard the NPF discusses how improved access to Dublin Airport will be a key growth enabler for Dublin, stating that:

'Improving access to Dublin Airport, to include improved public transport access, connections from the road network from the west and north and in the longer term, consideration of heavy rail access to facilitate direct services from the national rail network in the context of potential future electrification.'

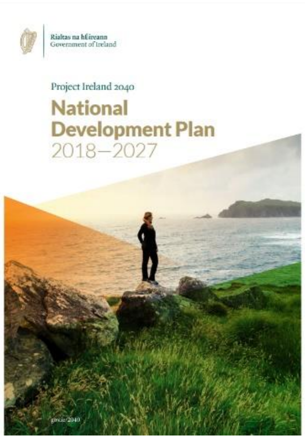
The NPF confirms the important role that Dublin Airport has in supporting the goals of the NPF. In this regard, itis considered that the proposed relevant action will enable the airport to maintain and enhance high-quality international connectivity by ensuring that the airport can appropriately utilise the runway system.

[3] Added by TPA

6.3.3.1 National Development Plan 2018-2027 (NPD)

The National Development Plan 2018 – 2027 (NDP) was published in conjunction with the NPF in February 2018. The NDP is the national plan setting out investment priorities to guide national, regional and local planning and investment decisions.

The NDP supports the implementation of the NPF and also the NAP. Under National Strategic Outcome 6, the NDP identifies the importance of high-quality international connectivity as:



"As an island, continued investment in our port and airport connections to the UK, the EU and the rest of the world, is integral to underpinning international competitiveness. It is also central to responding to the challenges as well as the opportunities arising from Brexit." (NDP p67)

The NDP further states the following under National Strategic Outcome 6:

'Significant investment in Ireland's airports and ports will play a major role in safeguarding and enhancing Ireland's international connectivity which is fundamental to Ireland's international competitiveness, trading performance in both goods and services and enhancing its attractiveness to foreign direct investment. The importance of this objective cannot be understated in the context of the UK's exit from the EU in 2019.'

Under National Strategic Outcome 6, the NDP identifies Dublin Airport as one of its strategic investment priorities, with North Runway as a major national infrastructure project for appraisal and delivery during the lifetime of the Plan (NDP, p67). The plan states;

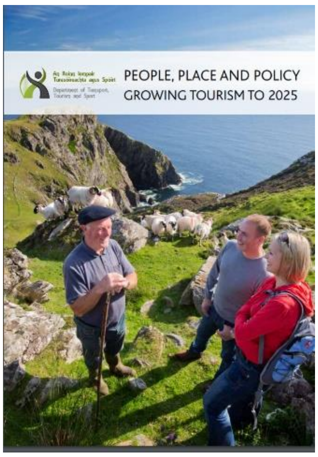
'DAA is planning the delivery of a new runway for Dublin Airport by 2021 at an estimated cost of €320 million which will continue to be developed as an international hub' (NDP, p67)

North Runway is identified as a crucial signature project for achieving Strategic Outcome 6 as part of the National Development Plan 2018-2027. The proposed Relevant Action will fulfil the aims of the NDP by supporting the growth of Dublin Airport, which will enable investment in the airport, thereby supporting Ireland's international competitiveness and attractiveness to foreign direct investment.

6.3.4 National Tourism Policy 2015: 'People, Place and Policy: Growing Tourism to 2025

The Department of Transport, Tourism and Sport published a National Tourism Policy in March 2015 entitled 'People, Place and Policy: Growing Tourism To 2025'.

Section 5.2 of the National Tourism Policy notes the importance of a high quality of service at frontiers:



'In addition to the quality of physical infrastructure at airports and ports, the quality of service to visitors at frontier checks is important in creating a first impression of Ireland's welcome.' (p67)

At page 68, the National Tourism Policy notes *"as an island, inbound tourism and the export earnings and employment supports are profoundly dependent on the volume, affordability and range of air access. Airports are core elements of the tourism infrastructure. In turn, tourism is an important source of traffic and customers for airports."*

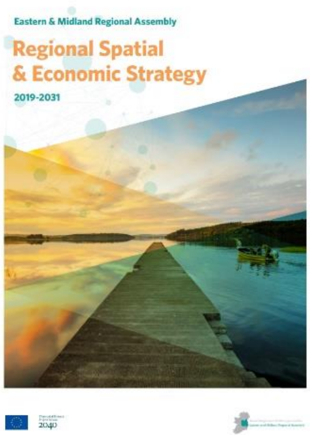
In addition to the above, Policy Proposal 5.2.2 in the National Tourism Policy states that:

"Air and sea port operators will be encouraged to ensure that visitor reception facilities are managed so that the visitor experience is optimised." (p70)

The proposed relevant action will enable Dublin Airport to continue to meet demand for airline arrivals and departures during night time hours. This is particularly important for the mainly short haul services based at the airport so they can maintain flight slots that provide connectivity with mainland Europe and also provide suitable transfer services to flights arriving from North America. The ability of the airport to maintain these flight slots will ensure that airline travel to/from Dublin is well serviced and remains affordable. As such, it is considered that the proposed relevant action is fully compliant with the policy provisions and will assist with the implementation of the National Tourism Policy.

6.3.5 Regional Spatial and Economic Strategy for the Eastern and Midland Region (RSES)

The Eastern and Midlands Regional Assembly's Regional Spatial and Economic Strategy, 2019 (RSES) sets out a long-term strategic planning and investment strategy for the Dublin area and surrounding counties and the Midlands to 2031. The RSES acknowledges Dublin Airport as a key national asset to Ireland's economic success which is linked with its global connectivity to trade and tourism markets and requires support to ensure it continues as an economic driver. The RSES acknowledges that the Dublin region is the main global gateway to Ireland with Dublin Airport one of the fastest growing airports in Europe. Page 195 of the RSES states in relation to Dublin Airport;



'Dublin Airport accounted for 85% of all air passengers in the Country in 2016. The number of passengers has increased year on year to reach 29.5 million in 2017 and is forecast to increase again in 2018. Dublin Airport is a key national asset to Ireland's economic success which is linked with its global connectivity to trade and tourism markets and requires support to ensure it continues as an economic driver. The National Aviation Strategy for the first time supports the growth of the Airport to a secondary hub airport; Dublin Airport has a number of features which make it an attractive option for airlines, including the availability of full US Preclearance.'

The main objective of the RSES is to determine at a regional scale how best to achieve the shared goals set out in the National Strategic Outcomes (NSOs) of the NPF. The Dublin Region is identified as the main global gateway to Ireland.

The international gateways of the Eastern and Midland region are noted as playing a critical economic role on both a national and regional level. Section 8.5 of the RSES outlines the regional policies for international connectivity relating to Dublin Airport as follows;

RPO 8.17: Support the National Aviation Policy for Ireland and the growth of movements and passengers at Dublin Airport to include its status as a secondary hub airport. In particular, support the provision of a second runway, improved terminal facilities and other infrastructure.

RPO 8.18: Improved access to Dublin Airport is supported, including Metrolink and improved bus services as part of BusConnects, connections from the road network from the west and north. Improve cycle access to Dublin Airport and surrounding employment locations. Support appropriate levels of car parking and car hire parking.

RPO 8.19: Spatial planning policies in the vicinity of the airport shall protect the operation of Dublin Airport in respect to its growth and the safe navigation of aircraft from non-compatible land uses. Policies shall recognise and reflect the airport noise zones associated with Dublin Airport. Within the Inner Airport Noise Zone, provision of new residential and/or other noise sensitive development shall be actively resisted. Within the Outer Noise Zone, provision of new residential and/or other noise sensitive development shall be strictly controlled and require appropriate levels of noise insulation in all cases.

RPO 8.20: Spatial planning policies for areas located within the Public Safety Zones shall reflect the guidance set out in the ERM Report "Public Safety Zones, 2005" (or any update thereof) commissioned by the then Department of Transport and the Department of Environment, Heritage and Local Government, in assessing proposals for development falling within Airport Public Safety Zones.

The proposed relevant action will be entirely consistent with the RSES Policy Objectives, outlined above, which support Dublin Airport as a key national asset to Ireland's economic success. Furthermore, the replacement of the operational restriction included in Condition 5 of the North Runway planning permission, will ensure that the airport can return to its permitted terminal capacity of 32mppa in a timely manner and continue to grow as a secondary hub airport.

6.4 Local Planning Policy

6.4.1 Fingal Development Plan 2017-2023

The site is subject to the 'DA' (Dublin Airport) zoning objective under the Fingal Development Plan 2017-2023 (County Development Plan). This seeks to:

"Ensure the efficient and effective operation and development of the airport in accordance with an approved Local Area Plan." (page 238)

Chapter 6 of the County Development Plan states that:

"The Dublin Airport (DA) zoning is a unique economic development zoning within Fingal, comprising an extensive area of some 1,024 ha. The DA zoning covers all the operational buildings and lands associated with the airport and runways. Within the lifetime of the Development Plan, the Council will prepare a LAP for Dublin Airport that will outline the future vision for the airport, examine its operational requirements and the associated environmental effects."

FCC's strategic policy for Dublin Airport is to:

"Safeguard the current and future operational, safety, and technical requirements of Dublin Airport and provide for its ongoing development within a sustainable development framework of a Local Area Plan. The plan shall take account of any potential impact on local communities and shall have regard to any wider environmental issues." (Page 10)

The Vision for 'DA' zoned lands is to:

"Facilitate air transport infrastructure and airport related activity/uses only (i.e. those uses that need to be located at or near the airport). All development within the Airport Area should be of a high standard reflecting the status of an international airport and its role as a gateway to the country and region. Minor extensions or alterations to existing properties located within the Airport Area which are not essential to the operational efficiency and amenity of the airport may be permitted, where it can be demonstrated that these works will not result in material intensification of land use.

Air Transport Infrastructure includes: aircraft areas, air traffic control/tower, ancillary health, safety and security uses, aprons, cargo handling, maintenance hangers, meteorology, retail – airside/duty free, runways, taxiways, terminals and piers" (Page 368)

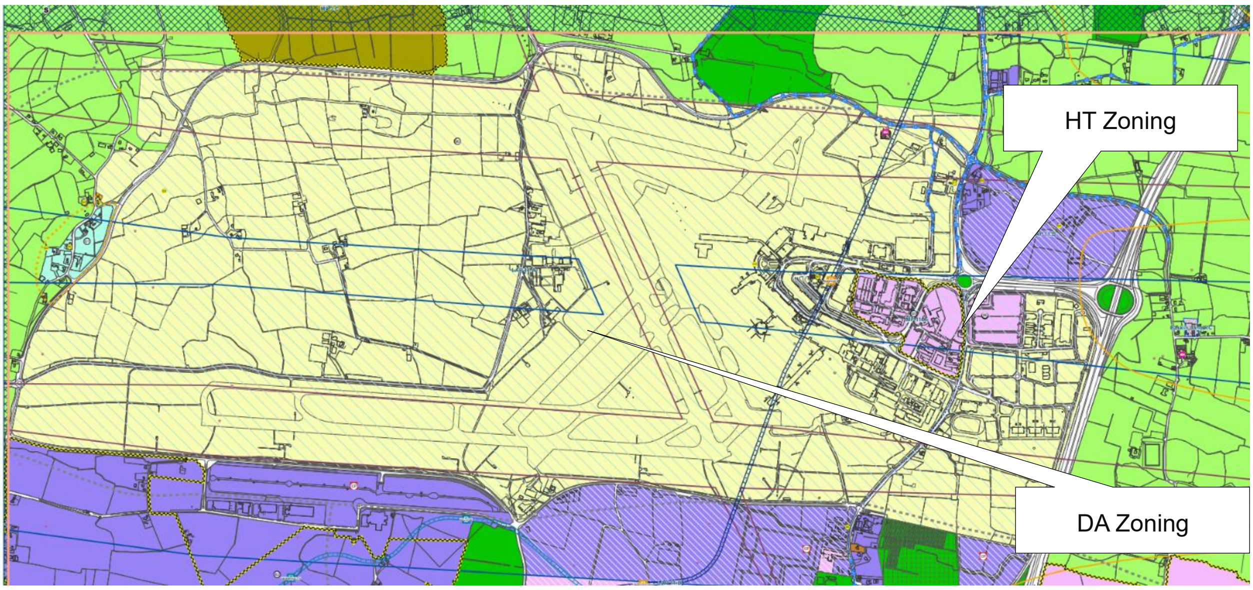


Figure 6-1 Extract from Fingal County Development Plan 2017-2023 – Sheet 11 Fingal South (annotated by TPA)

A portion of the Airport lands are also zoned HT – High Technology under the land use zoning identified in the County Development Plan, as indicated in pink on the Extract from the Fingal Zoning Map, Figure 6-1.

The Zoning Objective for the HT zoned lands seeks to:

‘Provide for office, research and development and high technology/high technology manufacturing type employment in a high quality built and landscaped environment.’

Chapter 6 of the County Development Plan states in relation to HT zoning:

‘High Technology HT

The purpose of the High Technology (HT) zoning is to facilitate opportunities for major office, science and technology, and research and development-based employment within high quality, highly accessible, campus style settings. The HT zoning is one of the most important economic development zonings in Fingal with just over 685 ha of HT zoned lands located principally in Blanchardstown and Swords, supplemented with significant zonings at Dublin Airport and along the southern boundary of the County with Dublin City’

The County Development Plan further states on page 240 under the heading Dublin Airport Central Masterplan:

“Additionally, the Council, in collaboration with the DAA, will review where appropriate the Dublin Airport Central Masterplan for strategically located lands adjacent to the airport on HT zoned lands. The Masterplan will be a framework for the creation of a high-quality commercial development comprising predominantly office accommodation, supplemented with hotel and ancillary uses, to be delivered on a phased basis.’

The proposed Relevant Action supports the central function of the DA zoning objective. The proposed Relevant Action will also provide for the efficient and effective operation of North Runway and the wider airport runway system.

In addition to the land use zoning, the County Development Plan also contains various Objectives which are of relevance to the proposed relevant action:

Table 6-1 Dublin Airport Objectives, Chapter 7, FCC Development Plan 2017-2023

Objective	Description
DA01	*"Facilitate the operation and future development of Dublin Airport, in line with Government policy, recognising its role in the provision of air transport, both passenger and freight".*
DA03	*"Safeguard the current and future operational, safety, technical and developmental requirements of Dublin Airport and provide for its ongoing development within a sustainable development framework, having regard to both the environmental impact on local communities and the economic impact on businesses within the area".*
DA05	*"Facilitate the development of a second major east-west runway at Dublin Airport and the extension of the existing east-west runway 10/28".*
DA09	*"Ensure that aircraft-related development and operation procedures proposed and existing at the Airport consider all measures necessary to mitigate against the potential negative impact of noise from aircraft operations (such as engine testing, taxiing, taking off and landing), on existing established residential communities, while not placing unreasonable, but allowing reasonable restrictions on airport development to prevent detrimental effects on local communities, taking into account EU Regulation 598/2014 (or any future superseding EU regulation applicable) having regard to the 'Balanced Approach' and the involvement of communities in ensuring a collaborative approach to mitigating against noise pollution."*
DA15	*"Take into account relevant publications issued by the Irish Aviation Authority in respect of the operations of and development in and around Dublin Airport."*
DA16	*"Continue to take account of the advice of the Irish Aviation Authority with regard to the effects of any development proposals on the safety of aircraft or the safe and efficient navigation thereof"*
DA18	*"Ensure that every development proposal in the environs of the Airport takes account of the current and predicted changes in air quality, greenhouse emissions and local environmental conditions."*
DA19	*"Ensure that every development proposal in the environs of the Airport takes into account the impact on water quality, water based-habitats and flooding of local streams and rivers and to provide mitigation of any negative impacts through avoidance or design and ensure compliance with the Eastern River Basin District Management Plan."*

In addition to the above policies, the County Development Plan also makes specific reference to the NAP as well as setting out the following objectives which directly support the proposed relevant action:

Objective ED31

> *"**Ensure that the required infrastructure and facilities are provided at Dublin Airport** so that the aviation sector can develop further and operate to its maximum sustainable potential, whilst taking into account the impact on local residential areas, and any negative impact such proposed developments may have on the sustainability of similar existing developments in the surrounding area, and the impact on the environment, including the climate."* (Page 205)
>
> ***Objective ED32***
>
> *Ensure an appropriate balance is achieved between developing the unique potential of Dublin Airport as an economic generator and major employer in the County and protecting its core operational function as the Country's main international airport.'*

The County Development Plan also sets out the following objectives of relevance to the proposed relevant action:

> ***"Objective AQ01***
>
> *Implement the provisions of EU and National legislation on air, light and noise and other relevant legislative requirements, as appropriate and in conjunction with all relevant stakeholders."*
>
> ***"Objective NP01***
>
> *Implement the relevant spatial planning recommendations and actions of the Dublin Agglomeration Environmental Noise Action Plan 2013-2018 (or any subsequent plan), working in conjunction with relevant statutory agencies."*
>
> ***"Objective NP02***
>
> *Continue to promote appropriate land use patterns in the vicinity of Dublin Airport to minimise the number of residents exposed to undesirable noise levels."*

> ***"Objective NP03***
>
> *Require all developments to be designed and operated in a manner that will minimise and contain noise levels."*
>
> **"Objective DMS162**
>
> *Ensure all development proposals include measures to protect and enhance biodiversity."*

By supporting the efficient and secure operation of the Airport, the proposed relevant action will be consistent with the objectives set out above. In summary, the proposed relevant action is consistent with the County Development Plan in that it supports growth at Dublin Airport and will contribute to connectivity and the local economy by providing additional passenger capacity and safeguarding operations at the airport.

It is noted that the application site is located within the Inner Public Safety Zone (PSZ) for Dublin Airport. The purpose of the PSZ is to restrict inappropriate land use within the environs of the runways at Dublin Airport.

The Public Safety Zone Report prepared by Environmental Resource Management Ireland Ltd. (ERM) 2003 on behalf of the Department of Trade, Tourism and Sport sets out certain types of restricted development which are permitted within the inner and outer Public Safety Zones.

The proposed relevant action relates to the operation of the permitted and existing runway system and does not constitute new development which may be restricted within this zone.

The County Development Plan was varied on 9th December 2019 (the Variation) to give effect to the new noise zones developed as part of the preparation of the Dublin Airport LAP 2020, the provision of specific noise related policy concerning noise from aircraft, road and rail and the removal of the Red Approach Area at the end of the airport's runways.

In addition to the introduction of new noise zones, the Variation to the County Development Plan included a number of new and updated objectives. In relation to the County Development Plan objectives listed above, the Variation deletes Objectives NP01 and replaces it with a new NP01 which states the following:

> **"Objective NP01**
>
> *Implement the relevant spatial planning recommendations and actions of the Dublin Agglomeration Environmental Noise Action Plan 2018-2023 and the Noise Action Plan for Dublin Airport 2019-2023 (or any subsequent plan), working in conjunction with relevant statutory agencies."*

In respect of noise, the variation provides for four noise zones at the airport, namely Zones A-D. The plan notes that:

'Three noise zones are shown in the Development Plan maps, Zones B and C within which the Council will continue to restrict inappropriate development, and Zone A within which new provisions for residential development and other noise sensitive uses will be actively resisted. An additional assessment zone, Zone D is also proposed to identify any larger residential developments in the vicinity of the flight paths serving the Airport in order to promote appropriate land use and to identify encroachment.'

Table 6-2 below represents the contents of table 7.2 of the variation which sets out the four aircraft noise zones and the associated objective of each zone along with an indication of the potential noise exposure from operations at Dublin Airport. The zones are based on potential noise exposure levels due to the airport using either North Runway or the existing southern runway for arrivals or departures.

The noise zoning system has been developed with the overarching objective to balance the potential impact of aircraft noise from the Airport on both external and internal noise amenity. This allows for noise impacts on development, which may be brought forward in the vicinity of the Airport's flight paths, to be identified and considered as part of the planning process. The focus of the noise zones is to ensure that the impact of noise on future residential development and other sensitive receptors such as schools, hospitals etc is appropriately considered during the planning stage and that new development is appropriately designed to pertinent standards as well as guidance in relation to planning and noise, namely:

- National Planning Framework 2040, DHPLG, February 2018;
- ProPG: Planning & Noise –New Residential Development, May 2017;
- British Standard BS8233:2014 'Guidance on sound insulation and noise reduction for buildings'; and

- ICAO guidance on Land-use Planning and Management in Annex 16, Volume I, Part IV and in the ICAO Doc 9184, Airport Planning Manual, Part 2 —Land Use and Environmental Control.

Table 6-2 Table 7.2 from the Variation to the Fingal Development Plan is as follows:

Zone	Indication of Potential Noise Exposure during Airport Operations	Objective
D	≥ 50 and < 54 dB $L_{Aeq, 16hr}$ and ≥ 40 and < 48 dB L_{night}	**To identify noise sensitive developments which could potentially be affected by aircraft noise and to identify any larger residential developments in the vicinity of the flight paths serving the Airport in order to promote appropriate land use andto identify encroachment.** *All noise sensitive development within this zone is likely to be acceptable from a noise perspective. An associated application would not normally be refused on noise grounds, however where the development is residential-led and comprises non- residential noise sensitive uses, or comprises 50 residential units or more, it may be necessary for the applicant to demonstrate that a good acoustic design has been followed.* *Applicants are* ***advised*** *to seek expert advice.*
C	≥ 54 and < 63 dB $L_{Aeq, 16hr}$ and ≥ 48 and < 55 dB L_{night}	**To manage noise sensitive development in areas where aircraft noise may give rise to annoyance and sleep disturbance, and to ensure, where appropriate, noise insulation is incorporated within the development** *Noise sensitive development in this zone is less suitable from a noise perspective than in Zone D. A noise assessment must be undertaken in order to demonstrate good acoustic design has been followed.* *The noise assessment must demonstrate that relevant internal noise guidelines will be met. This* ***may*** *require noise insulation measures.* *An external amenity area noise assessment* ***must*** *be undertaken where external amenity space is intrinsic to the development's design. This assessment should make specific consideration of the acoustic environment within those spaces as required so that they can be enjoyed as intended. Ideally, noise levels in external amenity spaces should be designed to achieve the lowest practicable noise levels.* *Applicants are* ***strongly advised*** *to seek expert advice.*
B	≥ 54 and < 63 dB $L_{Aeq, 16hr}$ and ≥ 55 dB L_{night}	**To manage noise sensitive development in areas where aircraft noise may give rise to annoyance and sleep disturbance, and to ensure noise insulation is incorporated within the development.** *Noise sensitive development in this zone is less suitable from a noise perspective than in Zone C. A noise assessment* ***must*** *be undertaken in order to demonstrate good acoustic design has been followed.* *Appropriate well-designed noise insulation measures* ***must*** *be incorporated into the development in order to meet relevant internal noise guidelines.* *An external amenity area noise assessment* ***must*** *be undertaken where external amenity space is intrinsic to the developments design. This assessment should make specific consideration of the acoustic environment within those spaces as required so that they can be enjoyed as intended. Ideally, noise levels in external amenity spaces should be designed to achieve the lowest practicable noise levels.*

Zone	Indication of Potential Noise Exposure during Airport Operations	Objective
		*Applicants **must** seek expert advice.*
A	≥ 63 dB $L_{Aeq, 16hr}$ and/or ≥ 55 dB L_{night}	**To resist new provision for residential development and other noise sensitive uses.** *All noise sensitive developments within this zone may potentially be exposed to high levels of aircraft noise, which may be harmful to health or otherwise unacceptable. The provision of new noise sensitive developments will be resisted.*

Notes:
'Good Acoustic Design' means following the principles of assessment and design as described in ProPG: Planning & Noise – New Residential Development, May 2017).

Internal and External Amenity and the design of noise insulation measures should follow the guidance provided in British Standard BS8233:2014 'Guidance on sound insulation and noise reduction for buildings'

6.4.2 Dublin Airport Local Area Plan (LAP)

A new LAP was published in January 2020. This new LAP recognises that *'Dublin Airport has grown significantly in size and importance since the adoption of the last LAP in 2006'*. At page 2, the LAP also recognises that the airport is of *'vital importance to the Irish economy and acts as the principal international gateway for trade, inward investment and tourism'*. The LAP also notes *that 'the Airport facilitates Ireland's integration with Europe and aids in attracting foreign direct investment'*.

The LAP sets out the robust policy framework in place at national, regional and now local level supporting the continued growth of Dublin Airport including its development as a secondary hub airport.

The LAP sets out a number of Key Strategic Objectives and aims to guide the future development and growth of Dublin Airport. These key objectives support the proposed relevant action and relate to the following:

- Support for airport safeguarding.
- Support the continued sustainable growth of Dublin Airport and connectivity as a hub airport whilst ensuring protection of the environment.
- Support the timely delivery of required infrastructure to facilitate airport growth.
- Support the growth of the Airport as a major economic driver for the region.
- Support continued communication between the Airport and neighbouring communities to protect community amenity and mitigate potential impact from airport growth in the interests of long-term sustainability.

The LAP recognises the NAP and notes that its states that:

'To ensure future connectivity and to deliver growth, it will be important that the State airports and Dublin Airport in particular, have sufficient capacity and runways of sufficient length to enable services to operate to global emerging markets without weight restriction '

and

'A specific level specific level of airport infrastructure, including terminal and runway capacity as well as surface access is required to support the development of Dublin Airport as a secondary hub'.

Section 7.2.2 of the LAP specifically relates to Runways. This section states the following objective which supports the proposed relevant action

> *"OBJECTIVE RW01*
>
> *Facilitate the operation of runways at Dublin Airport in line with current operational procedures, as determined by way of existing planning permissions or as otherwise determined in line with the requirements of the Aircraft Noise (Dublin Airport) Regulation Act 2019."*

The LAP dedicates an entire Section (section 9.1) to noise. In this section it notes the following:

"The Dublin Airport LAP is a land use plan for the purposes of effective land-use planning and safeguarding the use of the Airport. Noise zones relating to Dublin Airport have been in place for many years to aid land use planning. Since the publication of previous noise zones in 2005, and over the last decade, further evidence has emerged that has updated understanding of how aircraft noise can affect health and quality of life. With the north runway set to become operational in 2022, updated information is available relating to aircraft noise performance and flight paths. For these reasons, it was considered appropriate to update the noise zones for Dublin Airport to allow for more effective land use planning for development within airport noise zones.

The updated noise zones are set out in Fig. 9.1. Dublin Airport Noise Zones and policies relating to development in Noise Zones are set out in Variation No. 1 to the Fingal Development Plan 2017 - 2023." (Fig 6.2 below).

The proposed relevant action will ensure that the airport is able to maintain its current flight services that provide connectivity to mainland Europe, in particular, the proposed relevant action will ensure that the airport can meet the early morning and late night demand for take-off and landing that is required to ensure that flights leaving Ireland in the early morning can land at their European destination at the start of the working day. The proposed relevant action does not include any physical works, therefore there is limited opportunity for the proposed relevant action to contradict the stated objectives and policies of the LAP, notwithstanding this, the proposal will safeguard the night time usage of the runway for future growth.

For the above-mentioned reasons, it is considered that the proposed relevant action is fully aligned with the Dublin Airport LAP 2020.

6.4.3 Noise Action Plan for Dublin Airport (2019 – 2023)

The Noise Action Plan for Dublin Airport 2019 -2023 (Noise Action Plan) prepared under the Environmental Noise Regulations 2006 was adopted by FCC in December 2018. The Noise Action Plan is designed to manage noise issues and effects associated with existing operations at Dublin Airport. The Noise Action Plan sets out proposed actions including the following relating to land use planning and management:

- Keep under review land-use policies in relation to aircraft noise through the review of existing land use planning policy in so far as it relates to Dublin Airport.
- Monitor noise encroachment associated with Dublin Airport to ensure that land use planning policy is appropriately informed as it relates to Dublin Airport

The LAP and the above-mentioned Variation to the County Development Plan provides the land use planning framework to achieve these actions.

The Noise Action Plan requires the impact of noise generated from other aviation related sources (for example ground engine testing, maintenance, etc.) within the Airport lands to also be considered with regard to adjoining land uses and amenities. Section 7.2 of the Noise Action Plan includes a list of actions to be taken over the duration of the Noise Action Plan.

The application material for the proposed Relevant Action has been prepared fully in line with the actions contained within the Noise Action Plan and the Regulation 598 Assessment submitted with this application identifies where application actions within the Noise Action Plan have been addressed.

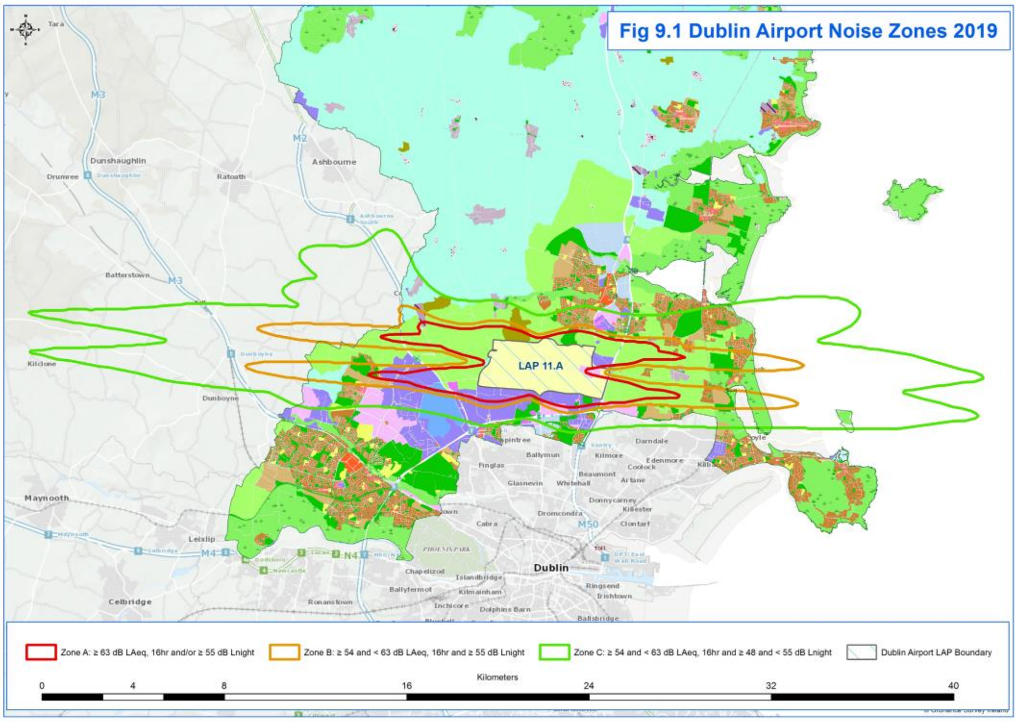


Figure 6-2 Extract of figure 9.1 from Dublin Airport Local Area Plan

6.5 Planning History

Planning permission was granted for North Runway in 2007 in ABP File Ref PL06F.217429 and contained 31 planning conditions. Two of these planning conditions (Conditions 3(d) and 5) related to operating restrictions on the use of the runways and overall airport operations at night. These are due to come into force once North Runway is operational. In addition, Condition 4 of the permission introduces a restriction on the use of the cross-wind runway (16/34). For avoidance of doubt there is no intention to apply to review Condition 4.

Condition 3(d) states that: Runway 10L 28R shall not be used for take-off or landing between 2300 hours and 0700 hours

Condition 5 states that: the average number of night time aircraft movements at the airport shall not exceed 65/night (between 2300 hours and 0700 hours) when measured over the 92day modelling period.

The origin of these conditions relates to information presented as part of the North Runway application. In particular, the Board asked the daa to outline the number of night-time flights (between 23:00 and 7:00) on the Southern Runway (Runway 10/28) at that time and into the future. daa responded that when preparing the EIS in 2004 there were 45 flights at night-time on Runway 10/28. They noted that this would grow to 65 flights on Runway 10/28 without the northern runway (Constrained case) and 95 flights if the northern runway were permitted but not used between 2300 and 0700 (Unconstrained case). daa clearly stated that the constrained case was conservatively low and that “A greater relative growth could have been assumed for night-time traffic in the constrained case as the relatively higher scarcity of daytime slots might cause airlines to modify schedules to include more night-time activity to compensate”. This approach would reduce the difference between the constrained case and the unconstrained case but was not used as it would not represent a credible worst case for the assessment of impacts.

The Board chose to impose the limit of 65 no. flights (Constrained scenario) which is based on aircraft movement forecasts without North Runway operating.

When North Runway is operational, the existing runway will be re-designated as runway 10R/28L (South Runway) and North Runway will be designated as 10L/28R.

Condition 5 of the grant of planning states that: On completion of construction of the runway hereby permitted, the average number of night time aircraft movements at the airport shall not exceed 65/night (between 2300 hours and

0700 hours) when measured over the 92-day modelling period as set out in the reply to the further information request received by ABP on the 5th day of March 2007.

It is important to note that although Condition 5 states *'the average number of night-time aircraft movements at the airport shall not exceed 65/night'* this must be read in conjunction with Condition 3d and 4 which limit the use of North Runway and Runway 16/34 at night.

6.6 Conclusion

Since the 2007 planning permission was granted, Dublin Airport has experienced a strong sustained growth trajectory, with the current runway at capacity during peak times in 2019. This included levels of demand for night flights (23:00-07:00) at over 100/night in 2019, with 113/night associated with regularly scheduled services on a typical busy Summer day of that year.

Notwithstanding this, as a result of the Covid-19 Pandemic, as per all other international airports, Dublin Airport has seen a significant drop in air traffic movements and passenger numbers. However, strong sustained growth is expected to return post pandemic. In order to forecast the future growth post Covid-19, future forecasts have been undertaken by Mott McDonald on behalf of daa and are included with the application for planning permission. The forecasts identify that 108/night movements will be required in 2022/23 to sustain the airport's rebound, rising to 113/night when the airport returns to 32 million passengers per annum (mppa) in around 2025.

The operating restrictions imposed by Conditions 3(d) and 5 will impact the on movements specified above (specifically Condition 5) and subsequently the airport's ability to meet future demand. As such, the proposed relevant action seeks to amend and replace these operating restrictions.

The proposed relevant action is fully in compliance with multi-governmental strategic objectives and policies that seek to facilitate the growth of Dublin Airport and foster the airports connectiveness to the UK, Europe and wider global environment. By comparison, the existing permitted operating restrictions which the planning application seeks to amend/replace run contrary to these strategic objectives and policies.

Chapter 07: Population and Human Health

07

7. Population and Human Health

7.1 Introduction

This chapter of the Environmental Impact Assessment Report (EIAR) details the findings of an assessment of the likely significant effects on population and human health as a result of the proposed Relevant Action.

This assessment and EIAR chapter have been prepared by AECOM.

The appraisal of likely significant effects of the proposed Relevant Action on population and human health has been conducted by reviewing the current socio-economic environment and the potential impact on this environment at multiple spatial scales.

The proposed relevant action does not seek any amendment of conditions of the North Runway Planning Permission governing the general operation of the runway system (i.e., conditions which are not specific to night-time use, namely conditions no. 3 (a), 3(b), 3(c) and 4 of the North Runway Planning Permission) or any amendment of permitted annual passenger capacity of the Terminals at Dublin Airport. Condition no. 3 of the Terminal 2 Planning Permission (Fingal County Council Reg. Ref. No. F04A/1755; ABP Ref. No. PL06F.220670) and condition no. 2 of the Terminal 1 Extension Planning Permission (Fingal County Council Reg. Ref. No. F06A/1843; ABP Ref. No. PL06F.223469) provide that the combined capacity of Terminal 1 and Terminal 2 together shall not exceed 32 million passengers per annum.

This assessment will focus on impacts on:

- Amenity and local communities (effects on amenity uses of a site or of other areas in the vicinity); and
- Human health and well-being (to consider the impact of the proposed Relevant Action on the health and wellbeing of the communities).

This chapter describes the national and local policy and legislation context; the relevant literature on potential impacts on population and human health; assessment methods used; baseline conditions; potential direct and indirect population impacts during the operational phase of the proposed Relevant Action; potential human health and well-being impacts during the operational phase of the proposed Relevant Action; mitigation measures; and relevant residual effects.

The result of the permitted / constrained scenario coming into effect when North Runway becomes operational in 2022, is a loss of air traffic movements and associated loss of 1.1m passengers per year (-3.5%) and a cumulative loss over the 4-year period 2022-2025 of 4.3m passengers. The net effect of the proposed Relevant Action would be to facilitate an increase in the number of flights permitted to take off from, or land at, Dublin Airport at night, which would enable the lost 1.1million passengers to be regained annually in the post-COVID-19 recovery period.

Further information of the economic impact of the permitted / constrained scenario, and the proposed Relevant Action (ie the proposed / unconstrained scenario) is provided in Chapter 3: *Need for the Project*, and the InterVISTAS report which is provided as part of the planning application package.

7.2 Legislation, Guidance and Planning Policy Context

7.2.1 National Guidance

The following national legislation is directly applicable to the proposed Relevant Action in terms of the assessment of population and human health effects:

- Draft Guidelines on the Information to be Contained in Environmental Impact Assessment Reports (EPA, 2017);
- Draft Advice Notes for Preparing Environmental Impact Statements (EPA, 2017b);
- Guidelines on the Information to be contained in Environmental Impact Statements (EPA, 2002); and
- Advice Notes on Current Practice in the Preparation of Environmental Impact Statements (EPA, 2002)

7.2.2 National Planning Policy

7.2.2.1 National Planning Framework: Project Ireland 2040

The National Planning Framework: Project Ireland 2040 is the Government's high-level strategic plan for shaping the future growth and development of Ireland to the year 2040 (Government of Ireland, 2018). It is a framework to guide public and private investment, to create and promote opportunities for the people of Ireland, and to protect and enhance the environment.

Chapter 6: People, Homes and Communities of the National Planning Framework: Project Ireland 2040 sets out the following themes of relevance to Population and Human Health:

- 'Quality of Life and Place';
- 'Healthy Communities';
- 'Diverse and Inclusive Ireland';
- 'Age Friendly Communities';
- 'Childcare, Education and Life Long Learning'; and
- 'Housing',

Within Section 6.2: 'Healthy Communities', it is noted how specific health risks, such as include heart disease, respiratory disease, mental health, obesity and other injuries, can be influenced by spatial planning. It is also suggested that by taking a whole-system approach to addressing the many factors that impact on health and wellbeing and which contribute to health inequalities, and by empowering and enabling individuals and communities to make healthier choices, it will be possible to improve health outcomes, particularly for the next generation of citizens.

The following objectives are of relevance to this population and human health assessment:

National Policy Objective 26: *"Support the objectives of public health policy including Healthy Ireland and the National Physical Activity Plan, though integrating such policies, where appropriate and at the applicable scale, with planning policy".*

7.2.2.2 Healthy Ireland Framework 2019 – 2025

The Healthy Ireland Framework sets out a vision to create "A Healthy Ireland, where everyone can enjoy physical and mental health and wellbeing to their full potential, where wellbeing is valued and supported at every level of society and is everyone's responsibility".

The Healthy Ireland Framework is designed to bring about real, measurable change and is based on an understanding of the determinants of health. Health and wellbeing are affected by all aspects of a person's life; economic status, education, housing, the physical environment in which people live and work.

The Healthy Ireland Framework was launched in 2013 and presents four central goals for improved health and well-being (FCC, 2017):

- *"increase the proportion of people who are healthy at all stages of life;*
- *Reduce health inequalities;*
- *Protect the public from threats to health and well-being; and*
- *Create an environment where every individual and sector of society can play their part in achieving a healthy Ireland."*

The Healthy Ireland Framework states that *"The area of environment and health, in its broadest sense,* comprises those aspects of human health, disease, and injury that are determined or influenced by factors in the environment. This includes not only the study of the direct pathological effects of various chemical, physical, and biological agents, but also the effects on health of the broad physical and social environment, which includes housing, urban development, land use and transportation, industry, and agriculture". As such, reaffirming the need for the proposed Relevant Action to be considered in respect of its impacts on health.

7.2.3 Local Planning Policy

7.2.3.1 Fingal Development Plan 2017-2023

Fingal County Council (FCC) adopted the Fingal Development Plan 2017-2023 (FCC, 2017) in March 2017 which sets out the policies and objectives to achieve the vision for the County over the plan period. The Development Plan aims to "*develop and improve, in a sustainable manner, the social, economic, environmental and cultural assets of the County*".

The following objectives are of relevance to this population and human health assessment:

- Objective PM69 in Chapter 3 seeks to "Ensure that proposals do not have a detrimental effect on local amenity by way of traffic, parking, noise or loss of privacy of adjacent residents".
- Objective ED31 in Chapter 6 aims to provide the infrastructure and facilities to allow Dublin Airport to operate at its maximum sustainable potential, *"whilst taking into account the impact on local residential areas, and any negative impact such proposed developments may have on the sustainability of similar existing developments in the surrounding area".* This will be key for the assessment.
- Objective DA07 in Chapter 7 seeks to *"Strictly control inappropriate development and require noise insulation where appropriate within the Outer Noise Zone, and actively resist new provision for residential development and other noise sensitive uses within the Inner Noise Zone, as shown on the Development Plan maps, while recognising the housing needs of established families farming in the zone. To accept that time based operational restrictions on usage of a second runway are not unreasonable to minimize the adverse impact of noise on existing housing within the inner and outer noise zone".*
- Objective DA09 in Chapter 7 seeks to *"Ensure that aircraft-related development and operation procedures proposed and existing at the Airport consider all measures necessary to mitigate against the potential negative impact of noise from aircraft operations (such as engine testing, taxiing, taking off and landing), on existing established residential communities, while not placing unreasonable, but allowing reasonable restrictions on airport development to prevent detrimental effects on local communities, taking into account EU Regulation 598/2014 (or any future superseding EU regulation applicable) having regard to the 'Balanced Approach' and the involvement of communities in ensuring a collaborative approach to mitigating against noise pollution".*

The Fingal Development Plan also includes a map indicating zoning land uses across the County. This map and the following objectives are relevant to the overall assessment:

- Zoning Objective *'CI' Community Infrastructure aims to "provide for and protect civic, religious, community, education, health care and social infrastructure".* This objective will advise land use assessment.
- Zoning Objective 'DA' Dublin Airport in aims to *"ensure the efficient and effective operation and development of the airport"* in line with the Airport Local Area Plan. Within the vision for Dublin Airport, the Fingal Development Plan states that *"minor extensions or alterations to existing properties located within the Airport Area which are not essential to the operational efficiency and amenity of the airport may be permitted, where it can be demonstrated that these works will not result in material intensification of land use".* This objective and vision will be accounted for throughout the assessment.

Zoning Objective 'HA' High Amenity in Chapter 11 aims to protect and enhance the highly sensitive amenity areas and scenic locations "*from inappropriate development and reinforce their character, distinctiveness and sense of place*". This objective will be considered in the assessment of amenity effects.

7.2.3.2 Dublin Airport Local Area Plan

FCC published the Dublin Airport Local Area Plan in January 2020. The Dublin Airport Local Area Plan identifies various issues of relevance and establishes the principles for future development in the area.

Within Chapter 9 Environment & Community, Figure 9.1 displays the updated Dublin Airport Noise Zones 2019. The accompanying text in Section 9.1 on noise details that these zones have been updated to allow for more effective land use planning within airport noise zones, using evidence on how aircraft noise can affect health and quality of life. Therefore, this text and map will be considered for the amenity and health and well-being assessments.

Appendix 1: Strategy for St. Margaret's Special Policy Area provides a plan and specific policies for the closest settlement to Dublin Airport. This strategy will be considered in the amenity and health and well-being assessment.

7.3 Assessment Methodology

7.3.1 Study Area

As there is no national guidance available on identifying an appropriate study area to focus the assessment of population and human health, the study area for the population and human health assessment has considered the area of land that may be affected by the proposed Relevant Action. It should be noted, however, that it is not always possible to determine the catchment area for community facilities. Residents of an area may utilise facilities located within different electoral divisions, counties or regions without regard for statutory boundaries.

7.3.2 Methodology for Determining Baseline Conditions and Sensitive Receptors

7.3.2.1 Baseline Conditions

A baseline community profile will help to establish an in-depth understanding of the population affected by the proposed Relevant Action, identifying potentially vulnerable groups. In order to gather baseline information pertaining to employment, demographics, human health and local amenities, a robust desktop study has been undertaken, drawing on information from the following sources:

- Central Statistics Office (CSO);
- Fingal County Council; and
- The 2016 Pobal HP Deprivation Index for Small Areas (SA).

The baseline for the Population and Human Health assessment was supported by a site visit undertaken by AECOM in August 2019. The site visit helped to develop a broader understanding of the local context and land uses in the local area. Key receptors, such as residential areas, community facilities, leisure facilities and walking routes, in the local area were visited during the site visit.

Baseline data collection for the population and human health assessment has therefore considered the communities and areas of land which may potentially be impacted by the proposed Relevant Action. The impact areas for certain impacts such as human health, amenities and community facilities, and local land uses have been informed by other assessments (Aircraft Noise and Vibration, Ground Noise and Vibration, Air Quality and Climate Change) during the assessment stage of the EIAR.

7.3.3 Methodology for Determining Construction Effects

7.3.3.1 Amenity and Local Communities

As the proposed Relevant Action will result in no changes to the design or construction of the North Runway, there will be no changes to the physical infrastructure of the North Runway. On that basis, the assessment of construction phase impacts on amenity and local communities has been **scoped out** of the EIAR.

7.3.3.2 Human Health and Well-being

As the proposed Relevant Action will result in no changes to the design or construction of the North Runway, there will be no changes to the physical infrastructure of the North Runway. On that basis, the assessment of construction phase impacts on human health and well-being has been **scoped out** of the EIAR.

7.3.3.3 Methodology for Determining Operational Effects

Effects on amenity and local communities, employment opportunities and human health are described using the criteria provided in EPA guidance (EPA, 2017 and EPA, 2017b), European Commission guidance (EC, 2017) and the London HUDU Rapid Health Impact Assessment Tool (London Healthy Urban Development Unit, 2019), as detailed in the following sub-sections.

7.3.3.4 Amenity and Local Communities

The assessment on amenity and local communities is concerned with how the proposed Relevant Action potentially impacts on the ability of residents and users of community and recreational facilities to achieve enjoyment and/or quality of life.

Assessing the impact of the proposed Relevant Action on amenity and local communities has taken into account the combined residual significant effects from other assessment topics (***Chapter 13. Air Noise and Vibration, Chapter 14. Ground Noise and Vibration, Chapter 10. Air Quality*** and ***Chapter 11. Climate and Carbon***.) which could affect people's enjoyment of a community facility, public space or residential property. Due to the nature of the proposed Relevant Action, the amenity and local communities assessment only considers the indirect effects arising from the combined residual significant effects from other topics on the amenity of properties and/or community resources in the study area. As there is no physical construction activity as a result of the proposed Relevant Action, direct effects (i.e. properties and/or facilities being cut off or split) are not considered within the assessment on amenity and local communities.

Some assessments within this EIAR have considered a variety of scenarios associated with the proposed Relevant Action. Where this chapter of the EIAR draws upon information from other chapters which have considered multiple scenarios, the worst-case scenario has been considered. For the purpose of this assessment, we have assumed a reasonable worst-case scenario from a noise and air quality perspective in that the comparison is made between the proposed / unconstrained 2025 Relevant Action and the permitted / constrained 2025 Baseline.

In assessing this, a descriptive approach has been used which gives an overall indication of the change i.e. positive, negative/adverse or neutral, in the amenity of the receptor. As set out in Table 7-2, the assessment is based on professional judgement and uses a four-point scale of high, medium, low and very low. Depending on the type of receptor being assessed, the magnitude of effect is based on the number of users and the extent to which these users experience impacts on their amenity.

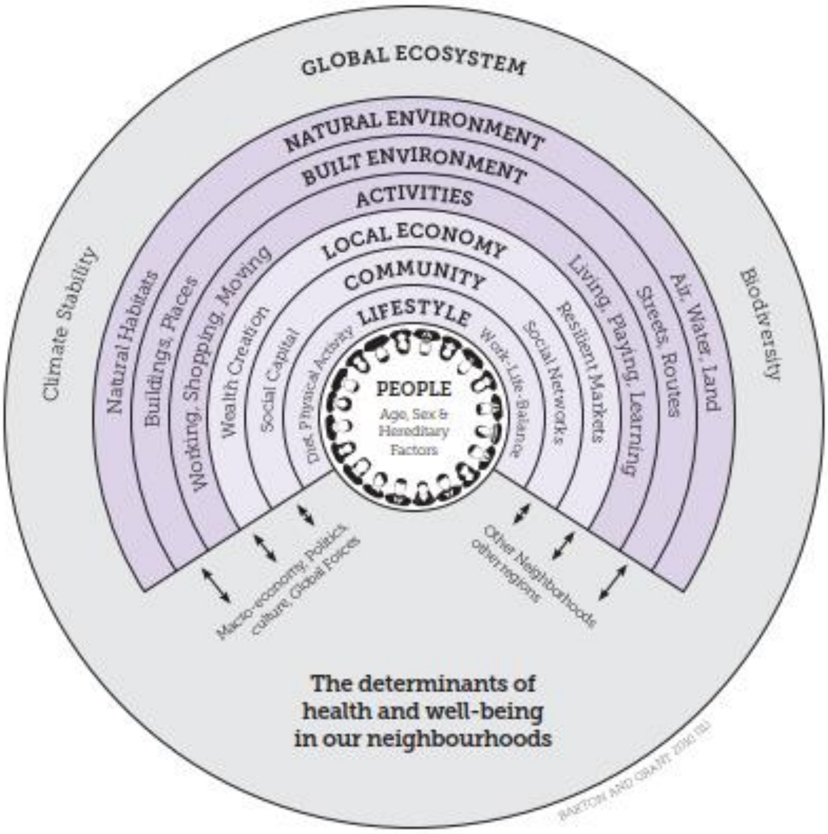
The assessment aligns with the relevant aspects of the Environmental Protection Agency's *Draft Guidelines on the Information to be Contained in Environmental Impact Assessment Reports* (EPA, 2017), *Draft Advice Notes for Preparing Environmental Impact Statements* (EPA, 2017b) as well as the European Commission's guidance document *Environmental Impact Assessment of Projects - Guidance on the preparation of the Environmental Impact Assessment Report* (EC, 2017).

7.3.3.5 Human Health and Well-being

The human health and well-being assessment includes impacts on the health of residents of properties and users of community resources in the study area. Whilst relevant guidance from the Institute of Public Health in Ireland (IPH), specifically the *Health Impact Assessment Guidance* (Institute of Public Health in Ireland, 2009), has been considered, there is no consolidated methodology or practice for describing effects on human health in EPA guidance. The impacts of the proposed Relevant Action on human health will therefore be assessed qualitatively using the health and well-being determinants set out in the *London HUDU Rapid Health Impact Assessment Tool* (London Healthy Urban Development Unit, 2019). The *London HUDU Rapid Health Impact Assessment Tool* is a checklist approach which provides a broad overview of the potential health impacts and is applicable to a wide range of proposals that considers impacts on a range of health determinants. The checklist is split into 11 broad determinants and is based on the World Health Organisation (WHO) publication 'Healthy Urban Planning' (Barton and Tsourou, 2000).

The WHO Europe defines health as *"a state of complete physical, mental and social wellbeing and not merely the absence of disease or infirmity"* (WHO, 2020). Consequently, public health encompasses general wellbeing, not just the absence of illness. Some effects are direct and obvious, others are indirect, while some may be synergistic, with different types of impact acting in combination. In keeping with this definition, this assessment considers the potential impacts of the proposed Relevant Action on physical, mental and social health.

Factors that have the most significant influence on the health of a population are called 'determinants of health'; these include an individual's genetics and their lifestyle, the surrounding environment, as well as political, cultural and societal issues. The interrelationship between these factors is shown in .



Source: Barton and Grant (2006)

Figure 7-1: Social determinants of health

An initial scoping exercise was undertaken to determine the health determinants within the *London HUDU Rapid Health Impact Assessment Tool* (London Healthy Urban Development Unit, 2019) which are relevant to this assessment. The following health determinants in the *London HUDU Rapid Health Impact Assessment Tool (*London Healthy Urban Development Unit, 2019) are associated with construction activities or the provision of new physical infrastructure and were not deemed to be of relevance to the proposed Relevant Action and therefore are not assessed further:

- Housing design and affordability;
- Access to health and social care services and other social infrastructure;
- Accessibility and active travel;
- Crime reduction and community safety;
- Access to healthy food;
- Social cohesion and inclusive design; and
- Minimising the use of resources.

The health determinants which will be assessed as part of this chapter are listed below:

- Air quality, noise and neighbourhood amenity; and
- Climate change.

A literature review further considers existing scientific evidence in order to identify the determinants of relevance to the proposed Relevant Action. This literature review provides scientific evidence which supports assumptions made about the potential health impacts of the proposed Relevant Action.

HUDU advises that the tool is generic and should be adapted to local circumstances. This assessment of human health and well-being effects includes the likely direct, indirect and cumulative effects of the proposed Relevant

Action. Potential impacts on the health and well-being of the existing local community and residents has been considered, in particular for more vulnerable groups (such as children and the elderly). Health inequalities have also been considered. Mitigation and enhancement measures for the proposed Relevant Action (some of which may have already been considered through the development of the proposed Relevant Action) have been considered and key indicators for monitoring health and well-being impacts moving forward have been established. This qualitative approach does not draw on specific receptors and significance levels and will not seek to conclude the significance of impacts.

7.3.4 Classification of Effects and Significance Criteria

7.3.4.1 Amenity and Local Communities

For amenity and local communities, conclusions on the classification of effects have been made by assessing the magnitude of impact, combined with the sensitivity of resources and receptors to these impacts.

Table 7-1: Type of Effects

Type of Effects	*Magnitude of Effect*
Beneficial	An impact that has a potential advantageous or beneficial effect on receptors within a specific geographical area, which may be minor, moderate, or major in effect.
Negligible	An impact that is expected to have imperceptible effects on receptors within a defined area.
Adverse	An impact that is expected to have a disadvantageous or adverse effect on receptors within a specific geographical area, which may be minor, moderate or major in effect.
No effect	An impact that is likely to have no effect on an area or local receptors.

Duration of effect is also considered, with more weight given to permanent changes than to temporary ones.

The impact assessment has been undertaken in accordance with the broad magnitude of impact and sensitivity of receptor definitions summarised in Table 7-2 and Table 7-3.

Table 7-2: Magnitude of Impact Criteria

Magnitude of Impact	*Magnitude of Effect*
High	An impact that is expected to have considerable adverse or beneficial effects on receptors. Such impacts will typically affect large numbers of residents, users, businesses or workers. High magnitude impacts will typically be long-term in nature, resulting in the permanent change of the study area's baseline conditions.
Medium	An impact that is expected to have a moderate effect on receptors. Such impacts will typically have a noticeable effect on a limited number of residents, users, businesses or workers, and will lead to a permanent (but not drastic) change to the study area's baseline conditions.
Low	An impact that is expected to affect a small number of residents, users, businesses or workers. Or an impact that may affect a larger number of receptors but without materially changing the study area's baseline conditions. Such impacts are likely to be temporary in nature.
Very Low	An impact that is likely to be temporary in nature, or which is anticipated to have a slight effect on the residents, users, businesses or workers.

Table 7-3: Sensitivity of Receptors

Sensitivity of Receptors	*Magnitude of Effect*
High	Receptor is likely to be directly affected. Receptor is well placed to take advantage of beneficial impacts, and/or is not well placed to deal with any adverse impacts.

Medium	Receptor is likely to be indirectly affected. Average ability to maximise beneficial impacts or cope with adverse impacts.
Low	Receptor is unlikely to benefit. Receptor is not well placed to take advantage of beneficial impacts, and/or is well placed to deal with any adverse impacts.

Once the magnitude of the effect has been identified, this can be cross-referenced with the importance of the sensitivity of the receptor to derive the overall significance of impact as per the EPA guidelines (EPA, 2017 and EPA 2017b). By bringing together magnitude and sensitivity, the assessment considers the classification of the effects as outlined in Table 7-4. Moderate and Major effects are considered to be significant. Minor and Negligible effects are considered to be not significant.

Table 7-4: Significance Criteria

Sensitivity of Receptors	*Magnitude of Effect*			
	High	**Medium**	**Low**	**Very Low**
High	Major	Major	Moderate	Minor
Medium	Major	Moderate	Minor	Negligible
Low	Moderate	Minor	Negligible	Negligible

7.3.4.2 Human Health and Well-being

The assessment of human health and well-being is a qualitative rather than quantitative assessment, due to the diverse nature of health determinants and health outcomes which are assessed. Although the assessment of human health effects describes the likely qualitative health outcomes, it is not possible to quantify the severity or extent of the effects which give rise to these impacts. As such, the potential health impacts are described as outlined in

Table 7-5, based on broad categories for the qualitative effects identified. Where an effect has been identified, actions have been recommended to mitigate negative impact on health, or opportunities to enhance health benefits. As detailed in ***Chapter 13. Air Noise and Vibration*** and ***Chapter 14. Ground Noise and Vibration***, embedded mitigation to reduce these effects or measures to enhance certain benefits already form part of the proposed Relevant Action and the assessment has considered these impacts as such.

Table 7-5: Human health impact categories

Impact category	*Impact symbol*	*Description*
Positive	+	A beneficial impact is identified
Neutral	0	No discernible health impact is identified
Negative	-	An adverse impact is identified
Uncertain	?	Where uncertainty as to the overall impact

7.3.5 Limitations and Assumptions

This population and human health assessment is based on professional judgement and takes into account both the adverse and beneficial impacts that the proposed Relevant Action can have upon existing and surrounding receptors. It provides a broad, high level indication of effects, reporting on the potential effects to people and the local community.

Assessment has been based on information about the proposed Relevant Action available at the time when the chapter was drafted. It has drawn upon other specialist topic inputs to aid the assessment of the impact of the proposed Relevant Action on population and human health receptors (***Chapter 13. Air Noise and Vibration, Chapter 14. Ground Noise and Vibration, Chapter 10. Air Quality*** and ***Chapter 11. Climate and Carbon***.)

With regards to ground noise and vibration impacts associated with the proposed Relevant Action, it should be noted that the residual effects within ***Chapter 14. Ground Noise and Vibration*** considers the cumulative effects of the proposed Relevant Action and Apron 5H (as defined in Chapter 14) schemes but not the residual effects of the proposed Relevant Action only. Therefore, this assessment has utilised the pre-residual effects assessment for ground noise and vibration impacts (***Chapter 14. Ground Noise and Vibration)*** which means that the benefit of mitigation is not accounted for, although the effect is unlikely to be substantive, this does therefore represent the worst case assessment.

Dwellings have been used to estimate population as part of ***Chapter 13. Air Noise and Vibration*** and ***Chapter 14. Ground Noise and Vibration***, hence results are presented within this chapter as the number of people rather than dwellings.

Community resources are mentioned expressly in the environmental baseline only where they contribute to the local context or where they may be affected by the proposed Relevant Action. Consequently, not all community resources within the study area are mentioned.

Information in the baseline related to demographics and the health profile of the population in the study area uses statistics from the census. Four years have passed since the previous census was published (2016).

7.4 Literature Review

As set out by the Institute of Public Health in Ireland, “A literature review should be undertaken to find evidence which supports or refutes the assumptions made at the screening stage about the potential health impacts of the proposal” (Institute of Public Health in Ireland, (2009). Therefore, a literature review which focuses on the potential impacts of the proposed Relevant Action on human health and well-being has been carried out.

Initially, this literature review has considered whether there is sufficient evidence from within the London HUDU Rapid Health Impact Assessment Tool to support an association between the activities associated with the proposed Relevant Action and the relevant determinant of health. The potential effects on health determinants have been summarised in Table 7-6.

Table 7-6: Potential effects of activities associated with the proposed Relevant Action on health determinants

Activity associated with the proposed Relevant Action	Health determinant and potential impact
Increased frequency of emissions and noise exposure from additional aircraft movements and associated operations	***Air quality, noise and neighbourhood amenity*** *– the quality of the local environment can have a significant impact on physical and mental health. Pollution caused by construction, traffic and commercial activity can result in poor air quality, noise nuisance and vibration. Poor air quality is linked to incidence of chronic lung disease (chronic bronchitis or emphysema) and heart conditions and asthma levels of among children and young people. Noise pollution can have a detrimental impact on health resulting in sleep disturbance, cardiovascular and psycho-physiological effects. Good design and the separation of land uses can lessen noise impacts.*
Increased frequency of emissions from additional aircraft movements and associated operations	***Climate change*** *– there is a clear link between climate change and health. Local areas should prioritise policies and interventions that ‘reduce both health inequalities and mitigate climate change’ because of the likelihood that people with the poorest health would be hit hardest by the impacts of climate change.*

Source: London HUDU Rapid Health Impact Assessment Tool (2019)

Having identified the health determinants which have the potential to be impacted by the activities associated with the proposed Relevant Action; this literature review now provides additional evidence, based on existing scientific literature, to reaffirm such potential health impacts.

7.4.1 Air quality, noise and neighbourhood amenity

Based on the scientific literature reviewed and referenced throughout this Chapter, there is strong evidence for the adverse effects of air pollution, specifically particulate matter (PM) and nitrogen dioxide (NO_2), on human health. Exposure to air pollution - induced by aircraft, airside plant and vehicle movements - over several years can reduce life-expectancy, mainly due to an increased risk of cardiovascular and respiratory illness such as chronic obstructive pulmonary disease (Liu, Y., Yan, S., Poh, K., *et al.,* 2016) and lung cancer (Loomis, D., Grosse, Y., *et al.,* 2013), while short-term exposure can aggravate respiratory and cardiovascular conditions, and trigger asthma attacks (Orellano, P., Quaranta, N., Reynoso, J., *et al.* 2017) and premature deaths. The evidence is strongest for cardiovascular and respiratory effects, particularly in younger (Bell, M. L., Zanobetti, A. & Dominici, F., 2013) and older people (Braubach, M., Jacobs, D. E. & Ormandy, D. 2011). The evidence for population level changes in health outcomes due to concentrations of fine PM and NO_2 below statutory levels is more limited, but there is a general association of sufficient strength to warrant assessment and development of environmental measures to reduce emission levels to as low as reasonably practicable (Bell, M. L., Zanobetti, A. & Dominici, F., 2013).

Based on the scientific literature reviewed, the strength of evidence is strong for a direct causal relationship between noise disturbance and health outcomes and quality of life effects although this is dependent on the level of disturbance. Emerging from the evidence base are a number of key health outcomes, including noise annoyance, sleep disturbance, cardiovascular health, mental health, and children's learning.

Noise annoyance, commonly used within European policy to measure the quality of life impacts of noise exposure on communities around airports, is defined as disturbance, irritation, dissatisfaction and nuisance from environmental noise (Institute of Public Health in Ireland, 2005). Existing evidence displays a variation in the strength of the relationship between aircraft noise and annoyance which may be associated with differences in methodologies, operational factors (i.e. runway operations and night-flight operations) and non-acoustic factors. Studies of change in aircraft noise exposure, including studies of newly affected communities, have found that there is an excess-response in relation to the change in noise exposure, both for decreased and for increased aircraft noise exposure (Breugelmans, O., Houthuijs, D., van Kamp, I., *et al*. (2007); Brown, A. L., and van Kamp, I., 2009). Whilst there is a relationship between aircraft noise and annoyance, there is very little evidence evaluating the impact of operational interventions on annoyance (White, K., Arntzen, M., Walker, F., *et al.* 2017).

Sleep disturbance, potentially induced by aircraft noise, can, in the short-term, impair mood and cognitive performance (Basner, M., & McGuire, S., 2018 and Institute of Public Health in Ireland, 2005). The long-term effects of sleep disturbance can influence glucose metabolism, appetite regulation, memory immune response and endothelial dysfunction, which can act as precursors for high blood pressure, cardiovascular disease, diabetes and obesity (Basner, M., & McGuire, S., 2018 and Müller, U., Schreckenberg, D., Möehler, U *et al.* 2018). Measuring sleep is challenging as there is no one physical, physiological or psychological measure that is considered reliable. As such, there is little evidence evaluating the relationship between aircraft noise and sleep disturbance. However, a recent study utilised meta-analysis (including a study of the Docklands Light Railway (DLR)) to estimate exposure-response functions for the probability of sleep change as a result of aircraft noise and findings suggested that a relationship did exist (Basner, M., & McGuire, S., 2018).

Cardiovascular disease (CVD), a term used to describe an umbrella of health conditions such as Coronary Heart Disease (CHD), Ischaemic Heart Disease (IHD), Angina, heart failure, stroke, and Acute Myocardial Infarction (AMI), have been widely studied in relation to environmental noise. Many studies have found that it is biologically plausible that environmental noise exposure might influence CVD (Babisch, W., 2014; Munzel, T., and Daiber, A., 2018 and Munzel, T., Sorensen, M., Schmidt, F., *et al* 2018). It is hypothesised that heightened noise exposure can cause physiological stress reactions, which in turn can increase CVD risk factors (Institute of Public Health in Ireland, 2005). In regards to studies which have specifically assessed aircraft noise and cardiovascular outcomes, a number of studies have found small, but statistically significant effects, on a range of cardiovascular outcomes including AMI and CHD as well as risk factors including hypertensions and diabetes (Basner, M., Babisch, W., Davis, A., et al 2014; Kempen, E. V., Casas, M., Pershagen, G., *et al* 2018; Vienneau, D., Schindler, C., Perez, L., *et al* 2015).

Mental health and well-being is defined by the WHO as a 'state of well-being 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'. Mental health and well-being is strongly influenced by socioeconomic status, age, gender, history of poor-mental health, and exposure to other life stressors (Gruebner, O., Rapp, M. A., Adli, M., *et al* 2017 and Clark, C., Pike, C., McManus, S*., et al.* 2012). This said, noise is thought to be an environmental stressor influencing mental health and well-being (Baudin, C., Lefevre, M., Champelovier, P., *et al.* 2018; Beutel, M. E., Junger, C., Klein, E. M., *et al.* 2016; Schreckenberg, D., Griefahn, B., and Meis, M., 2010). In regards to studies relating to aircraft noise, a number of studies have found evidence to suggest aircraft noise can be linked to a number of mental health and well-being outcomes including anxiety and depressive disorders (Baudin, C., Lefevre, M., Champelovier, P., *et al.* 2018; Beutel, M. E., Junger, C., Klein, E. M., *et al.* 2016; Schreckenberg, D., Griefahn, B., and Meis, M., 2010).

In addition, there is a reasonable body of scientific evidence indicating that both actual and perceived neighbourhood amenity plays an important role in physical and mental health (Miller, W. D., Pollack, C. E. & Williams, D. R., 2011). Broadly, the literature indicates that environmental features of a neighbourhood, such as its attractiveness or pollution levels, affect the socio-economic position of residents, which in turn affects health and health inequalities (Egan, M., Tannahill, C., Petticrew, M., et al., 2008).

7.4.2 Climate Change

There is an existing evidence base which suggests that climate change has a wide range of implications for human health, including increased mortality and morbidity from extreme weather events, infectious diseases (waterborne, foodborne and vector-borne),diseases resulting from degraded air pollution and mental health (WHO, 2009). As climate change is multi-faceted, it is not possible for studies to attribute health outcomes to specific developments such as airports.

Various studies have assessed the likely future effects of climate change on various health outcomes induced by extreme weather events, including heat waves, storms, cyclone, fires and floods (McMichael, A.J., and Lindgren, E., 2011). Evidence suggests that in temperate countries, as summers become increasingly hotter and heat waves more frequent and severe, additional heat-related deaths will progressively overwhelm the number of deaths averted as a result of milder winters (Knowlton. K., Lynn. B., and Goldberg. R.A., et al., 2007 and Bambrick. H., Dear. K., Woodruff. R., *et al.,* 2008).

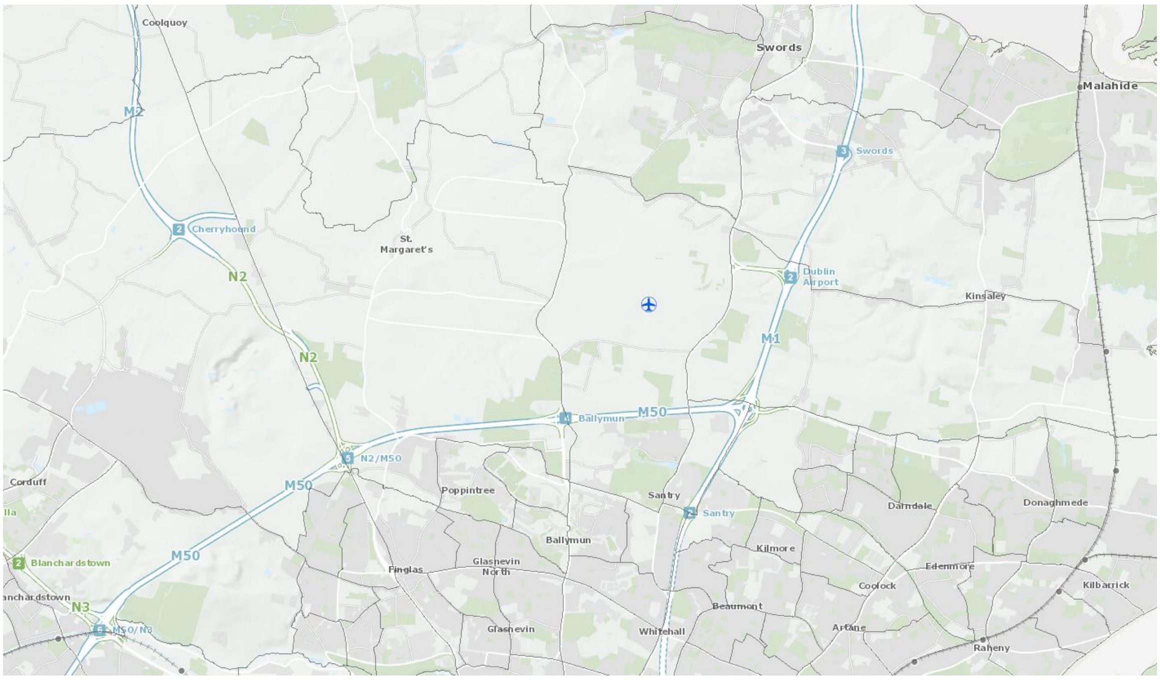
Evidence also suggests that rising temperatures also have implications on the formation and dispersal of various air pollutants. Ozone, a major urban pollutant, accumulates more readily from engine exhausts at higher temperatures. Studies have found that the mortality rate caused by Europe’s 2003 heat wave was exacerbated by high temperatures and ozone formation (McMichael, A.J., and Lindgren, E., 2011 and Dear, K., Ranmuthugala, G., and Kjellström, T*., et al.* 2005).

Furthermore, extensions in the geographic range of several vector-borne infectious diseases or their vectors have been linked to rising temperatures induced by climate change. Evidence suggest that temperature, rainfall and humidity can influence the replication and viability of pathogens and vectors (McMichael, A.J., and Lindgren, E., 2011).

7.5 Baseline Conditions

This section establishes a comprehensive and coherent socio-economic profile of the area, including consideration of the labour market and health indicators. Dependent on the availability of data from the Central Statistics Office (CSO), the baseline section presents analysis of socio-economic indicators which provides the narrative and evidence base of the current status of Dublin Airport. Baseline analysis in this section sets the context for the potential impacts of the proposed Relevant Action.

Dublin Airport intersects the two Electoral Divisions (ED) of Airport and Dubber. Both EDs are located within the county of Fingal, which itself, is situated in the wider jurisdictions of the Dublin Regional Authority and the Eastern & Midland Regional Assembly.



Source: Central Statistics Office (Ireland) (2016), Census 2016

Figure 7-2: Electoral Division

This section establishes the current baseline with regards to the following characteristics relevant to the potential impacts of Dublin Airport:

- Population;
- Labour market indicators; including:
  - Participation rate and unemployment;
  - Education and skills;
  - Occupational profile; and
  - Income profile.
- Human health; and

Local community facilities and land uses.

7.5.1 Population

7.5.1.1 Population

As shown in Table 7-7, the resident population of the Airport ED was 5,018 whilst Dubber ED was 7,372 in 2016 (Central Statistics Office, 2016). Both the Airport ED and Dubber ED, where the airport is located, had a higher proportion of working age residents and lower proportion of retirement age (65+ years) in comparison to Fingal, Dublin Regional Authority, the Eastern & Midland Regional Assembly and the average for Ireland. In 2016, 3,823 (76.2%) of the residents in the Airport ED were aged between 15 and 64 years. Dubber ED had 5,160 (70.0%) residents aged between 15 and 64 years in 2016.

The proportion of working aged residents in both the Airport ED and Dubber ED was noticeably higher than the average recorded for Fingal (66.3%), Dublin Regional Authority (68.5%), the Eastern & Midland Regional Assembly (66.8%) and Ireland (65.5%) as a whole. In addition, the Airport ED had a smaller proportion of residents aged 14 years or under (15.0%) in comparison to Fingal (24.5%), Dublin Regional Authority (19.3%), the Eastern & Midland Regional Assembly (21.1%) and Ireland (21.1%). Dubber ED (26.8%) had the largest proportion of residents aged 14 years or under. The proportion of residents aged 65 years or older in the Airport ED (8.8%) and Dubber ED (3.2%) was smaller than the average for Fingal (9.1%), Dublin Regional Authority (12.2%), the Eastern & Midland Regional Assembly (12.0%) and Ireland (13.4%).

Table 7-7: Population by age, (2016).

	Airport ED		Dubber ED		Fingal County		Dublin Regional Authority		Eastern & Midland Regional Assembly		Ireland	
	No.	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**
Aged 14 years or under	753	15.0	1,977	26.8	72,613	24.5	259,953	19.3	492,198	21.1	1,006,552	21.1
Aged 15-64 years	3,823	76.2	5,160	70.0	196,372	66.3	922,422	68.5	1,556,487	66.8	3,117,746	65.5
Aged 65 years or over	442	8.8	235	3.2	27,035	9.1	164,984	12.2	279,832	12.0	637,567	13.4
Total Population	**5,018**	**-**	**7,372**	**-**	**296,020**	**-**	**1,347,359**	**-**	**2,328,517**	**-**	**4,761,865**	**-**

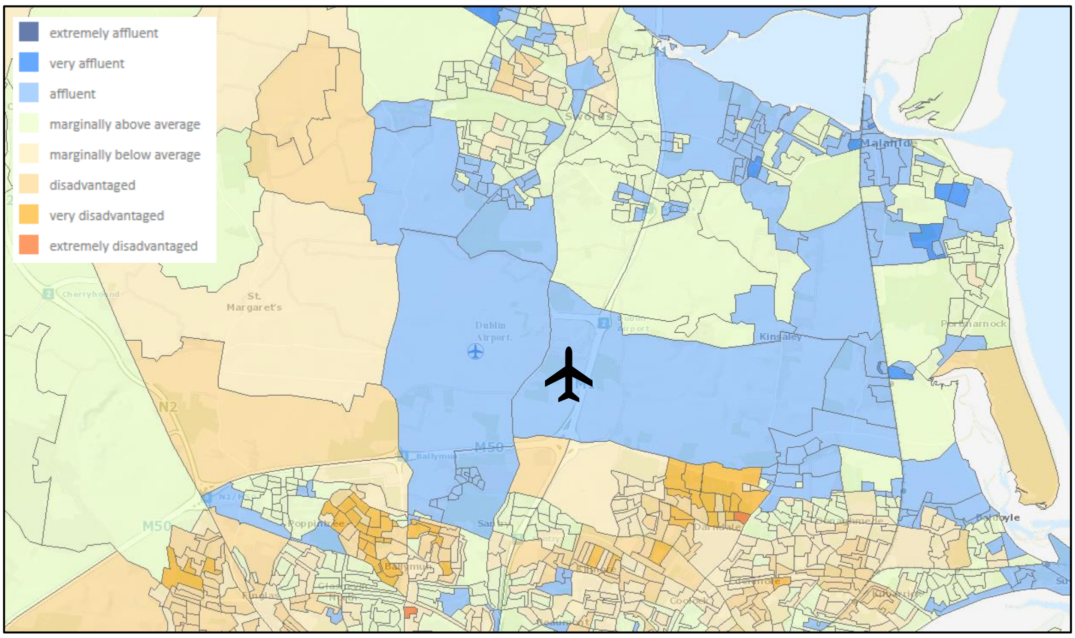
Source: Central Statistics Office (Ireland) (2016), Census 2016.

7.5.1.2 Deprivation

The Podal HP Deprivation Index (Haase, T., and Pratschke, J. 2017) is the primary source for deprivation in Ireland by combining three dimensions of affluence or disadvantage (demographic profile, social class composition and labour market situation) to provide a Relative Index Score for every Small Area in Ireland. The Relative Index Scores are normally distributed around a bell-shaped curve to display the current levels of deprivation compared to other areas, with most areas clustered around the mean and comparatively fewer areas exhibiting extreme levels of affluence or deprivation. The eight classifications for deprivation range from extremely affluent to extremely disadvantaged. According to the latest data, the local authority of Fingal is classified as 'marginally above average' (5th least deprived rank out of 8 classifications) in 2016 with a relative score of 5.3, whilst the Airport electoral division is considered 'affluent' (6th least deprived rank) with a relative score of 13.1.

As shown in Figure 7-3, all Small Areas which make up the Airport Electoral Division are classified by the Irish Deprivation Index as 'affluent'. Several Small Areas surround Dublin Airport are classified as 'marginally below average' and 'disadvantaged', this includes the neighbouring settlement of St Margaret's.

North of Dublin airport is the settlement of Swords which contains four Small Areas which are classified as 'disadvantaged' and seventeen which are classified as 'marginally below average'. West of Dublin is the settlement of Malahide which is classified as a mix of 'marginally above average', 'affluent' and 'very affluent'.



Source: Irish Deprivation Index, (2016). [Online]. Available from: https://maps.pobal.ie/WebApps/DeprivationIndices/index.html

Figure 7-3: Irish Deprivation Index

7.5.2 Labour Market Indicators

7.5.2.1 Participation Rate and Unemployment

The total size of the labour force across the Airport ED and Dubber ED in 2016 was 7,482. Within the labour force in this area, 711 (7.4%) people were unemployed having lost or given up a previous job. A further 78 people were looking for their first regular job. Of the labour force within this area, 6,693 (60.3%) were in employment.

The labour force participation rate (15-64 years) in the Airport ED (75.1%) and Dubber ED (79.3%) was significantly higher than the recorded rate in Fingal (66.9%), Dublin Regional Authority (63.9%), the Eastern & Midland Regional Assembly (63.3%) and Ireland (61.4%) as a whole.

The unemployment rate (15-64 years) in the Airport ED (8.3%) was significantly lower than the recorded rate in the Dubber ED (12.2%), Fingal (10.3%), Dublin Regional Authority (11.6%), the Eastern & Midland Regional Assembly (12.4%) and Ireland (12.9%) as a whole.

Table 7-8: Labour Force Participation Rate and Unemployment Rate, (2016).

	Airport ED	*Dubber ED*	*Fingal County*	*Dublin Regional Authority*	*Eastern & Midland Regional Assembly*	*Ireland*
	%	*%*	*%*	*%*	*%*	*%*
Labour Force Participation Rate	75.1	79.3	66.9	63.9	63.3	61.4
Unemployment Rate	8.3	12.2	10.3	11.6	12.4	12.9

Source: Central Statistics Office (Ireland) (2017), Census 2016.

7.5.2.2 Live Register

The Live Register is used to provide a monthly series of the numbers of people (with some exceptions) registering for Jobseekers Benefit (JB) or Jobseekers Allowance (JA) or for various other statutory entitlements at local offices of the Department of Social Protection.

Table 7-9 shows that the proportion of residents in the Dublin Regional Authority (38.9%) and the Eastern & Midland Regional Assembly (38.6%) on the Live Register for twelve months or more is higher than the national average (35.9%).

Table 7-9: Live register, (2020)

Indicator	*Dublin Regional Authority*		*Eastern & Midland Regional Assembly*		*Ireland*	
	Claimants	*%*	*Claimants*	*%*	*Claimants*	*%*
Claiming for under 12 months	30,942	61.1	56,775	61.4	135,596	64.1
Claiming for over 12 months	19,682	38.9	35,741	38.6	75,896	35.9
Total	**50,624**	**-**	**92,516**	**-**	**211,492**	**-**

Source: CSO, Live Register, (2020).

7.5.2.3 Education and Skills

The working-age residents within the Airport ED are well-qualified. Table 7-10 shows that 37.1% of residents within the Airport ED are qualified to Ordinary bachelors degree / professional qualification and above, which is higher than the recorded rate in Fingal (33.9%), Dublin Regional Authority (36.2%), the Eastern & Midland Regional Assembly (31.9%) and Ireland (28.5%) as a whole.

However, the proportion of working-age residents within the Dubber ED who hold an Ordinary bachelors degree / professional qualification is just 27.1%, significant lower than all other areas presented in Table 7-10.

Table 7-10: Highest level of education completed, (2016)

	Airport ED	Dubber ED	Fingal County	Dublin Regional Authority	Eastern & Midland Regional Assembly	Ireland
	%	%	%	%	%	%
No formal education	0.5	0.7	1.1	1.3	1.5	1.7
Primary education	2.9	5.0	6.6	9.2	9.8	10.8
Lower secondary	3.9	9.4	11.5	11.6	13.2	14.5
Upper secondary	12.3	17.8	19.6	17.0	18.0	18.5
Technical or vocational qualification	7.5	12.2	9.0	7.5	8.3	8.8
Advanced certificate / Completed apprenticeship	4.1	5.7	5.8	4.6	5.4	5.9
Higher certificate	5.4	5.8	5.7	4.6	4.9	5.0
Ordinary bachelor degree	9.3	8.2	9.1	8.0	7.9	7.7
Honours bachelor degree	12.7	10.9	12.6	13.4	12.0	10.7
Postgraduate diploma or degree	13.4	7.6	11.2	13.3	11.0	9.2
Doctorate (PhD)	1.7	0.4	1.0	1.4	1.1	0.9
Not stated	26.3	16.5	6.7	8.1	7.1	6.4

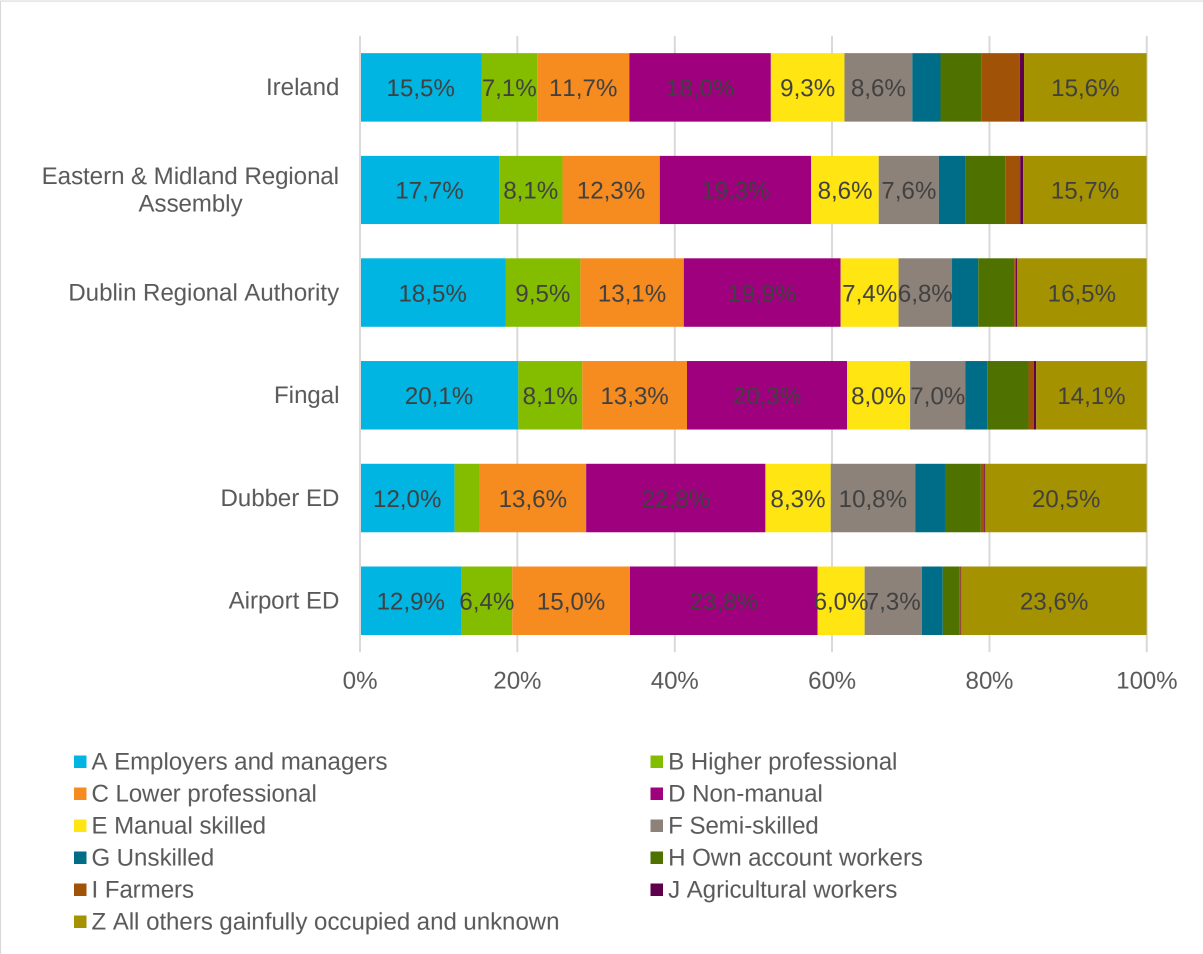
Source: Central Statistics Office (Ireland) (2017), Census 2016.

7.5.2.4 Occupational Profile

Socio-economic group (SEG) classifies the entire population into one of eleven groups based on the level of skill and educational attainment of the occupation (of those at work, unemployed or retired) while all other persons are classified to the socio-economic group of the person in the family on whom they are deemed to be dependent.

Within the Airport ED and Dubber ED, a large proportion of workers are employed within the lower professions or non-manual occupations. Similarly, the Airport ED and Dubber ED have a lower proportion of employers and managers and higher professionals in comparison to the averages for Fingal, the Dublin Regional Authority, the Eastern & Midland Regional Assembly and Ireland as a whole. This can be attributed to the large proportion of workers employed to support the operations of Dublin Airport.

Figure 7-4: Occupational profile by socio-economic group (15+ years) (%), (2016).



Source: Central Statistics Office (Ireland) (2017), Census 2016.

7.5.2.5 Income

Income levels in Fingal are substantially greater than across the country, likely helped by the high-level occupations that the residents in Fingal tend to hold. The median household annual income in Fingal in 2016 was €58,795, comfortably higher than the median rate for Ireland (€45,256). The median household weekly income within the Airport ED and Dubber ED is less than the average for Fingal, but still greater than the average across Ireland – as displayed in Table 7-11.

Table 7-11: Household income, (2016)

Indicator	*Airport ED*	*Dubber ED*	*Fingal*	*Ireland*
Median household annual income (€)	52,482	52,108	58,795	45,256

Source: CSO, Geographic Profiles of Income in Ireland (2016).

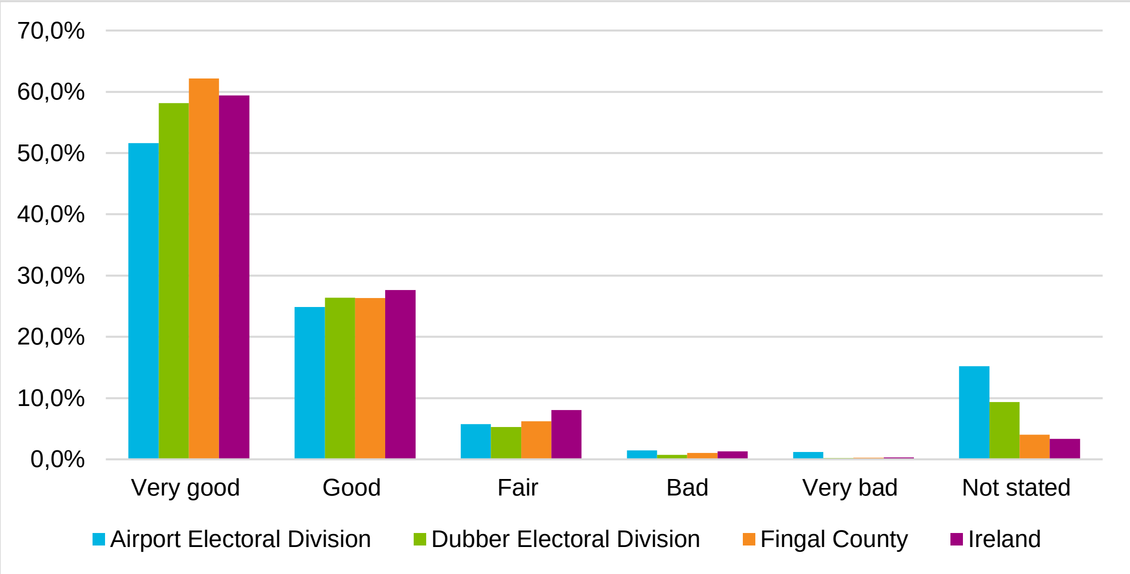
7.5.3 Human Health

The life expectancies in Dublin and Ireland have been increasing in recent years creating an ageing population, a trend that is currently being experienced across most developed countries. In 2016, male residents in the Dublin Regional Authority were expected to live to 80.1 years whilst female residents were expected to live to 83.4 years, compared to 78.3 years and 82.7 years respectively in 2011 (Central Statistics Office, 2019). The life expectancies in 2016 are broadly in line with the country's averages (79.6 years for males and 83.4 years for females).

The health conditions in Dubber ED, Fingal and across the country are positive, but they appear slightly worse within the Airport ED. In 2016, 89% of the population aged 15 years and over in Fingal County considered themselves to be in very good or good health, compared to Ireland's average of 88% (Central Statistics Office, 2016). In comparison, around 84% of residents in Dubber ED and 77% of residents in the Airport ED were in very good or good health[4].

It is worth noting that Ireland has the highest self-perceived health status of all EU countries, considerably above the EU average (67%) (DoH, 2018). Only 1% of residents in Dubber ED and Fingal were in bad or very bad health, which is the fourth lowest proportion of the 31 counties and cities across Ireland (Central Statistics Office, 2016). However, this proportion increases to 3% for Airport ED, which is high for the country. Figure 7-5 presents the health conditions in the Airport ED, Dubber ED and Fingal County, compared to the conditions across Ireland.

Figure 7-5: Health conditions for all persons aged 15 years and over (2015)



Source: Central Statistics Office (Ireland) (2017), Census 2016.

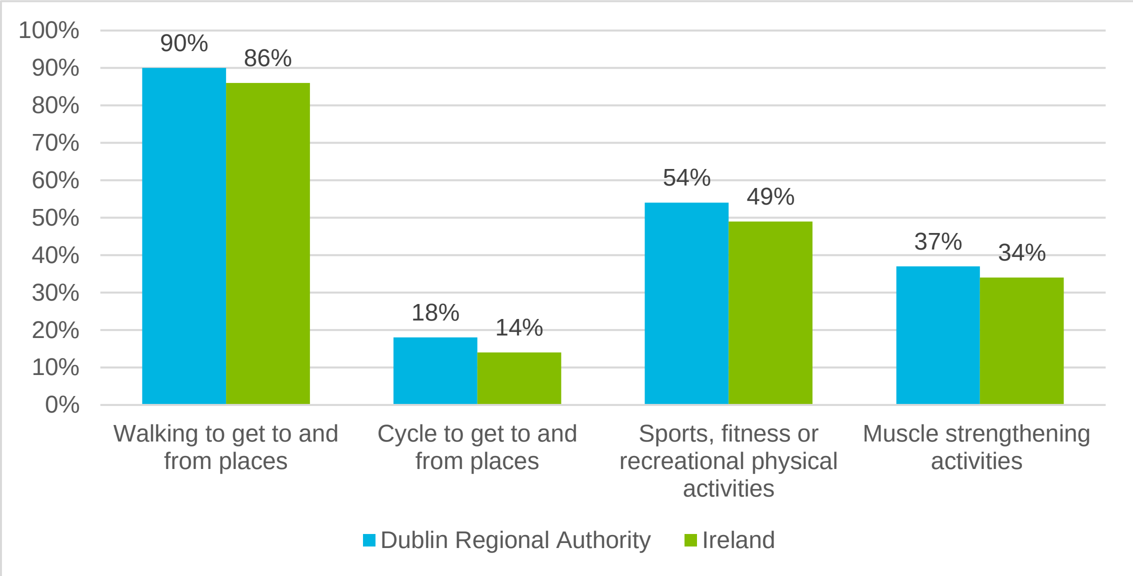
Fewer residents (as a percentage of total population) live with a disability in the Airport and Dubber EDs compared to Fingal and Ireland as a whole. In the 2016 Census, of residents aged 15 and over, 8.3% stated they had a disability in the Airport ED and 7.7% stated this in Dubber ED. These proportions are considerably lower than the averages for Fingal (10.8%) and Ireland (13.5%).

The Census 2016 does not provide further information on health limitations or physical activity data by local area. However, the Irish Health Survey provides further detail on health profiles at a regional level (Central Statistics Office, 2019).

Most residents aged 15 and over in the Dublin Regional Authority (73%) are not limited at all in their daily activities, with 24% limited slightly and only 3% considered to be severely limited. This profile almost matches the national results exactly, where 72% are not limited at all, 24% are limited slightly and 4% are severely limited. However, the residents in the region of Dublin tend to engage in more physical activity than the country's average. Figure 7-6 displays the proportion of residents aged 15 and over undertaking physical activity in the Dublin Regional Authority and Ireland. This highlights that residents in the Dublin Regional Authority are slightly more active across all metrics in comparison to the national averages.

[4] These statistics may not be wholly representative of the health conditions in the Electoral Divisions (ED), particularly the Airport ED, as 15% of respondents in the Airport ED and 9% of respondents in Dubber ED did not state an answer (country's average is 3%).

Figure 7-6: Physical activity undertaken for all persons aged 15 years and over in the Dublin Regional Authority and Ireland (2015)



Source: Centre Statistics Office (Ireland) (2019), Irish Health Survey 2015.

The Irish Health Survey reports the mental health status of residents (aged 15 and over). In 2015, 72% of residents stated they experience no or minimal depression in the Dublin Regional Authority, which was marginally lower than across Ireland (74%). The full mental health statistics for Dublin Regional Authority and Ireland are shown in Table 7-12, which indicates on the whole residents in Dublin experience similar levels of depression as residents across the county.

Table 7-12: Mental health status for all persons aged 15 and over

Mental health indicator	*Dublin Regional Authority*	*Ireland*
None to minimal depression	72%	74%
Mild depression	19%	18%
Moderate depression	6%	5%
Moderately severe or severe depression	3%	3%

Source: Central Statistics Office (Ireland), Irish Health Survey 2015.

There are several healthcare facilities in the surrounding area to Dublin Airport. The nearest of which is located within the Airport grounds, Medmark Dublin Airport Hospital, which provides occupational healthcare to residents in the area. Beaumont Hospital Dublin is the closest major hospital facility, located around 6km south of the Airport and easily accessible following the M1 South from the Airport. The Beaumont Hospital is a large facility, with 669 available inpatient beds (the third most of any hospital in Ireland) and 159 available day beds (most of any hospital in Ireland) (Department of Health, 2019). On average, across the Dublin Regional Authority, there are six GP consultations per person per year; this is the same as the country's average.

7.5.4 Local Community Facilities and Land Uses

7.5.4.1 Local Community Facilities and Land Uses

The area surrounding Dublin Airport is made up of several local communities which include numerous residential areas and community and recreational facilities such as open spaces and parks. Within the immediate vicinity of the airport, there is a cluster of community facilities. This includes the ALSAA Sports Centre, Swords Rugby Club, Kealy's public house and The Coachman's Inn; all of which are located along the R132. Approximately 500 metres to the south of these facilities is Dardistown Cemetery. North west of the airport is the St Margaret's Golf & Country Club and the St Margaret's GAA Club. North east of the airport, directly east of the E132 is the Halpenny Golf Driving Range. Immediately north of the Airport is the Forrest Little Golf Club.

To the immediate west of the airport boundary, located on the R108 is the Boot Inn public house. Directly to the south of the airport beyond the Blue Long Stay Car Park is the Silloge Park Golf Club, Na Fianna GAA Club, Ballymun Kickhams GAA Club and Starlights GFC.

Although strategic land-use planning means there are a lot fewer residential developments within close proximity to Dublin Airport in comparison to other airports of a similar size, there are a number of residential properties located to the west of the airport along Dunbro Lane. Beyond these is the community of Saint Margaret's. In addition to numerous residential dwellings, the village is home to St Margaret's Church and St Margaret's National Primary School.

The largest town within the surrounding area is Swords which is located around 5km north of Airport. Swords contains numerous community facilities, businesses, leisure and residential assets.

There are several villages located further to the east of the Airport towards the coast. This includes the suburbs of The Baskins (2.5km) and Kinsealy (3.5km). Further east towards the Irish Sea are the coastal towns of Malahide (5.5km) and Portmarnock (6.5km) which contain numerous community and recreational facilities. Several golf courses are located around Malahide and along the western coastline, including Malahide Golf Club (6.0km) and Portmarnock Hotel and Golf Links (7.0km).

7.5.4.2 Dublin Airport Community Fund

Dublin Airport, through the Dublin Airport Community Fund, provides support for sports and recreation, social inclusion and community development, health and well-being, culture and heritage, and environment and sustainability. Established in 2017, the €10 million Dublin Airport Community Fund has an annual investment of €400,000 over a 25-year period (WHO, 2020).

The Dublin Airport Community Fund supports community-led projects in 13 eligible areas[5] located in the immediate vicinity of Dublin Airport where communities are situated under flight paths (Barton, H. and Tsourou, C, (2000). The design of the Dublin Airport Community Fund, both in terms of geography and the type of activities which are being supported, was agreed following consideration of detailed feedback from the Northern Runway's second public consultation process in 2016.

All applications are independently assessed by a panel based on the project's positive contribution to local communities. To date, over 480 local community projects have shared over €1 million of allocations from the Dublin Airport Community Fund.

7.6 Environmental Design and Management

There are a number of measures already in place at Dublin Airport that reduce or mitigate the noise effects of aircraft operations. As described in Section 13.5 of ***Chapter 13. Air Noise and Vibration*** and Section 14.5 of ***Chapter 14. Ground Noise and Vibration***, these include:

- Reduction of noise at source;
- Land use planning and management (noise zones, residential sound insulation schemes, the schools sound insulation scheme, and the dwelling purchase scheme);
- Operational procedures; and
- Operating restrictions.

7.7 Assessment of Effects and Significance

7.7.1 Effects During Operation of Proposed Relevant Action

7.7.1.1 Amenity and Local Communities

<u>Noise and Vibration</u>

The noise and vibration impacts associated with the proposed Relevant Action have been considered in ***Chapter 13. Air Noise and Vibration*** and ***Chapter 14. Ground Noise and Vibration*** using two European noise metrics,

[5] Ballymun, Cloghran, Forrest Little, Greater Baskin, Hollystown, Malahide, Portmarnock, Rolestown, Santry, St. Margarets, Swords, The Ward, Tyrrelstown.

one which considers the level of activity over a 24-hour period metric (with penalties applied for noise during the evenings and overnight)[6] and one which considers the level of activity overnight[7].

With regards to air noise and vibration impacts associated with the proposed Relevant Action, a package of existing and proposed sound insulation schemes is offered, and will continue to be offered as part of this application by Dublin Airport to deliver improvements in internal noise levels experienced by residential and community facilities. This assessment considers the residual significant effects after allowing for the benefit of the existing and proposed sound insulation schemes.

Using the 24-hour period metric to assess residential receptors as set out in ***Chapter 13. Air Noise and Vibration***, 2,110 people are assessed as having a residual significant beneficial effect and 10 people are assessed as having a residual significant adverse effect as a consequence of the implementation of the proposed Relevant Action. Residential receptors close to flight paths to the west of the existing South Runway or close to flight paths from the crosswind runway typically are forecast to see reductions in noise level, whereas the opposite is true for receptors closer to flight paths to the west of North Runway.

Using the overnight metric to assess residential receptors as set out in ***Chapter 13. Air Noise and Vibration***, 1,125 people are assessed as having a residual significant beneficial effect and 11,756 people are assessed as having a residual significant adverse effect. As above, the majority of the residual significant adverse effects are expected to be experienced within close proximity to the flight paths from the North Runway.

The impact of noise and vibration on community facilities is also considered within ***Chapter 13. Air Noise and Vibration.*** The assessment considers, schools, residential healthcare facilities and places as worship as high sensitivity receptors. Receptors with a lower sensitivity to noise, such as open spaces and recreation grounds, have not been considered as part of the air noise and vibration assessment. There are no significant noise and vibration effects reported on schools, residential health care facilities or places of Worship[8].

As set out in ***Chapter 14. Ground Noise and Vibration***, no residential receptors are expected to experience significant effects, either adverse or beneficial, using the 24-hour period metric.

Using the overnight metric to assess residential receptors as set out in ***Chapter 14. Ground Noise and Vibration***, no people are assessed as having a significant beneficial effect and 34 people are assessed as having a significant adverse effect. With the residual situation with Apron 5H and the ebenfit of mitigation measures, there would be 3 people assessed as having a significant beneficial effect and 12 people assessed as having a significant adverse effect.

The impact of noise and vibrations on community facilities is also considered within ***Chapter 14. Ground Noise and Vibration***. The assessment considers dwellings, schools, residential healthcare facilities and places as worship as high sensitivity receptors. Receptors with a lower sensitivity to noise, such as open spaces and recreation grounds, have not been considered as part of their assessment. There are no schools or places of worship above the thresholds for significance, and one residential healthcare facility above the threshold.

<u>Air Quality</u>

In regard to emissions as set out in ***Chapter 10. Air Quality***, the proposed Relevant Action will not result in any significant change to the local air quality environment (NO_2, PM_{10} and $PM_{2.5}$) or odour as a result of the proposed change in aircraft movements. More specifically, the proposed Relevant Action will not result in any receptors exceeding European standards or the upper Irish air quality thresholds. Therefore, there is little risk of any exceedance of the environmental air quality assessment levels considered for the protection of human health for residents or users of community facilities.

<u>Assessment</u>

The amenity and local communities assessment considers the assessment findings from air quality, air noise and vibration, and the ground noise and vibration assessments. Sensitivity of affected local residents is assessed to be high while the impact is assessed as medium given the number of dwellings affected. Some residents will benefit

[6] L_{den}, which takes into account the annual activity throughout the 24-hour period, with a 5 dB penalty applied to noise in the evening (19:00-23:00) period and a 10 dB penalty applied to noise in the night (23:00-07:00) period. The key effect linked with this metric is annoyance.
[7] L_{night}, which takes into account the annual activity during the night (23:00-07:00) period. The key effect linked with this metric is sleep disturbance.
[8] It should be noted that only residential healthcare facilities are highly sensitive to noise at night. Schools and places of worship are not expected to be used during the hours specified in the overnight metric.

from the proposed Relevant Action whilst others will experience significant effects from air and ground-borne noise and vibration.

On the basis of the number of residents adversely impacted by air noise and vibration, the effect on amenity and local communities from a population and human health perspective is assessed to be **permanent moderate adverse (significant)**.

7.7.1.2 Human Health and Well-being

This section summarises the impact of the proposed Relevant Action on human health and well-being, structured by health determinants as set out in *London HUDU Rapid Health Impact Assessment Tool* (London Healthy Urban Development Unit, 2019).

Air quality, noise and neighbourhood amenity

As set out in Section 7.4, the quality of the local environment can have a significant impact on physical and mental health. Pollution caused by aviation and commercial activity can result in poor air quality, noise nuisance and vibration. Poor air quality is linked to incidence of chronic lung disease (chronic bronchitis or emphysema) and heart conditions and asthma levels of among children and young people. Noise pollution can have a detrimental impact on health resulting in sleep disturbance, cardiovascular and psycho-physiological effects. Good design and the separation of land uses can lessen noise impacts.

An assessment of the likely significant effects of air quality as a result of the proposed Relevant Action has been presented in ***Chapter 10. Air Quality***.

In regard to emissions, the proposed Relevant Action will not result in any significant change to the local air quality environment (NO_2, PM_{10} and $PM_{2.5}$) or odour as a result of the proposed change in aircraft movements. More specifically, the proposed Relevant Action resulted in no receptors being predicted to exceed European standards or the upper Irish air quality thresholds. Therefore, there is little risk of any exceedance of the environmental assessment levels considered for the protection of human health.

Noise pollution, both as a result of air noise and vibrations and ground noise and vibrations, can have a detrimental impact on health resulting in sleep disturbance, cardiovascular and psycho-physiological effects.

An assessment of the likely significant effects of air noise and vibrations as a result of the proposed Relevant Action has been presented in ***Chapter 13. Air Noise and Vibration***. As detailed in sections 0 to 0, some residents benefit from lower noise levels whilst some residents will be impacted adversely by higher noise levels. There are no significant noise and vibration effects reported on schools or residential health care facilities. Whilst it is accepted that there may be some degree of annoyance from noise to users of open space and nature, this will be commonly for short periods of time when people are passing through the open spaces and nature.

An assessment of the likely significant effects of ground noise and vibrations as a result of the proposed Relevant Action has been presented in ***Chapter 14. Ground Noise and Vibration.*** As detailed in sections 0 to 0, some residents are impacted adversely by higher noise levels. There are no significant noise and vibration effects reported on schools and residential healthcare facilities. Whilst it is accepted that there may be some degree of annoyance from noise to users of open space and nature, this will be commonly for short periods of time when people are passing through the open spaces and nature.

Given the number of people assessed as being adversely residually significantly affected within ***Chapter 13. Air Noise and Vibration***, the impact of the proposed Relevant Action on air quality, noise and neighbourhood amenity as a determinant of human health and well-being is assessed to be **negative (-).**

Climate change

An assessment of the likely significant effects on greenhouse gas (GHG) emissions as a result of the proposed Relevant Action has been presented in ***Chapter 11. Climate and Carbon***.

The GHG assessment study area considers all GHG emissions from fuel used by aircraft during the LTO cycle (i.e. approach/landing, taxiing, take-off and climb to 3,000 feet). It is stated that by 2025, the proposed Relevant Action is estimated to represent 333,474 tonnes of CO_2, an increase of 12,206 tonnes of CO_2 in comparison to the permitted operations.

The impact of the proposed Relevant Action has been compared with Ireland's projected National Emissions Inventories for each of the assessment years (under the With Additional Measures scenario) to determine the level of significance. As the GHG emissions associated with the proposed Relevant Action do not represent ≥1% of the projected National Emissions Inventory for either of the assessment years, GHG emissions are considered to be of minor significance.

The proposed Relevant Action is not likely to significantly affect significant ecological features during operation as a result of light or surface water pollution because there would be no additional lighting or surface drainage amendments relative to the consented (and amended in 2020) planning permission for the North Runway.

Therefore, impact of the proposed Relevant Action on climate change as a determinant of human health and well-being is assessed to be **neutral** (0).

7.8 Additional Mitigation Measures

7.8.1 Mitigation During Operation of Proposed Relevant Action

No additional mitigation measures related to Population and Human Health are anticipated to be required during the operation of the proposed Relevant Action.

This said, Dublin Airport will continue to provide support for community-based projects associated with sports and recreation, social inclusion and community development, health and well-being, culture and heritage, and environment and sustainability through the Dublin Airport Community Fund. Established in 2017, the €10 million Dublin Airport Community Fund will continue to provide up to €400,000 of investments annually over a 25-year period.

In addition to mitigation measures already in place at Dublin Airport, daa are also proposing a number of measures in relation to the air noise and vibration effects. Of relevance to population and human health is the proposal to provide eligible dwellings with a grant to pay for sound insulation works based on their night-time air noise level.

Further details of all mitigation measures relating to air noise and vibrations are presented in ***Chapter 13. Air Noise and Vibration.***

7.9 Residual Effects and Conclusions

As part of the assessment of impacts on population, the overall classification and significance of each effect has been assessed across the study area. A summary of the potential effects on population is identified in Table 7-13.

Table 7-13: Population Summary of Potential Effects

Description of Effect	*Sensitivity of Receptor*	*Nature of Effect / Geographic Scale*	*Magnitude of Impact*	*Initial Classification of Effect (with embedded mitigation)*	*Additional Mitigation*	*Residual Effect Classification and Significance*
Operation						
Amenity and Local Communities	High	Permanent / Local	Medium	Moderate Adverse	None	Moderate Adverse (significant)

As part of the assessment of impacts on human health, the overall classification for each health determinant has been assessed across the study area. A summary of the potential effects on human health is identified in Table 7-14.

Table 7-14: Human Health Summary of Potential Effects

Health Determinant	*Potential Health Impact*	*Additional Mitigation*	*Residual Effect Classification*

Operation

Air Quality, Noise and Neighbourhood Amenity	Negative (-)	None	Negative (-)
Climate Change	Neutral (0)	None	Neutral (0)

Chapter 08: Major Accidents and Disasters

08

8. Major Accidents and Disasters

8.1 Introduction

This chapter of the Environmental Impact Assessment Report (EIAR) describes the findings of an assessment of the likely significant effects of the proposed Relevant Action associated with the risks to third parties arising from aircraft crash.

The assessment take account of the requirement in Annex IV of the EIA Directive for "*A description of the likely significant effects of the proposed project on the environment resulting from, inter alia: (d) the risks to human health, cultural heritage or the environment (for example due to accidents or disasters)"* and the reference in point 8 of the Annex: "*A description of the expected significant adverse effects of the project on the environment deriving from the vulnerability of the project to risks of major accidents and/or disasters which are relevant to the project concerned. Relevant information available and obtained through risk assessments pursuant to Union legislation such as Directive 2012/18/EU of the European Parliament and of the Council or Council Directive 2009/71/Euratom or relevant assessments carried out pursuant to national legislation may be used for this purpose provided that the requirements of this Directive are met. Where appropriate, this description should include measures envisaged to prevent or mitigate the significant adverse effects of such events on the environment and details of the preparedness for and proposed response to such emergencies*".

The assessment also considers the effects of the following items of risk:

- Bird strike;
- Wake vortex; and
- Fuel dumping.

There is essentially no material difference between the permitted / constrained and proposed / unconstrained operations in respect of the three topics above. However, for completeness, a summary of each and the existing controls is provided in Sections 8.9 to 8.11 of this chapter. The primary focus of this chapter is therefore on the first of the above issues: the risk to third parties and the environment arising from aircraft crashes.

Aircraft crashes are very rare events but those that do occur take place predominantly during take-off and landing, along flight paths and close to the ends of runways. The risks to members of the public that live and work in these areas can therefore be expected to be elevated to some extent above the background to which people in general are exposed.

The proximity of populated areas to those areas along flight paths and close to the runway ends where the crash risk is more concentrated, and the associated risks to third parties, are therefore potential concerns for any airport development or operational change proposal. Given established land use practices, such risks cannot be eliminated completely and must therefore be tolerated in return for the benefits of air transport. In practice, in comparison with the situations encountered more generally in Europe and elsewhere, there are generally fairly limited areas of existing development in locations subject to elevated risks along flight paths at Dublin Airport. Nevertheless, it is appropriate to provide a thorough account of the implications of the proposed Relevant Action for the risks to third parties arising from aircraft crashes.

This assessment and EIAR chapter has been produced by Eddowes Aviation Safety Limited.

8.2 Legislation and Planning Policy Context

8.2.1 National Legislation

The primary legislation relating to aviation safety in the Republic of Ireland is set at EU level in accordance with Regulation No 1139/2018 on common rules in the field of civil aviation which includes the establishment of the European Aviation Safety Agency (EASA). This regulation defines the framework through which the standards and recommended practices of the International Civil Aviation Organisation (ICAO), which govern international civil aviation world-wide, are adopted across the EU. In the case of airports, Regulation No 139/2014, as amended by Regulation No 161/2017 and Regulation No 401/2018, establishes the basis for licensing of aerodromes by reference to defined certification specifications which identify the technical standards adopted by EASA, indicating means to show compliance with the framework regulation and its Implementing Rules. Licensing of aerodromes in accordance with these technical standards ensures that international airports such as Dublin Airport provide safe environments for the operation of the types of aircraft that they are intended to serve. Further regulations apply to the operation of aircraft and to air traffic management services to ensure that all elements of the system provide for safe and efficient air transport. These requirements are implemented at national level by the Irish Aviation Authority (IAA).

Whilst the safety framework identified above is intended primarily to provide for the safety of aircraft and their occupants, it will also support the safety of those living and working in the vicinity of airports by ensuring that aircraft crashes are very rare events. Nevertheless, as has already been noted above, although aircraft crashes are very rare events, the majority occur along flight paths and close to the runway ends where the crash risk is more concentrated, as demonstrated by the detailed technical analysis that underpins the models employed to support the assessment of crash risk described later in this chapter. Whilst the ICAO and EASA technical specifications for the physical characteristics of aerodromes provide a safe operating environment for aircraft, they do not make any specific provisions for the protection of third parties. Guidance in relation to airport planning supporting the implementation of the standards recognises that third-party risk is an important issue in decision-making on airport development. No specific aerodrome design prescriptions relating to this issue are provided in the standards. However, the guidance advises that specific methodologies can be developed by States and used to define dedicated land use policy controls.

Within the above international regulatory framework for aviation safety, the Republic of Ireland is one of a limited number of countries that has developed specific land use controls to address third party risk, as discussed below.

8.2.2 National Planning Policy

In 2003, the Department of Transport and the Department of Environment, Heritage and Local Government (DoEHLG) commissioned a study (ERM, 2005) into Public Safety Zones (PSZs) at Ireland's three principal airports; Cork, Dublin, and Shannon (hereafter referred to as the ERM Report). The study resulted in the recommendation that a policy for land-use planning control be adopted in areas located in the vicinity of runway ends that are subject to higher levels of risk. The two primary elements of this policy recommendation were as follows:

- To prevent further development within inner PSZs, defined by the limits of the area subject to an individual risk of 1 in 100,000 per year, but to allow existing developments to remain.
- To allow existing developments to remain within the outer PSZs, defined by the limits of the area subject to an individual risk of 1 in 1,000,000 per year but prevent high density housing development, and the building of schools, hospitals and facilities attracting large numbers of people.

The concept of individual risk that underpins these recommendations is explained further in Section 9.3 and, in particular, in paragraph 9.3.23 which identifies the assessment criteria for evaluation of impact significance.

As yet, guidelines for the implementation of this PSZ policy recommendation have not been issued by the Department of Housing, Local Government and Heritage. However, the general principles behind the policy are adopted at the local planning level, as described further below.

However, it should be recognised that the PSZ approach to the control of new development in the vicinity of airports does not explicitly address the issues associated with a new development within an established built environment. These are two distinct development control issues and the assessment of the proposed Relevant Action requires consideration of the latter one relating to impacts on existing development. In that context, the inner and outer PSZs, as determined for the operations foreseen for the current application, identify areas that are subject to identified levels of risk and establish an objective framework for the consideration of the significance of risk impacts. Thus, whilst not directly relevant to the evaluation of the proposed Relevant Action, PSZ policy provides a useful reference point.

8.2.3 Local Planning Policy

Provisional PSZs, based on the 1 in 100,000 per annum and 1 in 1,000,000 per annum individual risk contours, were identified for Dublin Airport as part of the 2003 DoEHLG study. These provisional PSZs, shown in Figure 8-1, were based on an assumed maximum capacity scenario, involving the equal use of the two parallel runways in mixed mode. They are therefore conservative and cover larger areas than those required to meet the identified PSZ policy objective for the anticipated operations considered in this assessment.

The developing PSZ policy approach was first recognised formally in local planning policy in 2005 under the Fingal County Development Plan 2005 – 2011 (FCC, 2005). This plan describes the background to PSZ policy, stating that "the purpose of Public Safety Zones is to protect the public on the ground from the small but real possibility that an aircraft might crash in a populated area" and that "a Public Safety Zone is used to prevent inappropriate use of land where the risk to the public is greatest." In that context, the County Development Plan identifies a commitment to implement the policies to be determined by Government in relation to Public Safety Zones for Dublin Airport under Policy TP19. The County Development Plan also identified a more general requirement under Strategy DAS3 "to promote appropriate land use patterns in the vicinity of the Airport and of the flight paths serving the Airport, having regard to the existing and anticipated noise, safety and environmental impacts of aircraft movements" which is consistent with Policy TP19. Whilst noting that the definition of the extent of PSZs and the associated land use restrictions were awaiting a decision by Government on the Draft PSZ Study the County Development Plan identified the draft zones determined in the 2003 DoEHLG study on the Development Plan maps. These elements of policy have been retained in subsequent County Development Plans (FCC, 2011) & (FCC, 2017), including the current County Development Plan 2017-2023, as described further in the following section.

The draft PSZs were also employed to support the consideration of the safety impacts of the proposals for the Northern Runway during the original planning process (F04A/1755 & PL06F.217429) (ABP, 2006). Clarification concerning the interpretation of the status of PSZs by Fingal County Council was provided at the oral hearing when it was stated that the Council was taking the view that a cabinet decision was made to adopt the ERM report in principle. As such, the relevant recommendations in terms of restrictions on development were being followed by the planning authority.

8.2.3.1 Fingal Development Plan 2017-2023

In accordance with the above discussion, the County Development Plan 2017-2023 identifies the following objectives in relation to land use controls and public safety in the vicinity of Dublin Airport:

- Objective DA13: Promote appropriate land use patterns in the vicinity of the flight paths serving the Airport, having regard to the precautionary principle, based on existing and anticipated environmental and safety impacts of aircraft movements.
- Objective DA14: Implement the policies to be determined by the Government in relation to Public Safety Zones for Dublin Airport.

8.2.4 Other Relevant Policy, Standards and Guidance

In addition to the standards applicable to development control in the vicinity of airports under PSZ policy to address risk associated with aircraft crash events, the Health and Safety Authority (HSA) provides guidance (HSA, 2010) on the assessment and management of other potentially hazardous activities in the Republic of Ireland, more specifically in the context of the regulation of Control of Major Accident Hazard (COMAH) sites and land-use planning in their vicinity. Whilst airport aircraft related operations are not covered by the COMAH Regulation, the nature of the hazard associated with an aircraft crash is similar in some respects to that associated with COMAH sites in so far as both may give rise to periodic accidental events causing multiple fatalities. The approach set out by the Health and Safety Authority is consistent with that adopted more widely in Europe and elsewhere. It reflects the recognition that risks in modern industrial society cannot be eliminated entirely in the context of the existing development framework and so may need to be tolerated in return for the benefits associated with them, provided that they are sufficiently small and managed so as to be as low as reasonably practicable, as summarised broadly in UK guidance (UK HSE, 2001).

The HSA guidance describes requirements for the rigorous and systematic quantitative assessment of major accidents and disasters and the use of quantitative risk criteria for evaluating risk significance and acceptability. As well as identifying individual risk criteria, conceptually similar to those adopted under PSZ policy, the HSA guidance identifies "societal risk" criteria that provide a basis for assessing the significance of periodic accidents that may give rise to multiple fatalities. This broader guidance has been employed to support the establishment of an objective framework for evaluation of the risks associated with operations at Dublin Airport.

8.3 Assessment Methodology

This section of this EIAR chapter describes the approach to the assessment of the risks to third parties arising from aircraft crash associated with the proposed Relevant Action, covering the following:

- Information sources that have supported the preparation of this chapter;
- Details of supporting consultation that has been undertaken;
- The methodology behind the assessment, including the criteria for the determination of the scale of impacts and the magnitude of change from the identified 'baseline' conditions for the parallel runway system from

the start of its operation: ie a comparison between the 2022 and 2025 permitted / constrained and proposed / unconstrained scenarios;

- An explanation as to how the identification and assessment of potential third party risk impact effects has been reached; and
- The significance criteria and terminology for the assessment of residual risk impacts to people within the vicinity of the airport and with consideration to ecological designated sites.

The key characteristics of the proposed Relevant Action that define the basis for the assessment of potentially significant third party risk impacts are as follows:

- The runway layout, in particular the runway end locations that provide the reference points for the relevant take-off and landing operations;
- Flight paths to and from the runways that define the areas over which aircraft fly and hence where the crash risk may be elevated above the wider background levels;
- The fleet mix of aircraft operating under the scenarios identified for assessment and the annual number of movements of each aircraft type which determine the scale of the risk, in accordance with the risk model that identifies crash rates from the historical accident record that are dependent upon the different aircraft types concerned and the consequences of ground impacts that are similarly dependent upon the aircraft types, according to their size.

The assessment has employed equivalent assumptions in respect of these characteristics to those used in the noise assessment in this EIAR (*Chapter 13: Air Noise and Vibration*, and *Chapter 14: Ground Noise and Vibration*). It is based on forecast operations for the permitted / constrained and proposed / unconstrained operations in 2022 and 2025, at night time. The future year of 2022, rather than the current year of 2020, has been selected on the basis that this is expected to be the first year when North Runway is expected to be operational and this is considered to provide a more appropriate reference point than a nominal year covering operations from the existing South Runway and Crosswind Runway only. Further details of the relevant assumptions are provided in the technical appendix to this chapter.

8.3.1 Methodology for Determining Baseline and Proposed Operational Effects

The risks associated with civil aviation are well-established on the basis of considerable operational experience worldwide over a substantial period of time. Whilst crashes may be considered rare at any given airport and within any limited time period, reference to the wider international accident record over an extended time period provides an effective basis for characterising this risk. It is evident from that experience that the primary hazard requiring attention in the context of the proposed Relevant Action relates to aircraft crash that might affect people living and working in the vicinity of the airport.

Site-specific risks to the public in the vicinity of airports can be estimated quantitatively by using an empirical modelling approach, based on historical accident data that characterises risk by reference to three key parameters as follows:

- The likelihood or probability (frequency per annum) of an aircraft crash occurring during take-off or landing operations, anywhere in the vicinity of an airport, having regard to the number of movements and the inherent reliability of different aircraft types, as determined from the available crash statistics;
- The probability of impact at any specific location at or near an airport relative to the runway ends and the flight paths beyond them, as described by the crash location distribution, determined by reference to crash locations in the historical accident data set;
- The severity of the consequences of an impact on the ground, according to the size of the aircraft concerned and again determined by reference to the historical accident data set.

The model provides estimates for the first factor on the basis of the crash rates derived for different aircraft types (e.g. civil passenger jet aircraft, civil passenger turboprop aircraft, business jet aircraft, jet and turboprop cargo aircraft) from the recent historical accident record. The model identifies different crash rates for take-off and landing operations. Based on the crash rates per movement for each aircraft type and the anticipated annual number of movements at Dublin Airport, the model provides an estimated annual crash rate for those operations.

The model provides estimates for the second factor by using generic crash location distribution functions that are determined for the observed historical distribution for civil aircraft accidents involving aircraft types that are generally representative of those operating at Dublin Airport.

The historical accident record demonstrates a relationship between the severity of crash consequences and the size of aircraft involved from which an empirical model relating the area affected to the take-off weight of the aircraft concerned has been derived to address the third factor. The crash consequences for the anticipated operations at Dublin can therefore be expected to cover a range of severities. The empirical crash consequence model is used to estimate the severities of these accident consequences by reference to the aircraft types and the associated size characteristics of aircraft within the anticipated fleet mix.

The modelling approach employed in the current assessment is essentially that identified by the UK Department for Transport (Department of Transport, 1997 and NATS, 2000) for the support of Public Safety Zone policy and adopted also in the DoEHLG PSZ study. No equivalent model has been developed in the Republic of Ireland and, given the time and effort that would be required to develop one, the adoption of the available UK DfT model represents a cost-effective practical solution. The technical details of the model are described further in the Technical Appendices supporting the EIAR.

In accordance with the outline provided in paragraph 9.3.2, key inputs required to support the above modelling approach are therefore as follows:

- The geometrical characteristics of the runway layout, in particular the runway end locations that provide the reference points for the relevant take-off and landing operations, and the associated flight paths to and from the runways that define the areas over which aircraft fly;
- The fleet mix of aircraft operating under the scenarios identified for assessment and the annual number of movements of each aircraft type which determine the scale of the risk.

The baseline operational impacts have been assessed on the basis of forecast operations for two reference years, 2022 and 2025, under the assumption that the current noise related operating restrictions continue to apply. All modelled scenarios employ forecast operations based on the assumption that the current 32 mppa limit on terminal capacity applies. Given that terminal capacity limit and the current global decline in air travel due to the Covid-19 pandemic, a relatively moderate growth in aircraft movements is forecast between 2022 and 2025 and the overall difference in forecast aircraft movements between the permitted / constrained scenario and those with the proposed / unconstrained scenario are relatively small.

Aircraft routes are defined according to international standards for the design of instrument flight procedures that ensure the safe separation of aircraft in flight, having further regard to the objective of minimising noise impacts on neighbouring communities. The use of noise preferential routes that avoid flight over populated areas where practicable will assist in minimising the third party risk impacts.

The mode of operation of the parallel runway system is a further relevant consideration. Preferential use of one or other runway for take-off or landing under either easterly or westerly operations, according to wind conditions can further limit the impacts on sensitive receptors. In the context of the Regulation 598 noise management requirements, extensive noise assessments have been undertaken [further details are provided in *Chapter 13: Air Noise and Vibration*, and *Chapter 14: Ground Noise and Vibration]* to identify the mode of operation that can minimise noise impacts, whilst meeting the anticipated demand for take-off and landing operations. The detailed operational specifications that have been developed through these noise assessments have been employed as the basis for the third party risk assessments.

Further details concerning the assumptions in the model and the relevant operational assumptions are provided in the Technical Appendices supporting the EIAR.

8.3.2 Study Area

The study area has been defined essentially as that area across which the scale of the risks to third parties arising from aircraft crash is sufficient to be considered potentially significant, when judged against the criteria described further below. A risk level above 1 in a million per annum has been identified as the appropriate criteria for the identification of a potentially significant risk of fatality for an individual. The primary study area in respect of individual risk was therefore defined to extend to at least the limit of the 1 in a million per annum individual risk contours for the different operational scenarios, as discussed in further detail in Sections 9.4 and 9.5. In order to provide an effective description of elevated risk levels along all flight paths, the study area was selected to extend out to beyond the limits of the 1 in a million per annum individual risk contours.

For societal risk estimation, the study area extends to a distance of 16 km laterally from the runway extended centrelines of the Southern Runway (Runway 10R-28L) and to a longitudinal distance of 18 km beyond and behind the Runway 10R Threshold. The mathematical functions that are employed for the estimation of risk as a function of location relative to flight paths identify crash probabilities that decrease progressively with increasing distance from the line of the flight paths and increasing distance from the runway ends. For mathematical functions of this sort, some residual element of risk will be identified to be located beyond any defined area extending out to any given distance from the runway. It is therefore impractical to define an area that encapsulates all of the risk predicted by these mathematical functions. Adoption of the area identified accounts for all but a few percent of the risk identified by the model functions and this area covers the vast majority of the areas of development where there would be a risk of fatalities in the event of an aircraft crash. The selection of this study area represents a pragmatic balance that will therefore ensure that reliable societal estimates are provided in return for a practical level of assessment effort.

In the context of the EIA, the sensitive receptors in the study area are the people living and working across it. The risks vary according to the precise location of sites relative to the runway ends and flight paths. The locations where people may be present and the numbers of individuals at each of the occupied locations was identified primarily by reference to the Q2 2019 An Post GeoDirectory, in accordance with the approach employed for the noise assessment. This approach identified individual residential development locations and community buildings within three categories: education, healthcare and religious buildings.

Consideration has also been given to the risk associated with a major accident or disaster occurring close to or in the vicinity of ecologically sensitive areas within the study are. Further details of which are provided in *Chapter 14: Biodiversity.*

For the purposes of the third party risk assessment, business premises that were identified through the Q2 2019 An Post GeoDirectory not included in the noise assessment were also considered on the basis of location, numbers present and periods of occupancy. The characterisation of these areas of development was supported by the review of Google Earth satellite images. The assessment also included consideration of risks to occupants within the airport terminal complex, taking account of the numbers working at the airport and the anticipated passenger throughput.

The specifications for distribution of people across the study area and the basis on which they were derived are described in further detail in the Technical Appendices supporting the EIAR.

8.3.3 Significance Criteria

Two distinct measures are available for characterising the risks estimated by airport-related crash risk models, as follows:

- Individual Risk: the annual probability of fatality for a hypothetical resident present at any given location relative to the runway threshold and flight path to and from it;
- Societal Risk: the annual probability of accidents causing any given number of fatalities in any particular area of development, taking account of the nature of the development, in particular the density of occupancy.

Both measures have been employed in this assessment. They are routinely employed in the assessment of the risks associated with other potentially hazardous facilities, within the Republic of Ireland (HSA, 2010 and ERM, 2005) and internationally (HSE, 2001).

Individual risk is the measure employed for the definition of PSZs. Public Safety Zone policy is a land-use planning tool for controlling new residential and other development in the vicinity of existing airport infrastructure. Certain land-uses are restricted in areas subject to a defined quantitative level of risk or more, on the basis that it is considered cost-beneficial to forego the development potential of the land, which involves a lost opportunity cost, in return for the benefit of reducing the risk of people on the ground being killed in areas along flight paths that are subject to elevated levels of risk. The individual risks are characterised in terms of a set of risk contours, representing the limit of the area subject to a defined level of risk.

Risk contours for three different levels of risk are typically employed in the assessment of individual risk, as follows:

- A risk of 1 in 10,000 per annum, considered to be a relatively high risk and at the limit of what is considered to be an acceptable level of risk exposure for members of the public;

- A risk of 1 in 100,000 per annum, considered to be a risk that is of potential concern but one that can nevertheless be considered acceptable in return for the economic benefits derived from the activity giving rise to the risk, provided that the risk is managed so as to be as low as reasonably practicable;
- A risk of 1 in a million per annum, considered to be a low risk that is a generally acceptable level of exposure for members of the public.

These identified risk levels provide a well-defined set of internationally recognised quantitative criteria for the evaluation of risk impact significance. In addition to the risk levels themselves, the relative numbers of people exposed to these risk levels provide a further criterion for evaluation of risk significance. Having regard to the established practice in the Republic of Ireland and elsewhere, criteria for assessing the significance of individual risk impacts have been developed in the format recommended in Section 3: Page 53 of the EPA Guidelines (EPA, 2017). These individual risk criteria for the identified descriptors of impact significance, summarised in Table 8-1, have been employed for the assessment of the impacts of operations at Dublin Airport. They are based on professional judgement concerning the alignment of the established safety standards and terminology with the framework identified in EPA guidelines.

Table 8-1 Assessment Criteria for Individual Risk Significance

Significance of Impact	Topic Specific Criteria
Negligible[1]	Individual fatality risk < 1 in 1,000,000 per annum
Slight Effects	1 in 1,000,000 per annum < Individual fatality risk < 1 in 100,000 per annum Low numbers (up to a few tens) of people exposed
Moderate Effects[2]	1 in 1,000,000 per annum < Individual fatality risk < 1 in 100,000 per annum High numbers (hundreds to thousands) of people exposed, Or 1 in 100,000 per annum < Individual fatality risk < 1 in 10,000 per annum Low numbers (up to a few tens) of people exposed
Significant Effects	1 in 100,000 per annum < Individual fatality risk < 1 in 10,000 per annum High numbers of people exposed
Very Significant Effects	Individual fatality risk > 1 in 10,000 per annum Low numbers (up to a few tens) of people exposed
Profound Effects	Individual fatality risk > 1 in 10,000 per annum High numbers (hundreds to thousands) of people exposed

Note 1: The term "negligible" is typically employed in safety regulation for risk levels that are below regulatory concern and this category can be considered to equate essentially with the "Not significant" and "Imperceptible" impact significance categories identified in EPA guidance.
Note 2: There will be some overlap between scenarios meeting the criteria identified for "moderate effects", according to the level of risk within the identified bands and the numbers of people exposed.

Individual risks for airport operations were estimated as part of the (DoEHLG) study (ERM, 2003) into Public Safety Zones. These risk estimates provide a further potentially useful reference scenario for evaluation of the risk impacts predicted as a result of the proposal to change permitted operations.

Whilst the identified individual risk criteria that underpin PSZ policy in the Republic of Ireland can provide some insight into the extent to which people living and working in the vicinity of Dublin Airport are exposed to the risk of aircraft crash, the individual risk measure does not effectively characterise the true nature of the risk. PSZ policy is concerned with the control of new development near existing airports and the use of individual risk criteria in that context is entirely appropriate. However, the current assessment is concerned with determining the impact of airport operations on existing development which is a distinct question. For these purposes, the aircraft crash risk is better represented as a periodic event that may lead to multiple fatalities, where the number of fatalities will depend on the density of occupation of the crash site and size of the aircraft concerned. This sort of scenario can be characterised more effectively in terms of the "societal risk", characterised quantitatively in terms of the estimated frequency of accidents, *f(N)*, leading to a defined number of fatalities, *N*. Societal risk estimates typically take account of the wide range of potential outcomes of an accident from the more common scenarios involving relatively few fatalities to less common ones involving larger numbers of fatalities.

Specific quantitative criteria for evaluating the significance of societal risks in the Republic of Ireland have been identified (HSA, 2010) in the context of the regulation of Control of Major Accident Hazard (COMAH) sites and land-use planning in their vicinity. Whilst the operation of aircraft at and in the vicinity of an airport are not covered by the COMAH regulations, the nature of the hazard associated with an aircraft crash is similar in some respects to the operation of facilities that are in so far as both may give rise to periodic accidental events causing multiple fatalities. In common with COMAH sites, operation of the airport provides a clear tangible economic benefit that must be balanced against the risk associated with operation. In the absence of any societal risk criteria developed specifically for airport operations, reference has been made to these available criteria which can be seen to have been developed to address a broadly equivalent issue. These criteria are defined by reference to a “Scaled Risk Integral” (SRI) representing the sum over all scenarios of the accident frequency, *f(N)*, multiplied by the number of fatalities, *N*.

The risk integral is defined as:

$$SRI = \sum_{1}^{Nmax} f(N).N^{a}$$

In this expression, *f(N)* is the frequency of events leading to *N* fatalities (in units of casualties per million years), and ‘*a*’ is a constant. For the assessment of COMAH (Seveso) establishments, the Health and Safety Authority guidance identifies the use of a value of *a* = 1.4, and the scale of the risk as measured by the risk integral can be judged against criteria of 2,000, identified as “broadly acceptable” in the wording of the guidance and 500,000, identified as “significant” in the wording of the guidance. In order to define quantitative criteria corresponding with the range of impact significance descriptions, in accordance with the approach identified for individual risk in Table 8-1, an SRI score of 2,000 has been equated with the upper limit of the “Not Significant” band whilst an SRI score of 500,000 has been equated with the lower limit of the “Significant Effects” band. A factor of approximately 16 between the upper and lower limits of each band is found to provide for the required subdivisions across that range and the societal risk significance criteria identified in Table 8-2 are determined on that basis. These societal risk criteria for the identified descriptors of impact significance have been developed, based on professional judgement, to set the standards identified in Health and Safety Authority guidance (HSA, 2010 in a framework consistent with the EPA Guidelines (EPA , 2017).

Table 8-2 SRI Assessment Criteria for Societal Risk Significance

Significance of Impact	Topic Specific Criteria
Negligible	Societal Risk Index (SRI) < 2,000
Slight Effects	2,000 < Societal Risk Index (SRI) < 32,000
Moderate Effects	32,000 < Societal Risk Index (SRI) < 500,000
Significant Effects	Societal Risk Index (SRI) > 500,000

The Health & Safety guidance (HSA, 2010) states (Section 2.2, page 11) that the SRI is used “*to provide a rapid initial assessment of the societal risk”* and that *“it must be emphasised that a full consideration of the FN curve is probably a more robust approach.”* The more robust approach through consideration of the FN curve, based on estimates for the frequency, F, of events that cause N or more casualties, has been adopted in this assessment. The guidance further states that *“there is ongoing debate as to whether scale aversion should be included at all in societal risk measures for land use planning, and so such risk integrals are only used as screening aids.”* Both of these approaches have been applied here and it is found that they lead to comparable conclusions concerning the significance of the impacts associated with the currently permitted and proposed future operations.

The choice of the value of the constant, *a*, determines the extent to which the possible greater aversion to accidents involving larger numbers of fatalities is factored into the evaluation of the risk significance. In the UK, the identified quantitative criteria (UK HSE 1989; 1992; Health and Safety Commission, 1991) for assessing the risks associated with major accidents and disasters have typically not adopted an aversion factor, corresponding with a value for the constant, *a* = 1. The most recent UK Health and Safety Executive guidance (UK HSE, 2001) identifies an event giving rise to 50 or more deaths with a frequency of more than 1 in 5,000 years as one that should be regarded as intolerable where there is a choice whether to accept the risk or not. The selection of that criterion takes some account of the aversion to events leading to large numbers of fatalities. The proposed Relevant Action has been assessed against these available quantitative criteria. These criteria have been developed by reference to the risks associated with a wide range of industrial and other activities. Whilst not developed specifically by reference to the risks associated with airport operations, they are considered to be of general utility for the assessment of the significance of societal risk and provide useful reference points in the current context.

8.3.4 Limitations and Assumptions

As outlined earlier in Section 8.3, the assessment is based on an empirical model that was developed by reference to recent historical accident data which provides generic insight into the likelihood of aircraft crashes, the likely locations of events in relation to flight paths and the impact consequences on the ground. Future risks associated with operations at Dublin Airport are estimated on the basis of forecasts for future operations, in terms of the numbers of aircraft movements following the available departure and approach paths to the three runways and the aircraft types involved. There will inevitably be limitations to the reliability of any quantitative risk model of this type due to inherent uncertainties in the model itself and the forecasts for future operations. Careful consideration has been given to the possible limitations of the modelling approach employed, as set out in Appendix A8. It has been concluded that this modelling approach is consistent with current best practice and provides a sound basis for assessing the implications for public safety of the proposed Relevant Action.

8.3.5 Methodology for Determining Construction Effects

As the proposed Relevant Action will result in no changes to the design or construction of the North Runway, there will be no changes to the physical infrastructure of the North Runway. On that basis, the assessment of construction phase impacts on the identified major accidents and disasters has been scoped out of the EIAR.

8.4 Baseline Conditions

8.4.1 2022 Individual Risk

The predicted baseline in respect of the individual risk impacts in 2022, after the North Runway has been constructed and is operational, i.e the permitted / constrained scenario, is summarised by the contour plots shown in Figure 8-1. The 1 in 10,000 per annum upper risk contours for both ends of all three runways are contained entirely within the airport boundary. A substantial proportion of the total area of the 1 in 100,000 per annum risk contours (82%) is also contained within the airport boundary. The length and area characteristics of these contours are summarised in Table 8-3 which also summarises the number of residential properties located within the contours and the number of commercial properties, excluding those within the Airport Campus buildings.

Table 8-3 2022 Permitted Operations Individual Risk Contour Characteristics

Contour Feature	South Runway		North Runway		Cross Runway	
	West end	East end	West end	East end	North end	South end
1 in 100,000 per annum individual risk contour						
Distance from Runway end	1,471	2,593	1,605	1,096	35	125
Distance outside airside limit	425	1,608	912	760	0	0
Total area (hectares)[1]	12.29	26.87	18.05	6.95	N/A	N/A
Area outside airside limit (hectares)	2.18	10.49	6.99	4.55	-	-
Number of dwellings[2] inside	0	0	0	0	0	0
Commercial sites inside	0	0	0	1	0	0
1 in 1,000,000 per annum individual risk contour, excluding 1 in 100,000 contour						
Distance from Runway end	4,747	10,839	6,024	2,818	688	861
Distance outside airside limit	3,701	9,854	5,331	2,482	433	607
Total area (hectares)[3]	57.73	274.73	172.45	31.79	N/A	N/A
Number of dwellings inside[4]	0	85	17	3	0	0
Commercial sites inside[5]	3	9	5	2	0	0

Note 1: The area identified for the 1 in 100,000 per annum risk contour includes a small contribution from the 1 in 10,000 per annum risk contour. Due to the nature of the overlap between the contours for the cross runway with the other two runways and the limited size of these contours, no attempt has been made to estimate the areas of the cross runway contours.

Note 2: The count of dwellings in this assessment includes residential properties for which the available building inventory identifies both residential and commercial use and where the commercial use is relatively small scale. Counts include a small number of developments evident on satellite images which are not listed in the available building inventory some of which may not be currently in use. Judgements on use categories have been made on the basis of the satellite images.

Note 3: The area identified for the 1 in 1,000,000 per annum risk contour excludes the element within the 1 in 100,000 per annum risk contour.

Note 4: In addition to the dwellings located within the contours beyond the runway ends, there are several residential properties located within the 1 in 1,000,000 per annum risk contour between the thresholds of the Southern Runway but none elsewhere between the thresholds.

Note 5: This count excludes commercial facilities within the Airport Campus and dual residential/commercial use sites which are identified in the dwellings count. Some identified sites accommodate multiple enterprises.

A desktop review of the land-uses in the areas covered by the 2022 future baseline 1 in 100,000 per annum individual risk contours has been carried out with the assistance of the available satellite imagery and other data sources. The key findings of the review are as follows:

- ***South runway, eastern end:*** The contour extends approximately 1,608 m from the airport operational boundary, crossing the R132 dual carriageway and the M1 motorway. The majority of the land within the contour outside the airport operational boundary is open fields with scattered trees. The contour encroaches slightly on an area of car parking and also two football pitches within the ALSAA Sports Complex. There are no commercial or residential properties within this contour.
- ***South runway, western end:*** The contour extends approximately 425 m from the airport operational boundary, crossing the R122 single carriageway road that is located immediately to the west of the airport boundary. Land within the contour located further to the west is entirely open fields. There are no commercial or residential properties within this contour.
- ***North runway, eastern end:*** The contour extends approximately 760 m from the airport operational boundary, mostly across open fields. At its eastern extremity, the contour crosses the R132 dual carriageway at a roundabout. There is a single apparent commercial site within the contour shown on the satellite images but this site is not listed in the available buildings inventory. There are no residential properties within this contour.
- ***North runway, western end:*** The contour extends approximately 912 m from the future airport operational boundary, mostly across open fields with trees. The contour crosses the L3132 Dunbro Lane and Kilreesk Lane, immediately to the west of the airport boundary. There are no commercial or residential properties within this contour.
- ***Cross runway:*** The 1 in 100,000 per annum risk contours for this runway are contained entirely within the airport boundary, due to the low forecasted number of movements.

The 2022 baseline 1 in 1,000,000 per annum individual risk contours cover a substantially larger area than the 1 in 100,000 per annum individual risk contours. The sizes of the contours are summarised in Table 8-3. The desktop review of land-use reveals that the majority of the additional areas covered by the 1 in 1,000,000 per annum contours compared with the 1 in 100,000 per annum contours are open fields. However, there are some developed areas within the contours that merit some specific comment. The key findings of the review in this respect are as follows:

- ***South runway, eastern end:*** The contour extends approximately 9.9 km from the airport operational boundary, slightly beyond the coast to the south of Portmarnock, crossing the R132 dual carriageway and the M1 motorway. Closer to the runway on the north side, it encompasses some aircraft stands and other airport-related facilities. Immediately to the east of the R132 on the north side of the runway extended centreline, prior to reaching the M1 motorway, the contour contains some commercial sites within the Airport Campus, including car rental facilities, and the ALSAA Sports Centre (located outside the airport). To the south, at Dardistown, there are several commercial properties and two residential properties and an area of airport long-term car parking within the contour. Immediately to the east of the M1 motorway, the contour includes several football pitches (Athletic Union League). The remainder of the land within the contour beyond that point is agricultural land comprising of open fields with scattered trees but includes also a small number of isolated residential properties. The key exception to that is at Drumnigh Wood, Portmarnock where the contour includes approximately 50 hectares of residential development, including approximately 60 residential properties. A total of 85 residential dwellings are identified as being located within this contour. Further to the east by the coast, a narrow strip of this contour crosses a golf course, part of the Portmarnock Hotel and Golf Links Complex.
- ***South runway, western end:*** The contour extends approximately 3.7 km from the airport operational boundary, crossing a number of roads, including the N2 dual carriageway and three small light industrial/commercial sites. Otherwise, the land within the contour is open fields and contains no residential development.
- ***North runway, eastern end:*** The contour extends approximately 2.5 km from the current airside boundary, mostly across open fields but also across a number of roads, including the M1 motorway. To the south of the roundabout along the R132 dual carriageway the contour encroaches partly into a small area of mixed

residential/commercial development. It includes a second commercial site on the north side of the runway extended centreline and two other residential properties.

- ***North runway, western end:*** The contour extends approximately 5.3 km from the anticipated future operational airside boundary, mostly across open fields with trees. The contour crosses a number of roads, including the M2 motorway. There are a number of scattered residential developments in this area and the contour includes a total of 17 residential dwellings and 5 commercial sites.
- ***Cross runway:*** The 1 in 1,000,000 per annum risk contours are shorter compared with those for the other runways but, unlike the 1 in 100,000 per annum risk contours, extend outside the airside operational boundary. To the south, the contour extends into a car park, Quickpark at Dublin Airport. To the north, the contour covers open ground, extending across some minor roads (R108 and L3132, Naul Road), but excludes residential or other development.

For the currently permitted operations under the forecasts for 2022, there are no residential properties located within the 1 in 100,000 per annum contours for all runways. In total, 105 residential properties are identified as being located between the limits of the 1 in 100,000 and 1 in 1,000,000 per annum contours in 2022. There is a single apparent commercial site within the 1 in 100,000 per annum contours. There are 19 non-airport commercial sites between the limits of the 1 in 100,000 and 1 in 1,000,000 per annum contours, some of which accommodate multiple small enterprises. None of these are major employment sites holding large numbers of people. This contour contains further commercial sites within the Airport Campus.

8.4.2 2025 Individual Risk

The predicted baseline in respect of the individual risk impacts for the permitted / constrained scenario in 2025 is summarised by the contour plots shown in Figure 8-2. The key characteristics of the contours are summarised in Table 8-4. These contours are quite similar to those described for the 2022 permitted / constrained operations. They are marginally longer and broader, covering a correspondingly slightly larger area, as summarised in Table 8-4. This slight increase in contour size reflects the small increase in forecast movement numbers expected between 2022 and 2025 under the current permission.

There is no change in the number of properties within the North or South Runway 1 in 100,000 per annum contours between the 2022 and 2025 permitted operations scenarios. As for the 2022 permitted operations scenario, there is a single commercial site at the eastern end of the North Runway within the 2025 permitted operations 1 in 100,000 per annum contour. There is a predicted minor increase in the number of residential properties within the 1 in 1,000,000 per annum contours from 105 in 2022 to 111 in 2025. There is no change in the number of commercial sites within the 1 in 1,000,000 per annum contours in 2025 compared to the 2022 permitted operations.

The risk estimates made for the 2025 scenario are based on the assumption that aircraft crash rates remain the same as those determined according to the recent historical accident record that have also been applied to the 2022 baseline risk estimates which are outlined in the technical appendix to this chapter. In practice, there is clear evidence over a period of many decades, including recent years, for a continuing decline in aircraft crash rates. Statistical studies undertaken in relation to a previous new runway development programme at Frankfurt (Frankfurt Airport, 2003) have indicated an annual reduction, year-on-year, of around 0.732% for commercial air transport movements in so called “first world” countries that operate to the highest safety standards. Over a period of 3 years from 2022 to 2025, this yearly improvement in the safety record represents a decrease in the crash risk by 2.2%. If this anticipated improvement in the safety performance is factored into the risk estimates for 2025, very little change in the 2025 contours compared with the 2022 baseline is to be expected. Given the common standards employed in aviation and the common operators involved, this safety performance is considered to be indicative of operations at any major international airport in the region concerned and to be as representative of Dublin operations as it is of those at Frankfurt. Whilst rates of improvements have slowed since the major gains achieved in the earlier years of commercial civil aviation the recent trends in the historical accident record indicate that the current safety practices will continue to provide some improvement in safety into the future.

Table 8-4 2025 Permitted Operations Individual Risk Contour Characteristics

Contour Feature	South Runway		North Runway		Cross Runway	
	West end	East end	West end	East end	North end	South end
1 in 100,000 per annum individual risk contour						
Distance from Runway end	1,499	2,674	1,659	1,127	37	131

Contour Feature	South Runway		North Runway		Cross Runway	
	West end	East end	West end	East end	North end	South end
Distance outside airside limit	453	1,689	966	791	0	0
Total area (hectares)[1]	12.69	28.29	19.04	7.40	N/A	N/A
Area outside airside limit (hectares)	2.38	11.29	7.54	4.88	-	-
Number of dwellings[2] inside	0	0	0	0	0	0
Commercial sites inside	0	0	0	1	0	0
1 in 1,000,000 per annum individual risk contour, excluding 1 in 100,000 contour						
Distance from Runway end	4,834	11,060	6,230	2,917	716	887
Distance outside airside limit	3,788	10,075	5,537	2,581	461	633
Total area (hectares)[3]	59.17	288.25	183.90	33.54	N/A	N/A
Number of dwellings inside[4]	0	90	18	3	0	0
Commercial sites inside[5]	3	9	5	2	0	0

For explanatory notes 1 to 5, see Table 8-3.

8.4.3 Societal Risk

The societal risk impacts have been determined by consideration of the full range of accident scenarios involving aircraft of different sizes from the fleet mix anticipated for the permitted operations and impacts in different locations with different densities of occupation. This approach provides for the determination of the probability of accidents giving rise to a defined number of fatalities from one up to the maximum number estimated for a crash of the largest aircraft type into an area with the highest density of occupation. Societal risks were estimated separately for:

- Airport campus sites;
- all other sites; and
- for all sites combined.

These estimates were characterised by means of a number of quantitative risk measures, as follows:

- The overall frequency of accidents causing fatalities;
- The average number of fatalities involved;
- The expectation value, representing the average number of fatalities per annum;
- The Scaled Risk Integral Index (SRI), as employed in land-use planning in the vicinity of major hazard (COMAH) sites;
- FN curves for the full range of accident frequencies and consequences.

These risk estimates are summarised in Table 8-5 and the FN curve is shown in Figure 8-3.

Taking account of the distribution of accident locations, which are concentrated along the runway centreline and more towards the runway ends and having regard to the locations of properties around the airport, the vast majority of accidents are expected not to give rise to any third party fatalities. For the 2022 permitted operations, the probability of an aircraft crash accident affecting third parties is estimated to be 0.00106 per annum, or 1 in 947 years. For sites outside the Airport Campus, that value is slightly lower at 1 in 966 years. The average number of third party fatalities per crash event that is expected to lead to at least one third party fatality is estimated to be around 22. For sites outside the Airport Campus, the average number of fatalities per crash is estimated to be around 17. These estimates for the average number of fatalities and event frequency represent an expectation value of 1 fatality in every 42 years for all sites and 1 fatality in 56 years for non-airport sites outside the Airport Campus, on average.

For the 2025 permitted operations, summarised in Table 8-5, the societal risk is predicted to increase broadly in line with the 4.5% increase in the movement numbers and 2% increase in the average destroyed area. As can be seen from the FN curve shown in Figure 8-3, there is very little difference in the two cases with the exception of a marginal increase in probability of the high N fatality events which can be attributed to the slight increase in the average destroyed area in 2025 compared with 2022 resulting in slightly higher fatality predictions for on airport campus accidents. The expectation value for 2025 permitted operations is 6.8% higher than the 2022 baseline expectation value and the SRI score is 10% higher than the 2022 baseline SRI score. In accordance with the earlier discussion in relation to the 2025 individual risk estimates, the frequency of crash events in 2025 would reduce by 2.2% if the anticipated improvement in safety performance with time is taken into account, leading to a 2.2% reduction in the expectation value and in the frequency of all events identified in the FN curve.

Table 8-5 2022 and 2025 Permitted Operations Societal Risk Estimate Summary

Scenario	Rate of Fatality Accidents		Average fatalities	Expectation Value		SRI
	Per Annum	Return period / years		Per Annum	Return period / years	
2022 Permitted						
All Sites	1.06×10^{-3}	947	22.3	2.35×10^{-2}	42	148,752
Non-airport sites	1.04×10^{-3}	966	17.3	1.79×10^{-2}	56	85,564
Airport Campus	2.03×10^{-5}	49,272	275.9	5.60×10^{-3}	179	63,188
2025 Permitted						
All Sites	1.09×10^{-3}	919	23.0	2.51×10^{-2}	40	163,574
Non-airport sites	1.07×10^{-3}	937	17.6	1.88×10^{-2}	53	90,188
Airport Campus	2.09×10^{-5}	47,737	299.8	6.28×10^{-3}	159	73,387

8.5 Proposed Operations

8.5.1 2022 Individual Risk

The individual risk impacts in 2022 for the proposed / unconstrained scenario are summarised by the contour plots shown in Figure 8-4. The key parameters of the contours are summarised in Table 8-6.

The individual risk contours for the proposed / unconstrained operations in 2022 are quite similar to those for the permitted / constrained operations for that year but slightly larger. As for the 2022 permitted operations scenario, there are no residential or commercial properties inside the 1 in 100,000 per annum risk contour associated with the South Runway for the 2022 proposed operations scenario. Whilst there is a slight increase in the length of the 1 in 100,000 per annum risk contour associated with the North Runway for 2022 proposed operations at the west end, no change to the number of residential properties contained within it is observed. A single commercial property is located within this contour for the 2022 proposed operations, as is the case for 2022 permitted operations.

There is a predicted minor increase in the number of residential properties within the 1 in 1,000,000 per annum contours to 109 for 2022 proposed operations compared with the estimate of 105 for 2022 permitted operations. The number of commercial properties within this contour for 2022 proposed operations reduces by one to 18, compared with the estimate for 2022 permitted operations due to a slight narrowing of the contours at the east end of the North Runway.

Table 8-6 2022 Proposed Operations Individual Risk Contour Characteristics

Contour Feature	South Runway		North Runway		Cross Runway	
	West end	East end	West end	East end	North end	South end
1 in 100,000 per annum individual risk contour						
Distance from Runway end	1,483	2,649	1,636	1,033	36	131
Distance outside airside limit	437	1,664	943	697	0	0
Total area (hectares)[1]	12.28	27.90	18.67	6.23	N/A	N/A
Area outside airside limit (hectares)	2.26	11.01	7.32	3.85	-	-
Number of dwellings[2] inside	0	0	0	0	0	0
Commercial sites inside	0	0	0	1	0	0
1 in 1,000,000 per annum individual risk contour, excluding 1 in 100,000 contour						

Contour Feature	South Runway		North Runway		Cross Runway	
	West end	East end	West end	East end	North end	South end
Distance from Runway end	4,778	10,968	6,061	2,804	704	878
Distance outside airside limit	3,732	9,983	5,368	2,468	449	624
Total area (hectares)[3]	56.90	284.39	179.71	30.57	N/A	N/A
Number of dwellings inside[4]	0	89	18	2	0	0
Commercial sites inside[5]	3	9	5	1	0	0

For explanatory notes 1 to 5, see Table 8-3.

8.5.2 2025 Individual Risk

The individual risk impacts in 2025 for proposed / unconstrained operations are summarised by the contour plots shown in Figure 8-5. The key characteristics of the contours are summarised in Table 8-7. As for the three other scenarios, there is one commercial property within this contour for the 2025 proposed operations case and no residential properties.

With the increase in size of the 1 in 1,000,000 per annum contour predicted for the 2025 proposed operations scenario, the estimated number of dwellings inside this contour is estimated to increase to 114, compared with 111 estimated for permitted operations in 2025.

Table 8-7 2025 Proposed Operations Individual Risk Contour Characteristics

Contour Feature	South Runway		North Runway		Cross Runway	
	West end	East end	West end	East end	North end	South end
1 in 100,000 per annum individual risk contour						
Distance from Runway end	1,534	2,784	1,716	1,093	39	138
Distance outside airside limit	488	1,799	1,023	757	0	0
Total area (hectares)[1]	12.91	29.95	19.99	6.91	N/A	N/A
Area outside airside limit (hectares)	2.60	12.19	8.06	4.38	-	-
Number of dwellings[2] inside	0	0	0	0	0	0
Commercial sites inside	0	0	0	1	0	0
1 in 1,000,000 per annum individual risk contour, excluding 1 in 100,000 contour						
Distance from Runway end	4,955	11,333	6,368	2,950	748	917
Distance outside airside limit	3,909	10,348	5,675	2,614	493	663
Total area (hectares)[3]	59.59	304.19	196.09	32.96	N/A	N/A
Number of dwellings inside[4]	0	90	19	3	0	0
Commercial sites inside[5]	3	9	7	2	0	0

For explanatory notes 1 to 5, see Table 8-3.

8.5.3 Societal Risk

Societal risk estimates have been made for the 2022 and 2025 proposed / unconstrained operations, following the same approach employed for the assessment of the 2022 permitted / constrained operations. The risk estimates are slightly larger for these two cases, compared with those for permitted operations, in accordance with the increased movement numbers for these scenarios. These risk estimates are summarised in Table 8-8 and the FN curves are shown in Figure 8-6.

Table 8-8 2022 and 2025 Proposed / Unconstrained Operations Societal Risk Estimate Summary

Scenario	Rate of Fatality Accidents		Average fatalities	Expectation Value		SRI
	Per Annum	Return period / years		Per Annum	Return period / years	
2022 Proposed						
All Sites	1.07×10^{-3}	938	22.5	2.40×10^{-2}	42	153,503
Non-airport sites	1.05×10^{-3}	957	17.3	1.81×10^{-2}	55	86,355
Airport Campus	2.09×10^{-5}	47,939	282.7	5.90×10^{-3}	170	67,148
2025 Proposed						
All Sites	1.15×10^{-3}	872	22.8	2.61×10^{-2}	38	172,205
Non-airport sites	1.12×10^{-3}	889	17.2	1.93×10^{-2}	52	92,473
Airport Campus	2.25×10^{-5}	44,435	301.7	6.79×10^{-3}	147	79,731

8.6 Environmental Design and Management

A considerable amount of effort is directed towards ensuring that civil aviation is as safe as is reasonably practicable. The primary driving force for these efforts is, of course, the protection of passengers and crew and the material assets of aircraft operators. The very high safety standards of the aviation industry, combined with appropriate land-use planning controls, provide for low risks to third parties in the vicinity of airports. There are limits to the extent to which those risks can be further mitigated since risks cannot be eliminated entirely from aircraft operations which take place within an established pattern of land use around the airport and along flight paths.

Some mitigation will be provided by the mode of operation of the parallel runway system at Dublin Airport once operational. The current permission (baseline scenario) is subject to a condition that when winds are westerly, Runway 28L (South Runway) shall be preferred for arriving aircraft and when winds are easterly, Runway 10R (South Runway) shall be preferred for departing aircraft. When winds are westerly, the use of either Runway 28L (South Runway) or 28R (North Runway) shall be as determined by air traffic control, as is the case for the use of either Runway 10L (North Runway) or 10R (South Runway) for arriving aircraft when winds are easterly. In practice, given the identified preferential use of the South Runway, there are a higher proportion of departures from Runway 28R (North Runway) during westerly operations and of arrivals at Runway 10L (North Runway) during easterly operations. This mode of operation is adopted as it is seen to result in the least impact on local communities, primarily in respect of aircraft noise, having regard also to the prevailing wind conditions and the related implications for runway direction. A mode of operation that minimises noise impacts will similarly minimise third party risks by virtue of the fact that it will minimise flights over areas where more people are present and focus operations where the least number of people can be expected to be affected.

8.7 Assessment of Effects and Significance

8.7.1 2022 Permitted / Constrained Operations Baseline

The individual risk impacts associated with the 2022 baseline for permitted / constrained operation, as described in Section 8.4, are determined to fall around the border between the “slight effects” and “moderate effects” category, on the basis of the relatively low numbers of people exposed to an individual fatality risk between 1 in 100,000 per annum and 1 in 1,000,000 per annum. Based on the identified number of 105 residential properties within this contour and limited number of relatively small commercial sites outside the airport campus (19) within this contour, a few hundred people can be expected to be exposed to these levels of risk. Only one commercial site is found to be located within the 1 in 100,000 per annum risk contour. Given the generally sparse and distributed nature of the development, this total number of residents would not be at risk from any single accident and, as discussed in further detail in the societal risk assessment, the numbers of fatalities associated with a single crash event are expected to be quite limited. For the larger number of road users that pass through the areas covered by the contours, the individual fatality risk is less than 1 in 1,000,000 per annum and the risk falls into the “negligible” category.

When judged against the identified UK societal risk criteria (UK HSE, 2001; 1989; 1992; Health and Safety Commission, 1991), the risks associated with the 2022 permitted operations can be seen to be above the level where the risks would be considered to be negligible but below the "scrutiny level" at which risks would be considered to be significant and requiring specific regulatory scrutiny. The risk can therefore be seen to be within the "moderate effects" category when judged against the UK societal risk criteria, a finding that is consistent with SRI impact significance.

8.7.1.1 2025 Permitted / Constrained Operations

When assessed against the criteria identified in Table 8-1, the individual risks associated with the 2025 permitted operations are determined to fall around the border between the "slight effects" and "moderate effects" category on the basis of the low numbers of people exposed to an individual fatality risk between 1 in 100,000 per annum and 1 in 1,000,000 per annum. Compared with the 2022 baseline, the increased contour size is expected to increase the number of residential dwellings within this contour slightly from 105 to 111. However, the number of commercial sites remains the same at 19. Nevertheless, the overall risk categorisation remains essentially the same as for the 2022 permitted operations.

For the 2025 permitted operations, summarised in Table 8-4, the societal risk is predicted to increase broadly in line with the increase in the number of movements. As can be seen from the FN curve shown in Figure 8-3, the increase is only noticeable for the lower probability, higher fatality events associated with accidents on the airport campus. Nevertheless, the risk remains in the "moderate effects" category when judged against the UK societal risk criteria. The SRI score determined for 2025 permitted operations is also within the "moderate effects" category identified in the societal risk significance assessment criteria.

8.7.1.2 2022 Proposed / Unconstrained Operations

The estimated individual risks associated with the 2022 proposed operations are very similar to those identified for the 2022 permitted operations and 2025 permitted operations: i.e. around the border between the "slight effects" and "moderate effects" category on the basis of the low numbers of people to an individual fatality risk between 1 in 100,000 per annum and 1 in 1,000,000 per annum. The contour size increases slightly, compared with the 2022 baseline, and the number of residential dwellings within this contour is expected to increase from 105 to 109 and the number of commercial sites is found to reduce by 1 due to a subtle narrowing of the contours at the east end of the North Runway . Therefore, the overall risk categorisation remains essentially the same as that for the 2022 permitted operations.

The estimated societal risks associated with the 2022 proposed operations are very similar to the 2022 permitted operations and 2025 permitted operations: i.e. the "moderate effects" category applies.

The estimated risks to ecological designated sites with the 2022 proposed operations are in the same order of magnitude to the 2022 permitted operations and 2025 permitted operations and therefore the anticipated change in effects is not considered significant. Further details of the risk to Ecologically sensitive sites is provided within *Chapter 15: Biodiversity (Terrestrial).*

8.7.1.3 2025 Proposed Operations

When assessed against the criteria identified in Table 8-1, the individual risks associated with the 2025 proposed operations are determined to fall around the border between the "slight effects" and "moderate effects" category on the basis of the low numbers of people to an individual fatality risk between 1 in 100,000 per annum and 1 in 1,000,000 per annum. The contour size is expected to increase slightly, compared with the 2025 permitted case. However, the number of residential dwellings within this contour is expected to increase by only 3 to 114, and the number of commercial sites is expected to increase slightly from 19 to 20. Therefore, the overall risk categorisation remains essentially the same as that for the 2025 permitted operations.

For the 2025 proposed operations, summarised in Table 8-8, the societal risk is predicted to increase broadly in line with the increase in the number of movements. As can be seen from the tabulated risk estimates and the FN curve shown in Figure 8-6, the increase in risk is relatively minor and only noticeable for low probability, high fatality events. Therefore, the risk for this scenario remains in the "moderate effects" category when judged against the UK societal risk criteria. The SRI score determined for 2025 proposed operations is also within the "moderate effects" category identified in the societal risk significance assessment criteria.

The estimated risks to ecological designated sites with the 2025 proposed operations are in the same order of magnitude to the 2025 permitted operations and 2025 permitted operations and therefore the anticipated change in effects is not considered significant. An assessment of effects of the proposed Relevant Action is provided in *Chapter 15: Biodiversity*.

8.7.1.4 Permitted/Constrained and Proposed/Unconstrained Operations Comparison.

The scale of the increase in risk estimated for the different operational scenarios considered is best evaluated numerically by reference to the expectation value associated with the societal risk. It is also useful to consider more specifically the risk to third parties outside the airport campus when assessing the significance of risk impacts. It is common practice in risk management decision making to place more weight on the involuntary risks to which third parties are exposed than to the voluntary risks to those working at or using a facility that are gaining a direct benefit from it.

Quantitative risk comparisons between different operational scenarios are presented in Table 8-9. The first key point to note from the risk comparisons shown in the table is that an overall increase in risk, as measured in terms of the expectation value, by around 3% is expected due to the anticipated evolution of activity under the permitted operations between 2022 and 2025. That overall risk increase is associated with a broadly similar increase in the number of aircraft movements over that period but is offset slightly due to the effect of the changes in the fleet mix on the crash rate per annum. The risk increase for non-airport sites is estimated to be 3.1% which is again similar to the increase in the crash rate per annum. A similar risk increase is predicted between these two scenarios for airport sites.

Table 8-9 Between Scenario Societal Risk (Expectation Value) Comparisons

Measure	2022 permitted to 2025 permitted	2022 permitted to 2022 proposed	2025 permitted to 2025 proposed
Movement number increase	4.5%	2.6%	3.4%
Crash rate per million movements increase	-1.3%	-0.8%	2.9%
Crash rate per annum increase	3.2%	1.9%	6.3%
Non-airport sites risk increase	3.1%	0.9%	5.4%
Airport sites risk increase	3.2%	2.8%	7.4%
All sites risk increase	3.1%	1.0%	5.4%

Risk increases following broadly similar patterns are estimated for the comparisons between 2022 permitted and 2022 proposed operations and between 2025 permitted and 2025 proposed operations. The risk increase of 1% between 2022 permitted and 2022 proposed operations that is predicted is slightly lower than the 2.6% increase in movement numbers, partly due to a reduction in the average crash rate per movement. For the comparison between the 2025 permitted and 2025 proposed scenarios a similar pattern is observed. Again, the estimated risk increase of around 5.4% between these two scenarios, compared with the 3.4% increase in movement numbers can be expected to arise from changes in other factors that influence the magnitude of the risk, including a 3% increase in the average crash rate per movement,

When set against the current level of risk to non-airport sites and the anticipated increase of around 3% that is estimated for the evolution of the permitted operations between 2022 and 2025, the additional 5.4% increase that is estimated up to 2025 for the proposed operations can be seen to be small when set in the context of the increased level of activity that would be supported by the change.

8.8 Residual Effects and Conclusions

The assessment indicates that there is a third party risk impact associated with the operations at Dublin Airport associated with each of the operational scenarios that cannot be regarded to be negligible. Neither should this risk be regarded to be in any way exceptional when assessed against quantitative criteria developed by reference to risks associated with a wide range of activities that are undertaken in modern society. Whilst it is to be expected that there will be some additional risk associated with the proposed Relevant Action, the increase can be seen to be modest when set in the context of the increased level of activity that would be supported and the risk remains well within the level that is considered acceptable.

Accidents cannot be eliminated entirely and risks are typically accepted in return for the benefits that the activities giving rise to those risks provide. Such risks must be managed so as to be as low as reasonably practicable and are subject to regulatory scrutiny. As noted earlier in Section 8.2, a very considerable amount of effort is directed towards ensuring the safety of air transport operations, primarily from the perspective of the safety of passengers. These efforts similarly limit the risk to third parties on the ground. In that respect, risks are mitigated effectively by ensuring that aircraft accident rates are minimised such that they can be considered to be as low as reasonably practicable.

Further effective mitigation is provided by the location of flight paths relative to areas of development which means that risks to third parties on the ground are low in the unlikely event of an aircraft accident on take-off or landing. The majority of crashes can be expected to involve impact in unpopulated areas, given the runway and flight path layout with respect to areas of development. A comparison with other airports indicates that the residual risks associated with operations at Dublin Airport are relatively small when compared with those at some major airport locations. As discussed in Section 9.6, the parallel runway configuration will be operated in a manner that can be expected to further minimise the extent to which third parties are exposed to risks, by concentrating operations at those runway ends that leads to the least exposure.

The residual individual risk impacts for the 2022 baseline and for 2025 permitted operations have been assessed as being within the "slight" to moderate " effects" category, according to the impact significance classification summarised in Table 8-1. **For the proposed operations, the residual impacts are predicted to increase slightly, in accordance with the anticipated increase in movement numbers but the impact significance is predicted to remain within the same category.**

In summary, the assessment indicates that there will be a relatively small increase in the residual risk impacts as a result of the proposed Relevant Action. The risk mitigation provided by the high safety standards of modern civil aircraft operations, the inherent safety associated with the runway and flightpath layout and the mode of operation that will be employed ensure that the residual risks are at a level generally considered tolerable.

The scale of the risk associated with proposed operations can be put in perspective by a comparison between the risk contours for those operations and the contours identified for the parallel runway configuration in the DoEHLG study, shown in Figure 8-1 that informed the initial planning decision for the Northern Runway. In the context of PSZ policy, the DoEHLG study contours are considered to be acceptable. The predicted contours for the proposed operations are considerably smaller overall than those identified in the DoEHLG study and may therefore be considered acceptable also.

8.9 Bird Strike Hazard

Bird strike is a well-recognised hazard to aviation. Most bird strikes take place in the vicinity of airports during take-off and landing operations when aircraft are flying at lower altitudes at which birds fly. Following a number of catastrophic bird strike incidents in the earlier years of civil aviation, effective mitigation measures against bird strike have been established and the losses of civil airliners due to bird strike are now very rare events. Bird strike-related losses account for a small proportion of the total of accidental aircraft losses. The control measures fall into two categories as follows:

- Airfield bird hazard management by the adoption of various measures including habitat management to make areas around airports unattractive to birds and active dispersion;
- Technological measures to make aircraft more resilient to bird strike.

Modern aircraft standards are such that aircraft can usually withstand a bird strike without a catastrophic loss. Aircraft engines are built to withstand the ingestion of individuals of larger species and several individuals of smaller species without failure. Aircraft can fly safely following the loss of one engine. Catastrophic losses in the event of bird strike are therefore limited essentially to events involving multiple strikes of larger species that affect more than one engine. Effective bird hazard management that is based on an understanding of bird movements and the local environment around airports can ensure that such events are very rare.

The bird hazard management measures in place at Dublin Airport have been developed to address the requirements of the proposal to change permitted operations. In accordance with international good practice, the measures in place under the wildlife and habitat management section of the Aerodrome Manual (Dublin Airport, 2016) include the following:

- Bird detection and dispersal activities;
- Habitat management to make the airfield less attractive to birds;
- Land use planning controls in the areas surrounding the airport to avoid bird attraction;
- Bird activity and bird strike recording and monitoring;
- Action to disrupt bird flight lines and bird concentrations both on the airfield and in the surrounding countryside.

The Airport is currently being operated safely and daa have implemented an effective bird hazard management programme.

The proposed Relevant Action will therefore have no significant implications for future bird strike management requirements and the bird strike risk. An extended bird hazard management programme formed part of the planning permission for North Runway and this programme will be implemented when construction is completed and North Runway becomes operational. This programme will be able to effectively address bird hazard management for operations under the proposal to change permitted operations. The measures adopted to ensure that the permitted operations are safe should ensure that any operations from the runway system will be safe in this respect, regardless of the level of activity. It can therefore be concluded that the proposal to change permitted operations raises no additional issues in respect of bird strike-related risk than those already addressed by the risk assessment set out earlier.

8.10 Wake Vortex

Aircraft in flight creates vortices, circulating currents of air that are shed from the aircraft wings. For the most part, these vortices are dissipated by the effects of the wind and atmospheric turbulence before they reach the ground and, whilst they may more often be heard after an aircraft has passed, they seldom have any physical impact at ground level. Occasionally, however, vortices may persist long enough to make contact with buildings underneath the flight path. In extreme cases, the variation in pressure within these vortices can cause some damage to roofs if tiles or slates are not sufficiently firmly secured. In practice, such events may be encountered due to the passage of larger wide-bodied jets which create the largest vortices and during landing when aircraft are relatively close to the ground.

Wake vortex effects have been extensively studied in the context of operations at other major international airports. It has been established that building damage arising from wake vortices of the magnitudes encountered in practice can typically be eliminated by recovering of roofs in locations that are at risk to strengthen their resistance. Effective preventative measures can therefore be taken to mitigate wake vortex impacts. Once such mitigation measures have been implemented, they will be effective in respect of all future wake vortex events, regardless of frequency.

The issue of wake vortex damage was considered in some detail prior to the planning permission being granted for North Runway. The planning permission assumption was 348,358 movements per annum, significantly higher than the number now envisaged in 2025 for the proposed / unconstrained scenario which is 241,000 movements per annum. In granting permission for North Runway under those assumptions, the wake vortex impacts of that number of operations was evidently considered acceptable by the planning authorities. On that basis, the wake vortex impacts associated with the proposed change in permitted operations can be expected similarly to be considered acceptable.

8.11 Emergency Fuel Dumping

It was recognised that emergency fuel dumping could theoretically impact on people and properties on the ground. However, the available statistics from the UK indicated that there were very few suspected in-flight fuel loss incidents and, given the common operating standards, the same can be expected to apply in the Republic of Ireland. Those incidents that were identified appear to have been related to relatively minor leakages and resulted in no more than minor impacts in terms of oil deposits.

If emergency fuel dumping takes place, it is expected that this will typically be undertaken in a controlled manner in an appropriately selected area. The jettisoning of fuel is a rare occurrence and will not arise in normal operations. Aircraft have two primary weight limits: the maximum take-off weight and the maximum landing weight, with the maximum landing weight generally being the lower of the two. Aircraft under normal operations will depart at not more than the maximum take-off weight which may, according to operational requirements, be more than the maximum landing weight. Normally, aircraft consume fuel en-route and arrive at their intended destinations below the maximum landing weight. The fuel load on departure will have been chosen to provide for an appropriate landing weight, taking account of the anticipated en-route fuel consumption.

In abnormal, non-routine flight when an aircraft must return to the departure airport or divert en-route, for example due to aircraft technical faults or a passenger medical problem, the aircraft weight may exceed the maximum landing weight at the time a landing is required. It is only under these types of non-routine circumstances that there will be an operational benefit from jettisoning fuel. If a decision were to be made to jettison fuel, this would normally be undertaken in a controlled manner in consultation with air traffic control such that the impacts on the ground were minimised. In any event, it is expected that fuel would normally be jettisoned under these circumstances at a sufficient altitude to allow for vaporisation and dispersion before reaching ground level.

It should also be noted that a significant proportion of aircraft are not fitted with fuel jettison systems. Modern aircraft design and manufacturing allows aircraft to land at maximum take-off weight. In the event of an emergency, requiring a return to the departure airport, these aircraft will circle nearby in order to consume sufficient fuel to get down to the required landing weight limit.

The possibility of a pilot of an aircraft that is fitted with a fuel jettison system deciding to jettison fuel over land at a low altitude in an emergency situation cannot be discounted entirely. However, the jettisoning of fuel under circumstances that would result in any material impact on land in the vicinity of Dublin Airport can be seen to be very unlikely. Overall, it can therefore be concluded that impacts associated with emergency fuel dumping and possible in-flight accidental losses of fuel or oil can be considered to be not significant.

8.12 Figures

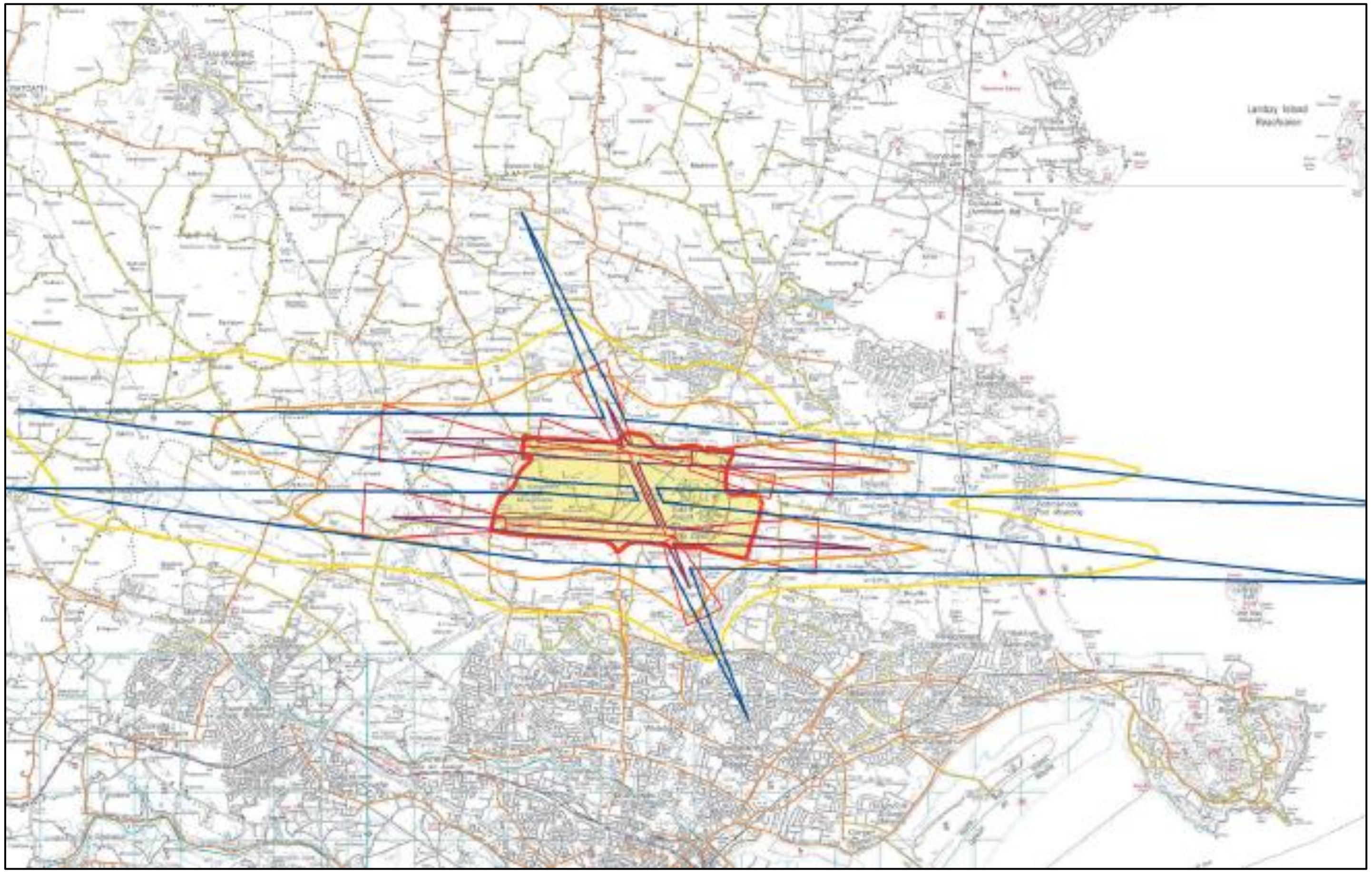


Figure 8-1 Provisional PSZs from the Dublin Airport Local Area Plan

Figure 8-2 2022 Permitted Operations Risk Contours

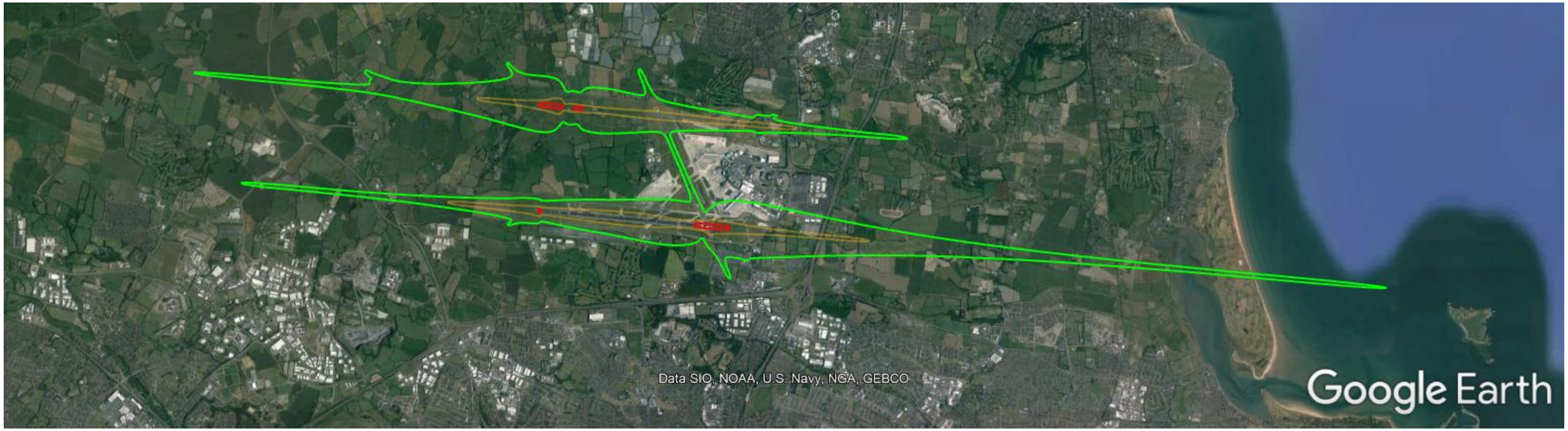


Figure 8-3 2025 Permitted Operations Risk Contours

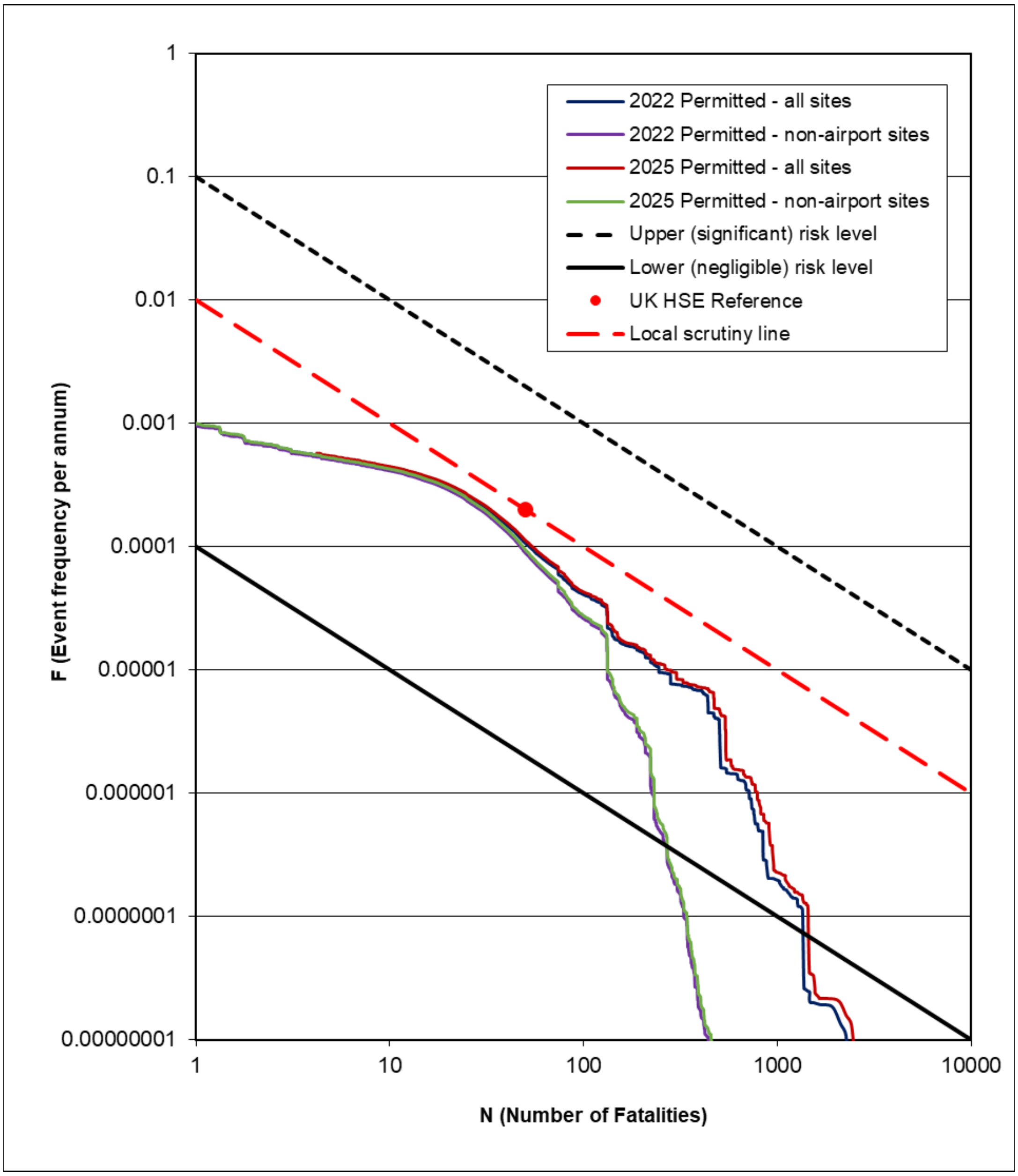


Figure 8-4 Societal Risk FN Curve for 2022 Baseline and 2025 Permitted Operations

Figure 8-5 2022 Proposed Operations Risk Contours

Figure 8-6 2025 Proposed Operations Risk Contours

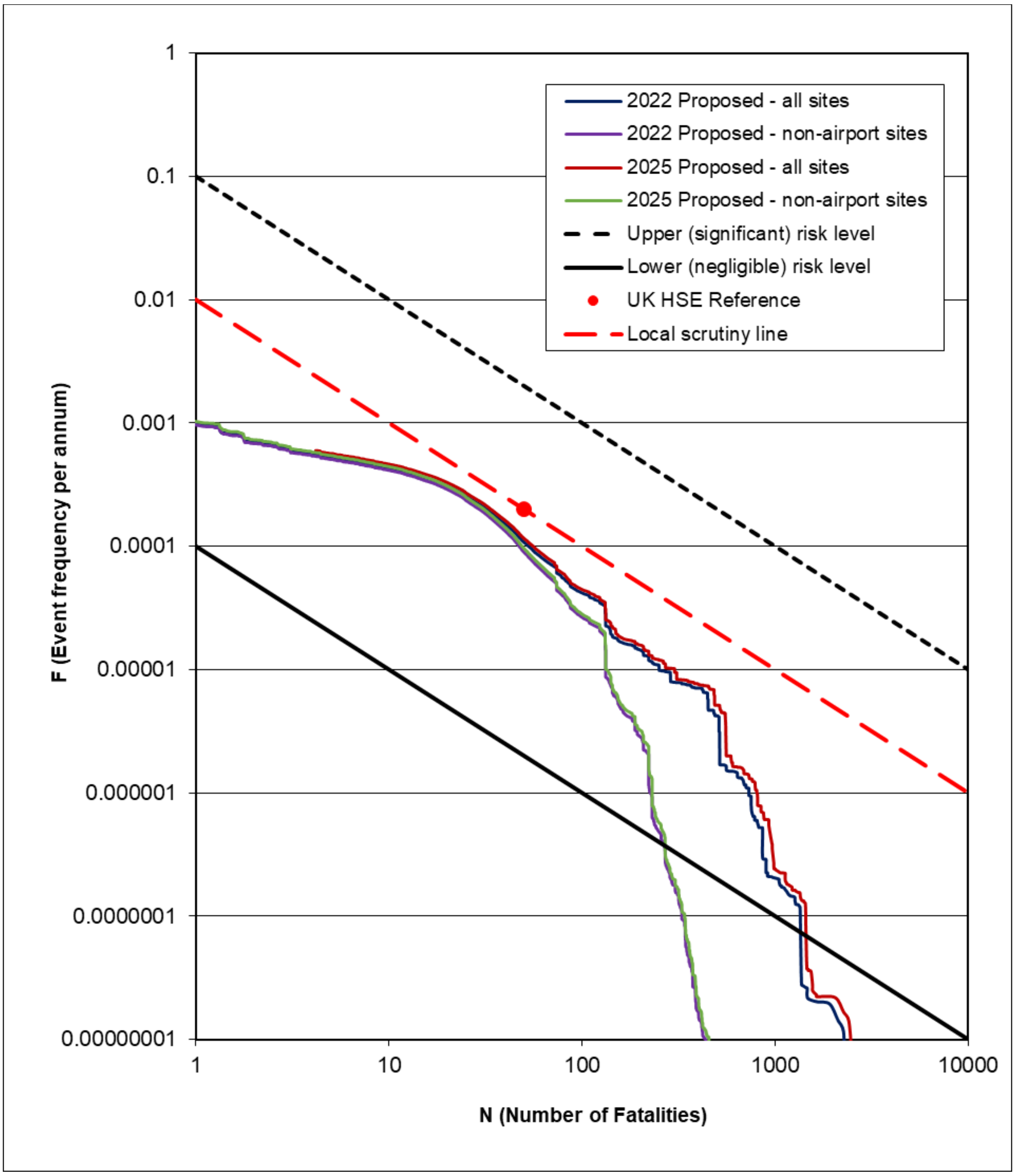


Figure 8-7 Societal Risk FN Curve for 2022 Baseline and 2025 Proposed Operations

Chapter 09:

Traffic and Transportation

09

9. Traffic and Transport

9.1 Introduction

This chapter presents an assessment of the likely potential impact to the road network from the proposed Relevant Action, in accordance with the requirements of the relevant legislation and guidance on preparation and content of EIARs.

9.2 Planning Policy Context

The following lists the relevant policy guidance and used to inform the traffic and transport assessment:

- 'Traffic and Transport Assessment Guidelines' (TII, 2014); and
- Draft 'Guidelines on the Information to be Contained in Environmental Impact Assessment Reports' (EPA, 2017)

9.3 Assessment Methodology

The following methodology was used to assess the potential impact of the proposed Relevant Action with regard to the permitted / constrained scenarios (ie the current planning permission) and the proposed / unconstrained scenario (the proposed Relevant Action) for 2022 and 2025:

- The Permitted/Constrained and Proposed/Unconstrained flight schedules for 2022 and 2025 were compared, to determine the potential changes in the number of passengers arriving and departing (airside) on an hourly basis
- Based on known passenger arrival / departures lag times the change in the number of passengers entering and exiting the Airport (landside) on an hourly basis, was determined.
- Based on existing passenger mode shares and existing vehicle occupancies, the change in the number of vehicle trips generated by the different schedules was determined.
- Using recorded Origin-Destination (O-D) survey data for existing Airport traffic, the changes in vehicle trips were distributed on to the surrounding road network, on an hourly basis.
- Any increases in vehicle trips resulting from the proposed Relevant Action were quantified and compared against background traffic flows (defined in Section 9.4.1, below) to assess whether or not they will have a significant adverse effects on network operations.

9.4 Baseline Conditions

9.4.1 Existing Traffic Flows

Traffic count data from surveys undertaken in May 2019 (when the Airport operated at 32 MPPA) was used to determine the existing traffic flows on the surrounding road network. The surveys recorded traffic flows during the periods 05:00 – 10:00 and 16:00 – 19:00, to cover the background peak periods, as well as the Airport-related pre-morning peak. The recorded 2019 background traffic flows are summarised in Table 9-1.

Table 9-1 Recorded Existing Two-Way Background Traffic Flows on Surrounding Road Network (May 2019)

Hour Commencing	*M1 Airport Link Road*	*M1 North of Airport*	*M1 South of Airport*	*M50 South of Junction 3*	*M50 West of Junction 3*	*M50 West of Junction 4*	*R132 North of Airport*	*R132 South of Airport*	*Old Airport Road*	*R108 North of M50*	*Naul Road*	*Kilshane Road*
05:00	3,077	1,966	3,900	2,318	2,577	3,004	761	843	614	663	311	159
06:00	2,843	6,575	8,017	5,215	7,506	8,006	1,073	967	733	880	603	378
07:00	3,464	8,781	10,579	6,553	11,182	11,758	1,633	1,556	1,080	1,130	999	736
08:00	4,032	8,598	10,415	5,908	10,509	11,051	1,969	1,792	1,129	1,212	1,236	930
09:00	3,745	6,860	9,078	5,784	9,056	9,782	1,680	1,630	1,009	1,143	908	706
16:00	3,928	9,114	11,071	6,591	11,330	12,107	2,194	1,815	1,358	1,482	1,271	829
17:00	3,827	9,397	10,918	6,790	10,740	11,436	2,154	1,868	1,380	1,544	1,580	812
18:00	3,383	7,855	9,695	6,154	9,233	10,000	1,687	1,319	1,051	1,153	1,130	450

9.4.2 Mode Share and Vehicle Occupancy

Mode share data from daa's Mobility Management Update (2019), outlined in Table 9-2, was used to determine the number of landside passengers that would use each mode to travel to the Airport for each scenario.

Table 9-2 2019 Passenger Mode Share at Dublin Airport

Mode	Percentage of Passengers
Car Private	35%
Car Rental	6%
Bus	35%
Taxi	22%
Other	2%

As well as the mode shares outlined above, recorded vehicle occupancies from surveys undertaken in May 2019, outlined in Table 9-3, were used to determine the number of vehicle movements generated by each profile.

Table 9-3 Recorded Average 2019 Vehicle Occupancies at Dublin Airport

Mode	Location	Average Occupancy (Passengers)
Car	Combined T1&T2 kerbside set-down	1.33
	Short-Stay car park	1.19
	Long-Stay car park	1.46
Taxi	Combined T1&T2 kerbside set-down	1.42

9.5 Assessment of Effects and Significance

9.5.1 Trip Generation and Distribution

9.5.1.1 Vehicle Trip Generation

Using the data outlined in the previous sections, the number of vehicle trips generated by the permitted / constrained and proposed / unconstrained scenarios for 2022 was calculated, as illustrated in Figure 9-1, below. The hourly difference in vehicle-trip generation resulting from the Relevant Action in 2022 is illustrated in Figure 9-2, below. The figures indicate that the Relevant Action is estimated to result in significant increases in vehicle trips during the periods 00:00 – 02:00, 04:00 – 05:00, and 07:00 – 08:00 with significant decreases during the periods 23:00 – 00:00, 02:00 – 04:00 and 05:00 – 06:00. Over a 24-hour period, there is no net increase in vehicle trips caused by the Relevant Action.

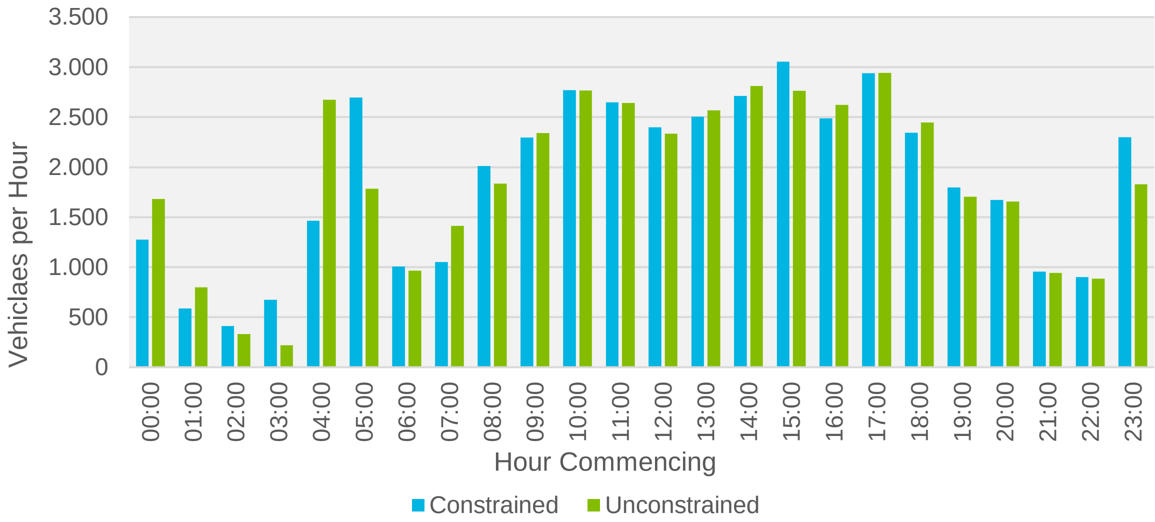


Figure 9-1 2022 Profiles of Vehicle Trips Generated – Permitted / Constrained vs Proposed / Unconstrained

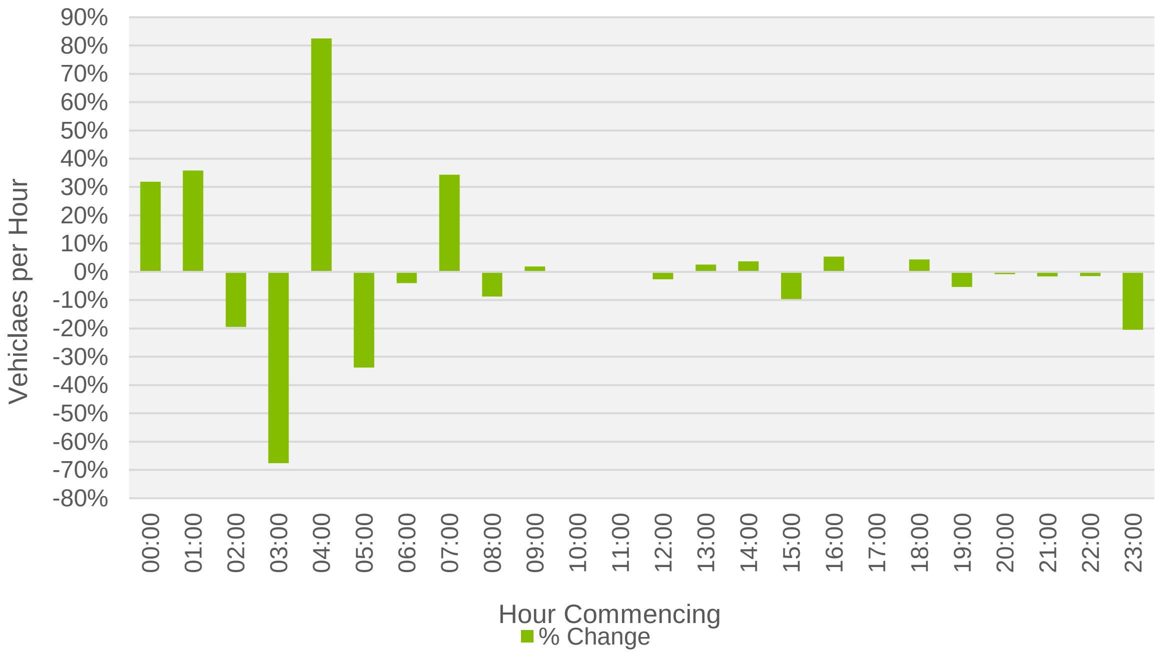


Figure 9-2 2022 Difference in Vehicle Trips Generated – Proposed / Unconstrained vs Permitted / Constrained

The number of vehicle trips generated by the constrained and unconstrained scenarios for 2025 is illustrated in Figure 9-3, while the hourly difference in vehicle-trip generation resulting from the Relevant Action is illustrated in Figure 9-4. The figures indicate that the proposed Relevant Action is estimated to result in similar changes in vehicle trips in 2025 as in 2022.

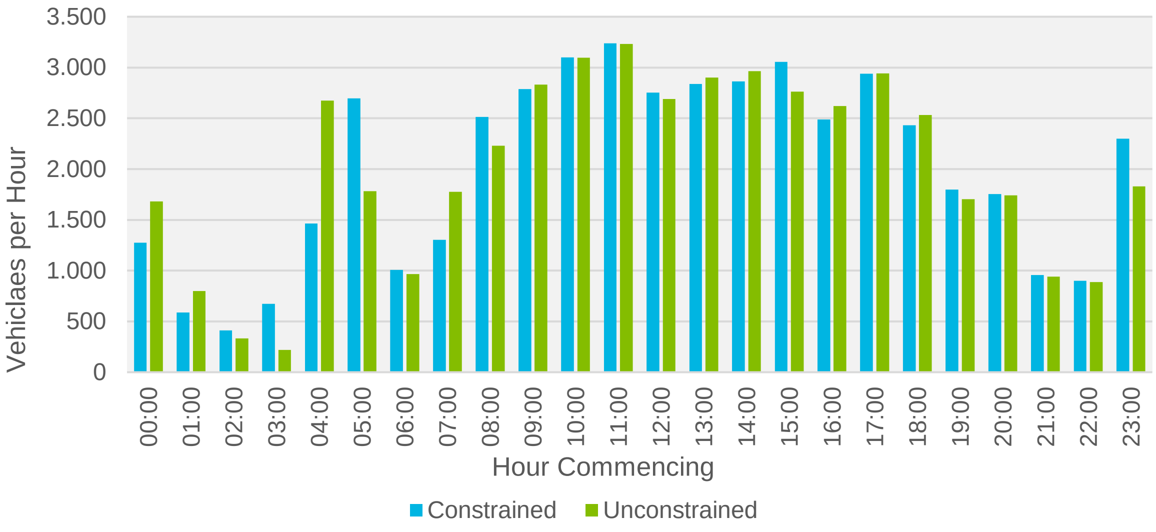


Figure 9-3 2025 Profiles of Vehicle Trips Generated – Permitted / Constrained vs Proposed / 0Unconstrained

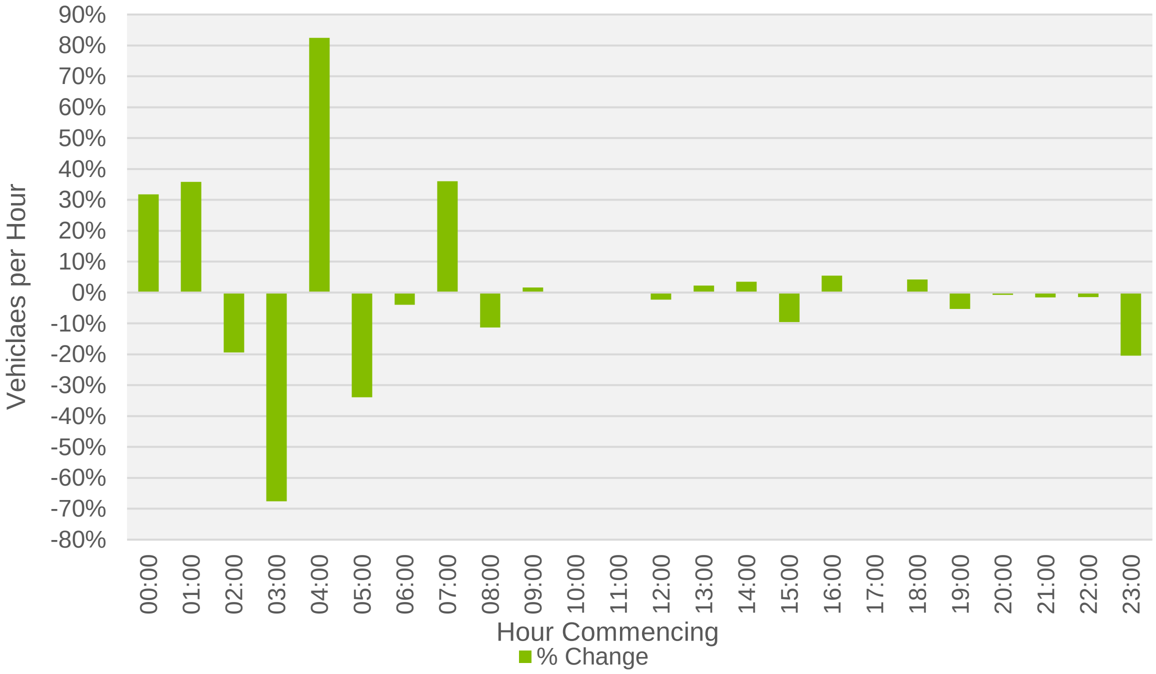


Figure 9-4 2025 Difference in Vehicle Trips Generated – Unconstrained vs Constrained

9.5.1.2 Vehicle Trip Distribution

The two-way hourly difference in vehicle-trip generation resulting from the Relevant Action was distributed on to the road network in the vicinity of the Airport, using passenger origin-destination data from Automatic Number Plate Registration (ANPR) surveys undertaken in May 2019, as summarised in Table 9-4 and Table 9-5. As can be seen, the proposed Relevant Action will not result in any additional trip generation over a 24-hour period.

Table 9-4 Estimated Change in Airport-Generated Traffic on Surrounding Road Network caused by Relevant Action 2022

Hour Commencing	M1 Airport Link Road	M1 North of Airport	M1 South of Airport	M50 South of Junction 3	M50 West of Junction 3	M50 West of Junction 4	R132 North of Airport	R132 South of Airport	Old Airport Road	R108 North of M50	Naul Road	Kilshane Road
00:00	273	47	227	53	170	222	40	92	77	63	8	1
01:00	142	24	118	27	88	115	21	48	40	33	4	1
02:00	-54	-9	-45	-10	-34	-44	-8	-18	-15	-13	-2	0
03:00	-307	-52	-255	-59	-191	-250	-45	-104	-87	-71	-9	-2
04:00	813	139	674	157	506	661	120	275	230	189	24	4
05:00	-615	-105	-510	-119	-382	-500	-91	-208	-174	-143	-18	-3
06:00	-27	-5	-22	-5	-17	-22	-4	-9	-8	-6	-1	0
07:00	243	41	202	47	151	198	36	82	69	56	7	1
08:00	-119	-20	-98	-23	-74	-96	-18	-40	-33	-28	-3	-1
09:00	30	5	25	6	19	25	4	10	9	7	1	0
10:00	-2	0	-1	0	-1	-1	0	-1	0	0	0	0
11:00	-3	0	-2	-1	-2	-2	0	-1	-1	-1	0	0
12:00	-43	-7	-36	-8	-27	-35	-6	-15	-12	-10	-1	0
13:00	43	7	36	8	27	35	6	15	12	10	1	0
14:00	67	11	56	13	42	55	10	23	19	16	2	0
15:00	-197	-34	-163	-38	-122	-160	-29	-67	-56	-46	-6	-1
16:00	91	15	75	18	57	74	13	31	26	21	3	0
17:00	2	0	1	0	1	1	0	1	0	0	0	0
18:00	69	12	58	13	43	57	10	24	20	16	2	0
19:00	-64	-11	-53	-12	-40	-52	-10	-22	-18	-15	-2	0
20:00	-9	-2	-8	-2	-6	-8	-1	-3	-3	-2	0	0
21:00	-10	-2	-8	-2	-6	-8	-2	-3	-3	-2	0	0
22:00	-9	-2	-7	-2	-6	-7	-1	-3	-3	-2	0	0
23:00	-316	-54	-262	-61	-197	-257	-47	-107	-89	-73	-9	-2
Total	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**

Table 9-5 Estimated Change in Airport-Generated Traffic on Surrounding Road Network caused by Relevant Action 2025

Hour Commencing	M1 Airport Link Road	M1 North of Airport	M1 South of Airport	M50 South of Junction 3	M50 West of Junction 3	M50 West of Junction 4	R132 North of Airport	R132 South of Airport	Old Airport Road	R108 North of M50	Naul Road	Kilshane Road
00:00	273	47	227	53	170	222	40	92	77	63	8	1
01:00	142	24	118	27	88	115	21	48	40	33	4	1
02:00	-54	-9	-45	-10	-34	-44	-8	-18	-15	-13	-2	0
03:00	-307	-52	-255	-59	-191	-250	-45	-104	-87	-71	-9	-2
04:00	813	139	674	157	506	661	120	275	230	189	24	4
05:00	-615	-105	-510	-119	-382	-500	-91	-208	-174	-143	-18	-3
06:00	-27	-5	-22	-5	-17	-22	-4	-9	-8	-6	-1	0
07:00	317	54	263	61	197	258	47	107	89	74	9	2
08:00	-192	-33	-159	-37	-120	-156	-28	-65	-54	-45	-6	-1
09:00	30	5	25	6	19	25	4	10	9	7	1	0
10:00	-2	0	-1	0	-1	-1	0	-1	0	0	0	0
11:00	-3	0	-2	-1	-2	-2	0	-1	-1	-1	0	0
12:00	-43	-7	-36	-8	-27	-35	-6	-15	-12	-10	-1	0
13:00	43	7	36	8	27	35	6	15	12	10	1	0
14:00	67	11	56	13	42	55	10	23	19	16	2	0
15:00	-197	-34	-163	-38	-122	-160	-29	-67	-56	-46	-6	-1
16:00	91	15	75	18	57	74	13	31	26	21	3	0
17:00	2	0	1	0	1	1	0	1	0	0	0	0
18:00	69	12	58	13	43	57	10	24	20	16	2	0
19:00	-64	-11	-53	-12	-40	-52	-10	-22	-18	-15	-2	0
20:00	-9	-2	-8	-2	-6	-8	-1	-3	-3	-2	0	0
21:00	-10	-2	-8	-2	-6	-8	-2	-3	-3	-2	0	0
22:00	-9	-2	-7	-2	-6	-7	-1	-3	-3	-2	0	0
23:00	-316	-54	-262	-61	-197	-257	-47	-107	-89	-73	-9	-2
Total	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**

9.5.2 Vehicle Trip Impact

To determine the impact caused by the Relevant Action, the change in Airport-related traffic on the surrounding road network, as outlined above, was added to / subtracted from the recorded 2019 background traffic flows on the network (outlined previously in Table 9.1) to determine the percentage change in hourly traffic flows, as outlined in Table 9-6 and Table 9-7.

It is possible that 2022 and 2025 traffic flows on the surrounding network may be higher than 2019. If this is the case, any potential hourly increase in traffic caused by the Relevant Action will have a less significant percentage impact. As such, it was considered that using the recorded 2019 background traffic flows for the analysis would provide a more robust assessment of the potential impact.

Road links on which the predicted increase in traffic flows are greater than 5% of the recorded 2019 background traffic flows were considered to have the potential to have a significant impact and are therefore highlighted in Table 9-6 and Table 9-7. These links were then subjected to further analysis.

Table 9-6 Percentage Change in Background Traffic Flows caused by Relevant Action 2022

Hour Commencing	M1 Airport Link Road	M1 North of Airport	M1 South of Airport	M50 South of Junction 3	M50 West of Junction 3	M50 West of Junction 4	R132 North of Airport	R132 South of Airport	Old Airport Road	R108 North of M50	Naul Road	Kilshane Road
05:00	-20.0%	-5.3%	-13.1%	-5.1%	-14.8%	-16.7%	-11.9%	-24.7%	-28.3%	-21.5%	-5.7%	-2.0%
06:00	-0.9%	-0.1%	-0.3%	-0.1%	-0.2%	-0.3%	-0.4%	-0.9%	-1.0%	-0.7%	-0.1%	0.0%
07:00	**7.0%**	0.5%	1.9%	0.7%	1.4%	1.7%	2.2%	**5.3%**	**6.4%**	**5.0%**	0.7%	0.2%
08:00	-2.9%	-0.2%	-0.9%	-0.4%	-0.7%	-0.9%	-0.9%	-2.2%	-3.0%	-2.3%	-0.3%	-0.1%
09:00	0.8%	0.1%	0.3%	0.1%	0.2%	0.3%	0.3%	0.6%	0.8%	0.6%	0.1%	0.0%
16:00	2.3%	0.2%	0.7%	0.3%	0.5%	0.6%	0.6%	1.7%	1.9%	1.4%	0.2%	0.1%
17:00	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
18:00	2.1%	0.2%	0.6%	0.2%	0.5%	0.6%	0.6%	1.8%	1.9%	1.4%	0.2%	0.1%

Table 9-7 Percentage Change in Background Traffic Flows caused by Relevant Action 2025

Hour Commencing	M1 Airport Link Road	M1 North of Airport	M1 South of Airport	M50 South of Junction 3	M50 West of Junction 3	M50 West of Junction 4	R132 North of Airport	R132 South of Airport	Old Airport Road	R108 North of M50	Naul Road	Kilshane Road
05:00	-20.0%	-5.3%	-13.1%	-5.1%	-14.8%	-16.7%	-11.9%	-24.7%	-28.3%	-21.5%	-5.7%	-2.0%
06:00	-0.9%	-0.1%	-0.3%	-0.1%	-0.2%	-0.3%	-0.4%	-0.9%	-1.0%	-0.7%	-0.1%	0.0%
07:00	**9.1%**	0.6%	2.5%	0.9%	1.8%	2.2%	2.9%	**6.9%**	**8.3%**	**6.5%**	0.9%	0.2%
08:00	-4.8%	-0.4%	-1.5%	-0.6%	-1.1%	-1.4%	-1.4%	-3.6%	-4.8%	-3.7%	-0.5%	-0.1%
09:00	0.8%	0.1%	0.3%	0.1%	0.2%	0.3%	0.3%	0.6%	0.8%	0.6%	0.1%	0.0%
16:00	2.3%	0.2%	0.7%	0.3%	0.5%	0.6%	0.6%	1.7%	1.9%	1.4%	0.2%	0.1%
17:00	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
18:00	2.1%	0.2%	0.6%	0.2%	0.5%	0.6%	0.6%	1.8%	1.9%	1.4%	0.2%	0.1%

Tables 9-6 and 9-7 highlight the road links on the surrounding network on which the Relevant Action will result in an increase in traffic flows greater than 5% of the recorded 2019 background traffic flows.

To further assess the potential impact on these links, the 'Relevant Action traffic flows' were compared to the maximum recorded 2019 background traffic flows, as summarised in Table 9-8 and Table 9-9.

Table 9-8 Relevant Action Traffic Flows vs Existing Maximum Traffic Flows - 2022

Link	Time Period	Increase in Flow	Background Flow	Relevant Action Flow	Max. Recorded Hourly Flow		Relevant Action Flow Exceeds Existing Max Flow?
					Period	Flow	
M1 Airport Link Road	07:00 – 08:00	243	3,464	3,707	08:00 - 09:00	4,032	No
R132 South of Airport	07:00 – 08:00	82	1,556	1,638	17:00 - 18:00	1,868	No
Old Airport Road	07:00 - 08:00	69	1,080	1,149	17:00 - 18:00	1,380	No
R108 North of M50	07:00 - 08:00	56	1,130	1,186	17:00 - 18:00	1,544	No

Table 9-9 Relevant Action Traffic Flows vs Existing Maximum Traffic Flows - 2025

Link	Time Period	Increase in Flow	Background Flow	Relevant Action Flow	Max. Recorded Hourly Flow		Relevant Action Flow Exceeds Existing Max Flow?
					Period	Flow	
M1 Airport Link Road	07:00 – 08:00	317	3,464	3,781	08:00 - 09:00	4,032	No
R132 South of Airport	07:00 – 08:00	107	1,556	1,663	17:00 - 18:00	1,868	No
Old Airport Road	07:00 - 08:00	89	1,080	1,169	17:00 - 18:00	1,380	No
R108 North of M50	07:00 - 08:00	74	1,130	1,204	17:00 - 18:00	1,544	No

Table 9-8 and Table 9-9 indicate that, although the Relevant Action traffic flows result in a greater than 5% increase on certain links at certain times, in all of these instances, the Relevant Action traffic flows will not exceed the existing maximum recorded 2019 background traffic flows on the affected road links, in 2022 or 2025.

Based on the above assessment, it is considered that the Relevant Action will not result in any significant effect on the surrounding road network.

9.6 Summary

An assessment of the potential traffic and transport impacts of the proposed Relevant Action) was undertaken.

A first principles trips generation exercise was undertaken to determine the change in vehicle trips on the surrounding road network caused by the Relevant Action, using

- Constrained and unconstrained flight schedules for 2022 and 2025;
- Established passenger lag times;
- Recorded passenger landside mode shares and vehicle occupancies; and
- Recorded origin/destination data for passengers travelling to the Airport.

The increase/decrease in traffic flows was compared to recorded existing traffic flows on the surrounding road network to determine the percentage increase/decrease caused by the Relevant Action.

The assessment indicated that:

- Over a 24-hour period, there is no net increase in vehicle trips caused by the Relevant Action. As such, the overall impact is such that it is considered to have a neutral effect.
- Broken down by hour, the Relevant Action will result in an increase in traffic flows on some adjacent roads, and a decrease on others. For the majority of adjacent road links, any increase in traffic flows caused by the Relevant Action, in 2022 and 2025, is estimated to be less than 5% of the recorded 2019 background traffic flows, and is therefore considered to have a slight effect; and
- In all of the instances where the estimated increase was estimated to be greater than 5%, the revised traffic flows resulting from the Relevant Action, in 2022 and 2025, were less than the recorded maximum traffic flows on those links during other time periods. As such, in these instances, the Relevant Action is considered to have a moderate effect.

Taking the above into account, it is considered that the Relevant Action will not result in any significant effect on the surrounding road network.

Chapter 10: Air Quality

10

10. Air Quality

10.1 Introduction

This Chapter of the Environmental Impact Assessment Report (EIAR) contains the findings of an assessment of the likely significant effects on air quality as a result of the proposed ''Relevant Action'. This Chapter should be read in conjunction with Technical Appendix A10-A.

This assessment and EIAR Chapter have been prepared by AECOM Limited, with support provided by Air Quality Consultants Limited.

The proposed Relevant Action has the potential to impact on local air quality at nearby sensitive receptors during the operational phase, primarily due to the proposed change in aircraft movements. A full description of the proposed Relevant Action is provided in EIAR Chapter 2*: Characteristics of the Relevant Action and* Chapter 3: *Background and Need for the Relevant Action.*

10.1.1 Scope of Assessment

The assessment focuses on the impact and effect of changes to long-term and short-term concentrations of nitrogen dioxide (NO_2) and Particulate Matter (PM_{10} and $PM_{2.5}$), considered the pollutants of greatest concern from aircraft emissions, at nearby human health sensitive receptors. Consideration is also given to the potential for odour nuisance associated with aircraft operations.

The air quality assessment is concerned with the impact and effect of emissions associated with a change in aircraft movements only. Whilst the proposed Relevant Action may change traffic flows on the local road network on the approach to and from the Airport, projected changes will not exceed the 10% of future baseline flow criteria set out in TII guidance (NRA, 2011). On average, the change in traffic flow on the local road network averages out at around 1% of future baseline flows (i.e within the permitted / constrained scenario). The implications of such a small change in traffic flow on road traffic emissions would be negligible and therefore screened out of the further assessment. To estimate total pollutant concentrations at air quality sensitive receptors close to the Airport and local road network, the assessment does account for permitted 2022/2025 road traffic flows and emissions on those roads local to the Airport. Therefore, the study area covers a radius of approximately 1km around the Airport boundary and the extent of the road transport network considered within Chapter 9: *Traffic and Transport.* These emission sources combined account for NO_2, PM_{10} and $PM_{2.5}$ concentrations, while hydrocarbon (HC) emissions have been derived based on the anticipated aircraft operations in idle mode. The study area includes likely worst-case impacts from the aircraft emissions, and any impacts beyond 1km are likely to be less than those reported in this assessment.

Following the compilation of a comprehensive emissions inventory of all significant Airport sources of emissions to air, selected representative air quality sensitive receptors within the study area, such as residential properties, schools and hospitals, have been identified on Figure 10-1. This information has been incorporated within an ADMS (Advanced Dispersion Modelling System)-Airport dispersion model, along with road traffic emissions data, to predict future changes to air quality, between the permitted / constrained 2022/2025 and proposed / unconstrained 2022/2025 scenarios. The assessment takes into account all relevant national policies, and statutory guidance. Specific statutory guidance of relevance to this assessment includes

- Advice Notes issued by the Environmental Protection Agency (EPA, 2017);

The assessment also draws on non-statutory guidance:

- Internationally recognised best practice guidance for the assessment of impacts from airports published by the International Civil Aviation Organization (ICAO, 2011).
- Good practice guidance on the assessment of significant effects issued by the Institute of Air Quality Management (EPUK, 2017); and
- elements of technical guidance (Local Air Quality Management Technical Guidance Note (LAQM.TG16)) for calculating air pollutant concentrations issued by the UK Department for Environment, Food and Rural Affairs (DEFRA, 2019).

The assessment focusses on a comparison between the future permitted baseline (2022 constrained) and the proposed (unconstrained) operational scenario relating to the amendment to Condition 3(d) and the replacement of Condition 5. The future years assessed include 2022 and 2025.

The existing baseline (2018), is evaluated as this provides an empirical description of the effects when the airport was close to 32mppa. 2018 is also the existing baseline year examined in detail in the noise chapters.

- Existing baseline year (2018)
- Future years without the proposed Relevant Action (2022 and 2025 – 'permitted / constrained scenario'; and
- Future years with the proposed Relevant Action (2022 and 2025 – 'proposed / unconstrained scenario.'

The future year scenarios listed above are based on post-Covid-19 forecasts that take into account the ongoing pandemic and its effect on future anticipated growth at the Airport in line with UK Department for Transport vehicle emissions forecast. However, the detailed modelling of airside emissions used to inform this assessment (as described in Technical Appendix A10-A) is based on the following scenarios that assumed pre-Covid-19 forecast data, which does not take into account the ongoing pandemic:

- Future years without the proposed Relevant Action (2022, 2022 (32mppa) and 2027) – 'Permitted / Constrained'; and
- Future years with the proposed Relevant Action (2022, 2022 (32mppa) and 2027) – 'Proposed / Unconstrained.'

The implications of referring to air quality predictions based on pre-Covid-19 forecast data are discussed in more detail in section *10.13 Methodology for Determining Operational Effects*. In summary, the pre-Covid-19 forecasts assumed a greater number of Aircraft Traffic Movements (ATM) and are therefore considerably more conservative than the post-Covid-19 forecasts and as such, the contribution of airside sources to pollutant concentrations in both Permitted and Proposed scenarios will be less than those reported in this Chapter. For this assessment, it is assumed that the Proposed and Permitted 2022 and 2027 pre-Covid-19 scenarios modelled in the detailed assessment (Technical Appendix A10-A) conservatively represent (i.e to consider the "worst case" or greater levels of impact) the 2022 and 2025 post-Covid-19 scenarios respectively. Based on professional judgment, this is considered to be an acceptable, proportionate and robust means by which to capture and identify any potential significant air quality effects.

10.2 Legislation and Planning Policy Context

10.2.1 National Legislation

10.2.1.1 Air Quality Standards Regulations 2011 (S.I. No. 180 of 2011)

The Air Quality Standard Regulations 2011 implement the European Union Directive 2008/50/EC on Ambient Air Quality and Cleaner Air for Europe (CAFE) and designate the EPA as the competent authority responsible for assessing ambient air quality in the territory of the State. The standards also establish Limit Values and alert thresholds for concentrations of certain pollutants in ambient air, to prevent or reduce harmful effects on human health and the environment.

The Air Quality Limit Values as set out in the regulations and considered within this assessment are provided in Table 10-1.

Table 10-1: Air Quality Limit Values

Pollutant	Averaging Period	Concentration (µg/m^3)	Permitted Exceedances
NO_2	Annual mean	40	None
	1-hour mean	200	not to be exceeded more than 18 times a year
PM_{10}	Annual mean	40	None

	24-hour mean	50	not to be exceeded more than 35 times a year
$PM_{2.5}$	Annual Mean	25	None

10.2.1.2 Air Pollution Act 1987 (Number 6 of 1987)

The Air Pollution Act 1987 provides local authorities with the primary responsibility for monitoring air quality, including the nature, extent and effects of emissions within their administrative area.

Local authorities are also given powers under the Act to take measures to prevent or limit air pollution in their administrative area. Owners of certain industrial activities must have an air pollution licence from either the local authority or the EPA, to run industries that are responsible for emissions.

10.2.1.3 Environmental Protection Agency Act 1992 (Number 7 of 1992)

The Environmental Protection Agency Act 1992 established the remit of the environmental regulator in Ireland to make further and better provision for the protection of the environment and the control of pollution.

Amongst the many duties of the EPA is the monitoring of local air quality across the country, including multiple locations in the Dublin region, and the regulation of licenced activities with emissions to air.

10.2.1.4 Protection of the Environment Act 2003

The Protection of the Environment Act 2003 was implemented to account for the European Union Directive 96/61/EC, of 24 September 1996, concerning Integrated Pollution Prevention and Control; this Amended the Environmental Protection Agency Act 1992.

10.2.2 National Planning Policy

10.2.2.1 National Aviation Policy (2015)

The National Aviation Policy (ICAO, 2016) sets out the Government's goals and commitments to the aviation industry in Ireland. Whereas the focus of this Policy in on the reduction of Greenhouse Gases (GHGs), the following points are of relevance to this assessment:

"Ireland is committed to working with its EU and international partners to mitigate the impacts of aviation on the environment and facilitate the sustainable growth of the sector

…

2.3.1 Ireland will work with European partners to achieve the development of global international standards for market based measures on aircraft emissions.

2.3.2 Ireland will develop its aviation emissions reporting capability in support of ICAO's evolving environmental policies.

…

2.3.4 Ireland will encourage research and development in Ireland of clean engine technologies and sustainable fuels."

10.2.2.2 Project Ireland 2040

Project Ireland 2040 is the Government's long-term overarching strategy for future development and infrastructure in Ireland. It consists of several documents, including the National Planning Framework (DHPLG, 2018), which is the Government's high-level strategic Plan for shaping the future growth and development of Ireland up to 2040.

The National Planning Framework includes the following overarching aim that is relevant to this assessment:

"*Creating a Clean Environment for a Healthy Society:*

…

Promoting Cleaner Air: Addressing air quality problems in urban and rural areas through better planning and design."

The National Planning Framework includes National Policy Objective 64, which stresses the importance of improving ambient air quality:

"National Policy Objective 64: Improve air quality and help prevent people being exposed to unacceptable levels of pollution in our urban and rural areas through integrated land use and spatial planning that supports public transport, walking and cycling as more favourable modes of transport to the private car, the promotion of energy efficient buildings and homes, heating systems with zero local emissions, green infrastructure planning and innovative design solutions."

Project Ireland 2040 also includes the Government's National Development Plan (DHPLG, 2018). This document is focused on Ireland's long-term economic, environmental and social progress up to 2027, and references improvements in air quality as an additional benefit to improving energy efficiency for the primary purpose of reducing carbon emissions.

10.2.3 Local Planning Policy

10.2.3.1 Fingal County Council Development Plan 2017-2023

The Fingal Development Plan 2017-2023 ("Development Plan) (FCC, 2017) sets out Fingal County Council's (FCC) proposed policies and objectives for the development of the County over the Plan period of 2017 to 2023. The Development Plan seeks to develop and improve, in a sustainable manner, the social, economic, environmental and cultural assets of the County.

The Development Plan includes multiple objectives that target the improvement of ambient air quality, including:

> *"**Objective AQ01** - Implement the provisions of EU and National legislation on air, light and noise and other relevant legislative requirements, as appropriate and in conjunction with all relevant stakeholders."*

The Development Plan states that FCC has adopted the Dublin Regional Air Quality Management Plan (DRAQMP):

> *"**Objective AQ02** - Implement the recommendations of the Dublin Regional Air Quality Management Plan (or any subsequent plan) and any other relevant policy documents and legislation in order to preserve good air quality where it exists or aim to improve air quality where it is unsatisfactory."*

With relation to the DRAQMP, the Development Plan states that the long-term monitoring of air quality at Dublin Airport and nearby major roads should continue and that as the Airport expands, the objectives of the Plan and its monitoring network should be revised to ensure appropriate coverage.

Some of the Development Plan objectives also relate specifically to Dublin Airport. That of relevance to air quality includes:

> *"**Objective DA18** - Ensure that every development proposal in the environs of the Airport takes account of the current and predicted changes in air quality, greenhouse emissions and local environmental conditions."*

10.2.3.2 Dublin Airport Local Area Plan 2020

The Dublin Airport Local Area Plan (LAP) (FCC, 2020) sets out how the Airport growth can be achieved sustainably.

The LAP includes the following objectives relating to air quality, not including those already listed within the Fingal Development Plan:

> *"**Objective AQ04** - Take account of the global and local impacts of aviation as well as the likelihood of international action to limit greenhouse gas emissions from aviation through action at the International Civil Aviation Organisation (ICAO)as mandated in the Kyoto Protocol when evaluating any proposals to significantly increase the use of Dublin Airport."*
>
> *"**Objective AQ05** - Undertake a review of existing air quality monitoring (and associated appropriate remedial action in the case of breaches) within and surrounding the Airport (including changes in Particulate Matter (PM) at relevant locations). Where relevant, such a review should identify additional monitoring proposals, remedial actions and implementation systems – such needs shall be provided for by Fingal County Council and/or daa."*

The Plan also acknowledges that the Airport impacts on air quality from the following activities:

- Emissions associated with ongoing operations of the Airport, such as aircraft and support services, and surrounding areas as a result of traffic accessing the Airport.

10.2.3.3 Dublin Regional Air Quality Management Plan 2009-2012

The DRAQMP (DCC, 2009) is referred to in both the Fingal Development Plan and the Dublin Airport Local Area Plan. The DRAQMP acknowledges that NO_2 and PM_{10} are the pollutants of most concern in the region.

It lists the following strategies local authorities in the region should consider to improve local air quality:

- Improve coordination of efforts and build on the good work to date;
- Mainstream air quality management into all major Policy areas;
- Strengthen evidence-based decision making by improving how information is shared on air quality;
- Lead by example with measures related to local authority activities that will reduce emissions;
- Identify and prioritise tackling main potential threats to air quality; and
- Provide clear time- bound criteria for the achievement of objectives.

Following the publication of the Air Quality Management Plan 2009-2012, a subsequent Air Quality Management Plan was published focusing on improving levels of NO_2 in the Dublin region (DCC, 2009). This document was prepared following a reported exceedance of annual mean air quality standard for NO_2 within the Dublin region in 2009.

The document analyses and considers the reason for the exceedance and responsible sources, as well as summarising existing (at the time of publication) national, regional and local Policy for improving air quality.

It goes on to suggest measures that could be implemented in the future to improve air quality conditions, nationally, regionally and locally. These include improved emissions technology within the power sector, the publication of regional development plans with greater emphasis on improving air quality and the promotion and implementation of sustainable transport.

10.2.4 Other Relevant Policy, Standards and Guidance

10.2.4.1 Airport Air Quality Manual 2016

Published by the International Civil Aviation Organization (ICAO), the Airport Air Quality Manual (ICAO, 2011) provides internationally recognised guidance on how to compile emissions inventories associated with Airport sources and how to use dispersion modelling to estimate the contribution of these emissions to local ambient concentrations.

This guidance has been used both for the compilation of the emissions inventory and to inform dispersion modelling method, as set out in Technical Appendix A10-A.

10.2.4.2 Local Air Quality Management Technical Guidance 2016

The UK Department for Environment, Food and Rural Affairs published their Local Air Quality Management Technical Guidance (DCC, 2009) to assist local authorities in the UK with their responsibilities to review and assess local air quality in their administrative areas. The technical guidance provides methods and tools that can be applied for air quality assessment, including an approach to dispersion model verification and the conversion of nitrogen oxides (NO_X) to NO_2 for road traffic sources.

10.2.4.3 Land-Use Planning & Development Control: Planning For Air Quality 2017

The Institute of Air Quality Management and Environmental Protection UK provide guidance for the consideration of air quality within the land-use planning and development control process (EPUK, 2017). The guidance sets out a means of describing air quality impacts based on the relationship between the magnitude of change and total pollutant concentration experienced, relative to the air quality standards (see Section 11.2). Therefore, a smaller magnitude of change could potentially have a greater impact, where total concentrations are close to or above an air quality standard, when compared to a larger magnitude of change, where total concentrations are below and not at risk of exceeding the standard.

10.3 Assessment Methodology

This section of this EIAR Chapter presents the following:

- Information sources that have been consulted throughout the preparation of this Chapter;
- Details of consultation undertaken concerning air quality;
- The methodology for the assessment of air quality effects, including the criteria for the determination of the sensitivity of receptors and magnitudes of change from the existing 'baseline' condition;
- An explanation as to how the identification and assessment of potential air quality effects has been reached; and
- The significance criteria and terminology for the assessment of air quality residual effects.

The following sources of information that define the proposed Relevant Action have been reviewed and form the basis of the assessment of likely significant effects on air quality:

- Detailed plans and elevations;
- Current and forecast data for the following sources:
  - Aircraft emissions (main engines operating within the Landing and Take-off (LTO) Cycle and the use of aircraft Auxiliary Power Units (APUs);
  - Aircraft handling emissions (Ground Support Equipment (GSE) including airside vehicles and Mobile Ground Power Units);
  - Infrastructure and stationary sources (such as energy plant); and
  - Vehicle traffic sources (landside).
- Local air quality monitoring data sourced from daa and the EPA; and
- Hourly sequential meteorological data sourced from Met Eireann.

10.3.1 Methodology for Determining Baseline Conditions and Sensitive Receptors

The study area (Figure 10-1) has been defined based on ICAO's Airport Air Quality Manual taking into account a geographical area where there is a potential for a change in air quality with the proposed operations and the extent of the road transport network considered. The contribution of Airport sources beyond 1km is negligible, based on professional experience.

Baseline (2018) air quality conditions have been identified and reviewed for both total and background concentrations for all of the pollutants of interest. Further information is provided in Section 10.5.

Sensitive receptors have been identified according to National Roads Authority Guidance (NRA, 2011). Receptors are classified as locations where members of the public are likely to be regularly present. These include residential housing, schools, hospitals, places of worship, sports centres and shopping areas. In selecting relevant receptors for assessment, consideration has been given to locations that may be affected by the operation of the North Runway and wider runway system.

Further details concerning sensitive receptors can be found in Section 10.5.

10.3.2 Methodology for Determining Construction Effects

As the proposed Relevant Action will result in no changes to the design or construction methodology of the North Runway. On that basis, the assessment of construction phase impacts on air quality has been scoped out of the EIA.

10.3.3 Methodology for Determining Operational Effects

The contribution of emissions associated with the existing Baseline (2018), Permitted / Constrained and Proposed / Unconstrained scenarios, and total pollutant concentrations at sensitive receptors, have been predicted using the detailed methodology described in Technical Appendix A10-A.

This has included the contribution of emissions from modelled airside sources and future baseline traffic flows. As first stated in section *10.1 Scope of Assessment*, the detailed assessment has considered more conservative aircraft forecasts than currently projected in both Permitted and Proposed scenarios, as summarised in Table 10-2. This is because at an earlier stage of the project, detailed modelling was undertaken using pre-Covid forecasts for assessment years 2022 and 2027, which contain higher ATM) than are now forecast for this proposed Relevant Action application. Based on professional judgement, it has been decided to continue to use modelling outputs from the modelling undertaken using the pre-Covid forecasts for the Air Quality assessment. This is considered an acceptable approach, as it represents a very conservative worst-case scenario. The forecast data for the existing Baseline scenario remains as modelled.

Table 10-2 Comparison of modelled Pre-Covid-19 Forecasts (A) and current Post-Covid-19 Forecasts (B)

Scenario	Year	Pre-Covid-19 Forecasts (ATM (000s))	Post-Covid-19 Forecasts (ATM (000s))	% Difference
Permitted	2022	225	223	-1%
	2025/27[1]	220[2]	233	+6%
Proposed	2022	255	229	-10%
	2025/27[1]	273[3]	241	-12%
Change (Proposed – Permitted)	2022	+30	+6	-80%
	2025/27[1]	+53	+8	-85%

Notes:

[1]Pre-Covid-19 forecast scenario data projected to 2027; Post-Covid-19 forecast scenario data projected to 2025.

[2]Permitted Pre-Covid-19 forecast data when projected to 2025 was 222,000 ATM

[3]Proposed Pre-Covid-19 forecast data when projected to 2025 was 264,000 ATM.

Table 10-2 demonstrates the conservative nature of the detailed assessment of airside sources, with pre-Covid-19 forecasts (as ATM) being higher than the respective post-Covid-19 forecasts now anticipated, for the 2022 Permitted and 2022 and 2025 Proposed Scenarios. It also shows that the change from Permitted to Proposed scenarios quantified in the detailed assessment using the pre-Covid-19 forecasts is more conservative than the same change based on current post-Covid-19 forecasts. The implications of the reduced emissions cannot be directly applied to modelled predictions of total pollutants reported. However, the percentage change in forecast data, and the difference between Permitted and Proposed scenarios, does provide clear indication that the contribution of airside sources to those pollutant concentrations and reported impacts are now significantly over-estimated. The 2022 and 2027 Permitted and Proposed scenario's total pollutant concentrations, and the change in concentration between 2022 and 2027 Permitted and Proposed scenarios, as quantified in the detailed assessment, are therefore considered to conservatively represent conditions in 2022 and 2025 for purposes of this assessment.

The difference between the 2027 Permitted and Proposed scenarios included in the detailed assessment and the 2025 Permitted and Proposed scenarios for which approvals are being sought, beyond the difference in forecast data described in the previous paragraph, is the change in future baseline traffic flow emissions. For 2027, the modelled contribution of future baseline road traffic emissions is based on an assumed level of year on year traffic flow growth on the local road network from the 2018 baseline to 2027. The 2025 scenarios now considered will see two years less growth than the 2027 scenarios included in the detailed assessment. However, whilst that would see a potential reduction in traffic flows, it would also see a potential increase in emission rates per vehicle. This is because the 2027 scenarios considered in the detailed assessment include two additional years of vehicle emissions technology improvements and evolution of the national vehicle fleet. In light of the above, with any improvement as result of lower flows offset by increased emission rates, it is considered that the future Baseline road traffic emissions contribution to total pollutant concentrations, as reported in the detailed assessment for 2027, is representative of future Baseline contributions in 2025.

Operational effects have been determined based on the descriptors included within the guidance issued by Environmental Protection UK and the Institute of Air Quality Management (EPUK, 2017). The impact descriptors express the magnitude of incremental change as a proportion of the relevant assessment level and then examine this change in the context of the new, total concentration, and its relationship to the assessment criterion. More information can be found in Paragraph "Significance Criteria" that follows.

10.3.4 Significance Criteria

The assessment refers to the 2017 guidance published by the EPA on assessing the significance of effects (EPA, 2017). It also takes into account the orientation of effect (positive, negative or neutral), the duration of effect, the extent and context of the effect, the significance of effect, the probability of effect, duration and frequency.

The assessment refers to guidance issued by Environmental Protection UK and the Institute of Air Quality Management (EPUK, 2017), which provides a means to describe the impact of the Proposed Scheme at individual receptors based on dispersion model outputs. The Environmental Protection UK and the Institute of Air Quality Management guidance uses the term "impact" to describe a change in pollutant concentration at a specific location, and the term "effect" to describe an environmental response resulting from the impact.

Receptors associated with human health impacts are selected based on the likely exposure of the public to the pollutants of concern for periods that are representative of the air quality standards, such as residential properties, schools and medical facilities with over-night accommodation. Land uses are, therefore either sensitive or not sensitive to air quality impacts. Where sensitive receptors are identified, all are considered to be as highly sensitive as each other.

The Environmental Protection UK and the Institute of Air Quality Management guidance states that an air quality impact can be expressed as the magnitude of change in pollutant concentration as a proportion of the relevant assessment level (for example the relevant air quality standards), and then to examine this change in the context of the total pollutant concentration with the proposed Relevant Action in place. This is summarised in Table 10-3.

Table 10-3: Air Quality Impact Descriptors At Individual Receptors

Long-term average concentration	% change in concentration relative to air quality assessment level				
	<1	1 – 2	2 – 5	6 – 10	>10
75% or less of Limit Value	Negligible	Negligible	Negligible	Slight	Moderate
76% - 94% of Limit Value	Negligible	Negligible	Slight	Moderate	Moderate
95% - 102% of Limit Value	Negligible	Slight	Moderate	Moderate	Substantial
103% - 109% of Limit Value	Negligible	Moderate	Moderate	Substantial	Substantial
110% or more of Limit Value	Negligible	Moderate	Substantial	Substantial	Substantial

Source: EPUK/IAQM 'Land-Use Planning & Development Control: Planning for Air Quality,2017'

The Environmental Protection UK and the Institute of Air Quality Management guidance includes seven explanatory notes to accompany the terminology for the descriptors listed in Table 10-3. It is noted that the descriptors are for individual receptors only and that overall significance is determined using professional judgement. Additionally, it is also noted that it is unwise to ascribe too much accuracy to incremental changes or background concentrations; this is especially important when total concentrations are close to the Limit Value. For a given year in the future, it is impossible to define the new total concentration without recognising the inherent uncertainty, which is why there is a category that has a range around the Limit Value for annual mean NO_2 (and annual mean PM_{10}), rather than being precisely equal to it.

A change in predicted annual mean concentrations of NO_2 or PM_{10} of less than 0.5% (0.2 μg/m^3) is considered to be imperceptible. A change (impact) that is imperceptible, given reasonable bounds of variation, would not be capable of having a direct effect on local air quality that could be considered to be significant. Likewise, a change in predicted annual mean concentrations of $PM_{2.5}$ of less than 0.5% (0.12 μg/m^3) is also considered to be imperceptible.

Additionally, the guidance also includes the potential for slight air quality impacts as a result of changes in pollutant concentrations between 2% and 5% of relevant air quality standards. For annual average NO_2 and PM_{10} concentrations, this relates to changes in concentrations ranging from 0.6 – 2.1 μg/m^3. In practice, changes in concentration of this magnitude at the lower end of this band are likely to be very difficult to distinguish through any post-operational monitoring regime, due to the number of sources of NO_2 in an urban environment and the interannual effects of varying meteorological conditions. In the overall evaluation of significance, the potential for significant air quality impacts within this band is, therefore, considered in this context.

Changes in concentration of more than 5% (moderate and substantial, the two highest bands) are considered to be of a magnitude which is far more likely to be discernible and as such carry additional weight within the overall evaluation of significance for air quality.

It should be noted that the impact descriptors in Table 10-3, are intended for application at individual modelled sensitive receptors. While there may be a ‘slight’, ‘moderate’ or ‘substantial’ impact at one or more receptors, the overall effect may not necessarily be judged as being significant in some circumstances. The overall significance of effects is determined using professional judgement, taking this into account and the EPA Advice Note criteria described above.

10.4 Assumptions, Limitations and Uncertainty

As stated in section *10.1 Scope of Assessment* and section *10.3 Methodology for Determining Operational Effects*, the quantification of Permitted and Proposed total pollutant concentrations and associated impacts for scenarios in 2022 and 2025 (post-Covid-19 forecasts) is based on earlier modelling that considered pre-Covid-19 forecasts for 2022 and 2027. Predictions of total pollutant concentrations and impacts using the pre-Covid-19 forecasts for 2022 and 2027 are considered to be a very conservative representation of the post-Covid-19 conditions in 2022 and 2025 respectively up to and beyond the likely worst case. This is professionally considered to represent a proportionate level of assessment for the current proposals.

All model assumptions used during the air quality assessment are presented in Technical Appendix A10-A, where the inputs of the model as well as their limitations are described in detail.

10.5 Baseline Conditions

10.5.1 Existing Baseline

Existing monitoring data made available by daa and the EPA allow for a general discussion of baseline air quality in the vicinity of the site.

10.5.1.1 Dublin Airport Authority Pollutant Monitoring

Over the past few years, daa has undertaken the monitoring of a range of pollutants at a continuous monitoring station located on the grounds of Dublin Airport. The concentrations measured for NO_2 and PM_{10} are reported quarterly by daa. The annual data are summarised in Table 10-4. This data demonstrates that annual mean NO_2 and PM_{10} concentrations monitored at Dublin Airport are consistently below relevant air quality standard values, typically representing around 50 - 60% of those values. It should be noted that activity around the location of the continuous analyser location increased significantly in recent years with a construction compound being located close to it.

Table 10-4: Continuous NO_2 Measurement Data – daa Dublin Airport

Pollutant and Averaging Period	Concentration / Number of Exceedances of Short-Term Air Quality Limit								
	2011	2012	2013	2014	2015	2016	2017	2018	2019
NO_2 - µg/m^3 (Annual Mean) Limit Value **40 µg/m^3**	16	19	19	22	22	23	20	28	28
PM_{10} - µg/m^3 (Annual Mean) Limit Value **40 µg/m^3**	18	20	23	21	20	23	21	20	18
PM_{10} - Days (Daily Mean) Limit Value **35 Days**	0	2	3	4	6	8	4	0	5

Notes: Concentrations rounded to whole numbers

Source: Dublin Airport Air Quality Monitoring – Annual Report 2019

In addition to the continuous monitoring data gathered within the Dublin Airport grounds, daa has also undertaken the measurements of NO_2, and benzene (C_6H_6) using passive sampling by diffusion tubes at several offsite locations in the vicinity of Dublin Airport. The concentrations measured for NO_2, and C_6H_6 are also reported quarterly, and the annual data are summarised in Table 10-5 to Table 10-7.

The data presented in these Tables demonstrate that the Air Quality Limit Values for the pollutants monitored are not being exceeded. Annual mean concentrations of NO_2 are notably higher at locations closest to roads where the primary source of air pollution is the road network itself (A5 to A7). It is also noted that NO_2 concentrations have been steadily increasing over the last eight years. Locations A5 and A6 are site boundary locations, and A11 represent the Airport bus station and do not represent relevant air quality sensitive exposure. They either comprise part of the Airport area and thus are not representative of sensitive receptor locations, or are sited explicitly to support local initiatives, such as monitoring the effects of buses switching engines on/off when idling. Some of the locations also changed position over the ten-year monitoring period.

Table 10-5: Passive NO_2 Measurement Data – daa Dublin Airport

Location	Concentration (µg/m^3)							
	2011	2012	2013	2014	2015	2016	2017	2018	2019
A1 - Forrest Little Golf Club	10	12	18	18	18	18	18	20	18
A2 - Kilreesk Lane, St. Margaret's	8	8	12	12	13	12	12	16	16
A3 - Ridgewood Estate West, Swords	9	9	17	n/a	n/a	20	17	17	16
A4 - St. Margaret's School and Parish House	10	11	16	15	16	16	16	19	17
A5 - Fire Station, Huntstown, Dublin Airport	11	13	18	19	20	22	24	29	25
A6 - Southern Boundary Fence, Dublin Airport	16	23	29	26	28	30	29	32	29
A7 - Western Boundary Fence, Dublin Airport	20	17	24	26	25	27	25	30	30
A8 - St. Nicholas of Myra School, Malahide Road	10	10	14	14	16	15	19	19	19
A9 - Naomh Mearnóg GAA Club Portmarnock	7	9	15	14	14	13	15	15	15
A10 - Oscar Papa Site, Portmarnock	9	10	15	14	14	15	15	16	17
A11 - Airport Bus Depot	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	**43**
A12 - Portmellick House, Dunbro Lane	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	23
Air Quality Standard					**40**				

Notes: Concentrations rounded to whole numbers

Source: Dublin Airport Air Quality Monitoring – Annual Report 2019

Table 10-6: Passive Benzene Measurement Data – daa Dublin Airport

Location	Concentration (µg/m^3)								
	2011	2012	2013	2014	2015	2016	2017	2018	2019
A1 - Forrest Little Golf Club	0.5	0.2	0.6	n/a	n/a	0.8	0.5	0.6	0.5
A2 - Kilreesk Lane, St. Margaret's	0.5	0.3	0.5	n/a	n/a	0.4	0.3	0.4	0.4
A3 - Ridgewood Estate West, Swords	0.3	0.2	0.6	n/a	n/a	0.6	0.4	0.5	0.4
A4 - St. Margaret's School and Parish House	0.4	0.3	0.5	n/a	n/a	0.4	0.4	0.5	0.4
A5 - Fire Station, Huntstown, Dublin Airport	0.4	0.3	0.5	n/a	n/a	0.8	0.4	0.5	0.6
A6 - Southern Boundary Fence, Dublin Airport	0.4	0.3	0.5	n/a	n/a	0.5	0.6	0.4	0.4
A7 - Western Boundary Fence, Dublin Airport	0.6	0.2	0.5	n/a	n/a	0.5	0.4	0.3	0.3
A8 - St. Nicholas of Myra School, Malahide Road	0.6	0.2	0.5	n/a	n/a	0.5	0.5	0.5	0.5
A9 - Naomh Mearnóg GAA Club Portmarnock	0.4	0.6	0.5	n/a	n/a	0.5	0.5	0.4	0.5

Location	Concentration (µg/m^3)								
	2011	2012	2013	2014	2015	2016	2017	2018	2019
A10 - Oscar Papa Site, Portmarnock	0.8	0.4	0.5	n/a	n/a	0.6	0.5	0.4	0.4
A11 - Airport Bus Depot	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	0.6
A12 - Portmellick House, Dunbro Lane	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	0.3
Air Quality Standard	**5**								

Source: Dublin Airport Authority, Dublin Airport Air Quality Monitoring – Annual Report 2019

10.5.1.2 EPA Pollutant Monitoring

The EPA measure annual mean concentrations of numerous pollutants in the Dublin region, including annual mean concentrations of NO_2, PM_{10} and $PM_{2.5}$. None of these monitoring locations are located close to Dublin Airport. The monitoring location in Swords is the closest, which is over 2 km to the north of the Airport The data gathered over recent years are summarised in Table 10-7 to Table 10-9. Location-specific data available for the most recent years demonstrates further compliance with the air quality standard values for these pollutants at the majority of areas considered by the EPA, with the exception of recent NO_2 monitoring on Pearse Street and St. Johns Road. Neither of these monitoring sites are in close proximity to Dublin Airport. The range in concentrations between measurement sites is likely due to their location and proximity to sources of existing emissions to air, such as busy roads and/or industrial stacks.

Table 10-7: Annual Mean NO_2 Monitoring Results (µg/m^3)

Location	2012	2013	2014	2015	2016	2017	2018	2019
Ballyfermot	-	16	16	16	17	17	17	20
Blanchardstown	-	-	-	-	-	-	25	31
Coleraine Street	-	-	-	-	28	26	-	-
Davitt Road	-	-	-	-	-	-	26*	24
Dun Laoghaire	18	16	15	16	19	17	19	15
Pearse St	-	-	-	-	-	-	-	49
Rathmines	21	19	17	18	20	17	20	22
Ringsend	-	-	-	-	-	22	27	24
St. Anne's Park	-	12	14	14	-	-	-	-
St. Johns Road	-	-	-	-	-	-	44*	43
Swords	15	15	14	13	16	14	16	15
Winetavern St	29	31	31	31	37	27	29	28
Air Quality Standard	**40**							

Notes: Concentrations rounded to whole numbers

* Monitoring undertaken for less than a year and may not comparable to the annual mean air quality standard.

Source: EPA, Air Quality in Ireland 2019

Table 10-8: Annual Mean PM_{10} Monitoring Results (µg/m^3)

Location	2012	2013	2014	2015	2016	2017	2018	2019
Ballyfermot	-	12	11	12	11	12	16	14
Blanchardstown	-	-	-	-	18	15	17	19
Davitt Road	-	-	-	-	-	-	14*	15

Location	2012	2013	2014	2015	2016	2017	2018	2019
Dun Laoghaire	-	17	14	13	13	12	13	12
Finglas	-	15	-	-	-	-	11*	13
Marino	-	-	-	-	-	-	12*	14
Phoenix Park	11	14	12	12	11	9	11	11
Rathmines	14	17	14	15	15	13	15	15
Ringsend	-	-	-	-	-	13	20	19
St. Anne's Park	-	19	17	15	-	-	11*	12
St. Johns Road	-	-	-	-	-	-	14*	14
Tallaght	-	-	-	-	14	12	15	12
Winetavern St	13	14	14	14	14	13	14	15
Air Quality Standard					**40**			

Notes: Concentrations rounded to whole numbers

* Monitoring undertaken for less than a year and may not comparable to the annual mean air quality standard.

Source: EPA, Air Quality in Ireland 2019

Table 10-9: Annual Mean $PM_{2.5}$ Monitoring Results (µg/m^3)

Location	2012	2013	2014	2015	2016	2017	2018	2019
Ballyfermot	-	-	-	-	-	-	7*	10
Coleraine Street	-	-	-	-	9	8	-	10
Davitt Road							8*	11
Finglas	-	-	7	8	9	7	8	9
Marino	8	9	8	8	7	7	6	9
Phoenix Park	-	-	-	-	-	-	6	8
Rathmines	11	11	9	10	10	9	9	8
Ringsend							8*	10
St. Anne's Park	-	-	-	-	-	-	7*	8
St. Johns Road	-	-	-	-	-	-	9*	9
Air Quality Standard					**25**			

Notes: Concentrations rounded to whole numbers

* Monitoring undertaken for less than a year and may not comparable to the annual mean air quality standard.

Source: EPA, Air Quality in Ireland 2019

10.5.1.3 Background Concentrations

Model outputs are combined with background concentrations to predict total pollutant concentrations at modelled receptors. Background concentrations are those from many sources which individually may not be significant, but collectively, over a large area, need to be considered.

Background pollutant concentrations have been defined from the latest available local monitoring data. Even though the national network consists of a variety of background monitoring locations for NO_2 and PM_{10}, there are only limited data to describe $PM_{2.5}$ background concentrations. The approach taken to estimate $PM_{2.5}$ concentrations was to use the UK Government's background pollutant concentrations maps (DEFRA, 2019) to calculate the average ratio between PM_{10} and $PM_{2.5}$ concentrations across the whole of Northern Ireland (mapped background data are not available for the Republic of Ireland) and apply this ratio to the measured PM_{10} background concentrations. The monitoring location considered to be representative of ambient background concentrations at Dublin Airport is Swords for NO_2 and Phoenix Park for PM_{10}. The baseline and future year background pollutant levels can be seen below in Table 10-10.

Table 10-10: Background Concentrations (µg/m³)

Pollutant	Year			
	2018	2022	2025	2027
NO_2	16.0	13.7	12.7	12.0
PM_{10}	11.0	10.5	10.3	10.2
$PM_{2.5}$	6.8	6.4	6.2	6.1

Sources: EPA, Air Quality in Ireland 2018

10.5.1.4 Receptors

Receptors considered in the detailed modelling study include a selection of residential properties and other sensitive locations such as schools and community facilities. A total of 52 existing receptors were modelled that may be affected by the operation of the permitted North Runaway, details of which can be found in Table 10-11 and Figure 10-1.

In some instances, a single receptor location has been selected to represent a group of residential properties, as the predicted concentrations would tend to be similar within the cluster of properties.

Table 10-11: Modelled Receptor Information

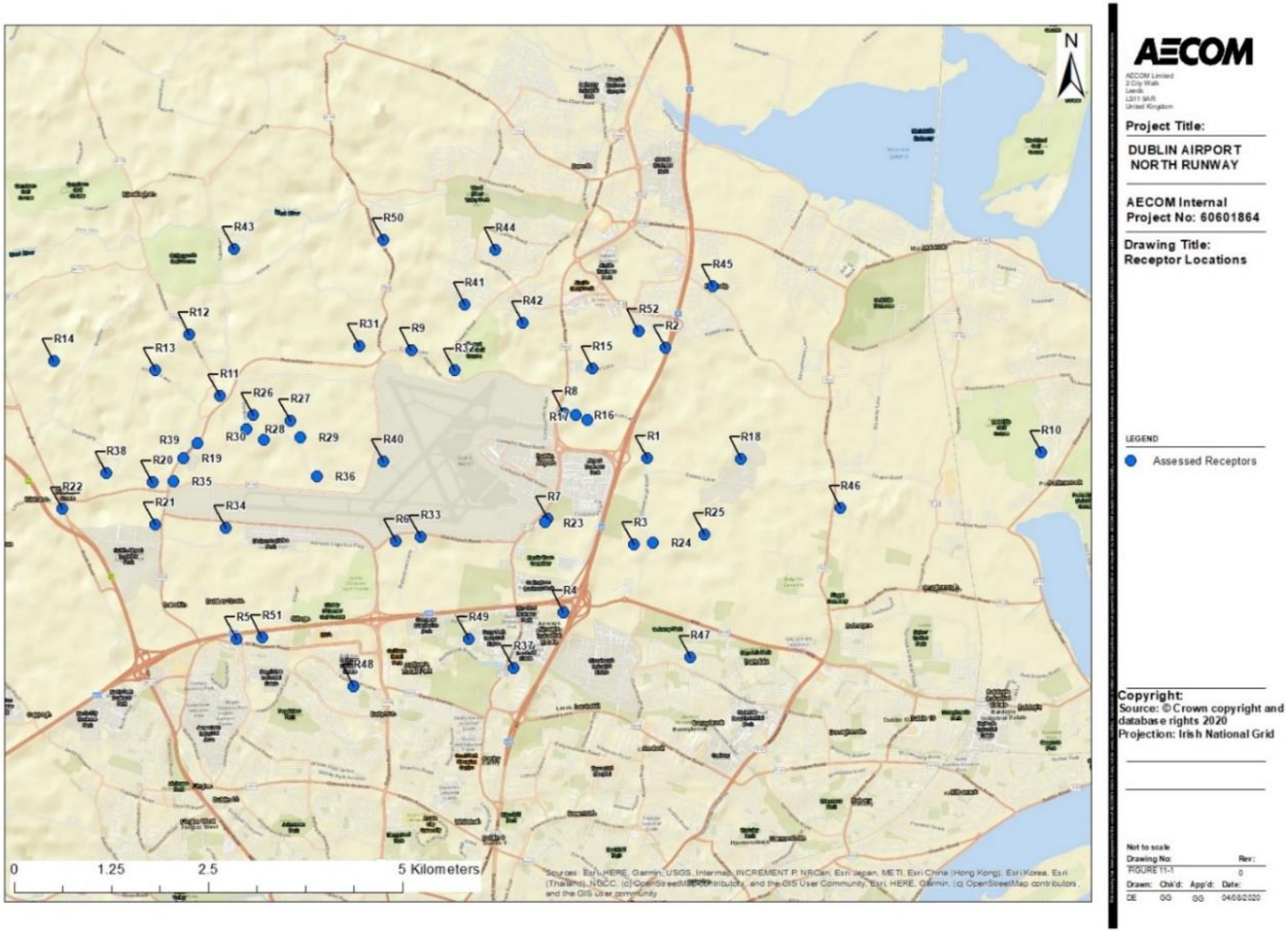
	Coordinate X	Coordinate Y	Height Z	Receptor Type
R1	318798	243360	1.5	Residential
R2	319033	244780	1.5	Residential
R3	318630	242250	1.5	Residential
R4	317726	241372	1.5	Residential
R5	313514	241030	1.5	Residential
R6	315562	242290	1.5	Residential
R7	317519	242579	1.5	Residential
R8	317729	243939	4.5	Public House
R9	315763	244749	1.5	Residential
R10	323880	243429	1.5	Residential
R11	313298	244155	1.5	Residential
R12	312909	244952	1.5	Residential
R13	312469	244492	1.5	Residential
R14	311160	244610	1.5	Residential
R15	318102	244515	1.5	Residential
R16	317888	243916	1.5	Residential
R17	318032	243850	1.5	Residential
R18	320013	243349	1.5	Residential
R19	312827	243360	1.5	Residential
R20	312430	243045	1.5	Residential
R21	312467	242503	1.5	Residential
R22	311268	242704	1.5	Residential
R23	317492	242531	1.5	Residential

	Coordinate X	Coordinate Y	Height Z	Receptor Type
R24	318874	242268	1.5	Residential
R25	319541	242373	1.5	Residential
R26	313730	243918	1.5	Residential
R27	314205	243834	1.5	Residential
R28	313642	243728	1.5	Residential
R29	314338	243623	1.5	Residential
R30	313862	243591	1.5	Residential
R31	315095	244802	1.5	Residential
R32	316326	244488	1.5	Residential
R33	315883	242339	1.5	Residential
R34	313373	242465	1.5	Residential
R35	312699	243059	1.5	Residential
R36	314546	243128	1.5	Residential
R37	317082	240657	1.5	Residential
R38	311841	243162	1.5	Residential
R39	313017	243550	1.5	School
R40	315404	243316	1.5	Residential
R41	316456	245336	1.5	Residential
R42	317203	245096	1.5	Residential
R43	313483	246051	1.5	School
R44	316850	246041	1.5	School
R45	319651	245565	1.5	School
R46	321294	242722	1.5	School
R47	319361	240790	1.5	School
R48	315022	240425	1.5	School
R49	316502	241030	1.5	Residential
R50	315409	246163	1.5	Residential
R51	313841	241050	1.5	Residential
R52	318690	244991	1.5	Residential

Source: AQC (2020) - Dublin Airport North Runway: Relevant Action Application - Technical Report

A visual representation of the relative receptor location around the area of the Dublin Airport is provided below in Figure 10-1.

Figure 10-1: Location Of Modelled Receptors



10.5.1.5 Conversion of NO_x to NO_2

The proportion of NO_2 in NO_x varies greatly with location and time according to several factors, including the amount of oxidant available and the distance from the emission source. NO_x concentrations are expected to decline in future years due to falling emissions, and the NO_2/NO_x ratio will likely increase. Also, a trend has been noted in recent years whereby roadside NO_2 concentrations have been increasing at specific roadside monitoring sites, despite emissions of NO_x falling. The direct NO_2 phenomenon is having an increasingly marked effect at many urban locations and must be considered when undertaking modelling studies

In this study modelled road-NO_x concentrations were converted to total NO_2 concentrations using Defra's 'NO_x to NO_2' calculator (V7.1) (DEFRA, 2019), released in April 2019. This calculator requires an estimate of the proportion of primary NO_2 (f-NO_2). This was calculated individually for each receptor based on the relative contribution of different sources to total locally generated NO_x concentrations. For road vehicles, representative values of f-NO_2 are contained within the 'NO_2 from NO_x calculator'. For aircraft, f-NO_2 values obtained from the National Atmospheric Emissions Inventory were used (NAEI, 2020). For all other sources, including APUs, GSE and terminal boiler plant, f-NO_2 values of either 5% or 15% were assumed.

The Year, Region and background NO_2 concentrations were specified in the calculator, as was the selection of "Newry and Morne" as a local authority to derive default values. It was also necessary to specify the "representative traffic mix"; this was assumed to be "all UK traffic". These assumptions have been based on guidance issued by National Roads Authority (ICAO, 2011).

10.5.1.6 Model Verification

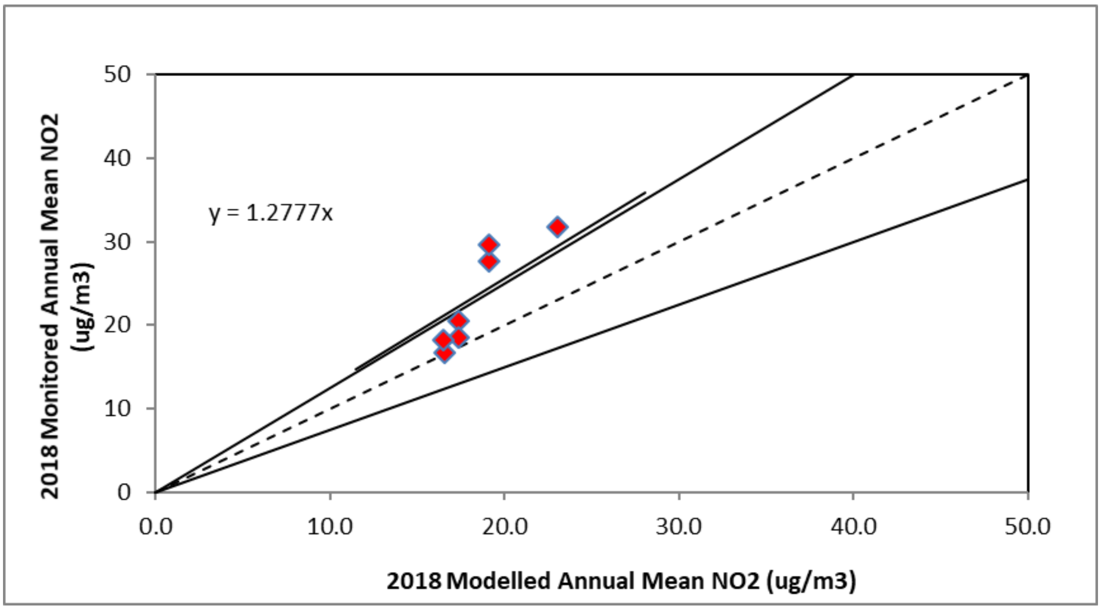
When using modelling techniques to predict concentrations, it is necessary to make a comparison between the modelling results and available measured monitoring data. This is to check if the model is reasonably reproducing actual observations and if necessary, allow the adjustment of modelled results to more closely match the monitoring data. The accuracy of the future year modelling results is relative to the accuracy of the base year results, therefore greater confidence can be placed in the future year concentrations if a good agreement is found for the base year.

The model has been run to predict the annual mean NO_x concentrations during 2018 at the Dublin Airport automatic monitor and the network of diffusion tube monitoring sites. Concentrations have been modelled at 2.4 m, the height of the monitors. A summary of the 2018 measured NO_2 concentrations is shown in Table 10-4.

Monitoring sites A9 andA10, and A3 and A7, have been excluded from the verification procedure. The first two are located in background locations further away from major Airport or road emissions, and the measured concentrations for 2018 are slightly lower than the background concentrations measured at EPA's Swords automatic monitoring station. The latter two have also been excluded as A3 is at a background location where the model over-predicts concentrations before any adjustment and site A7 is very close to the R108, which is not included in the model domain.

An initial comparison of the predicted NO_2 levels, based on combined "road-NO_x" and "airport-NO_x" emissions, which were converted into NO_2 using Defra's NO_x:NO_2 calculator and added to background values, with the measured NO_2 concentrations, shown an average under-prediction of 27.8% compared to measured concentrations, as can be seen in Figure 10-2:

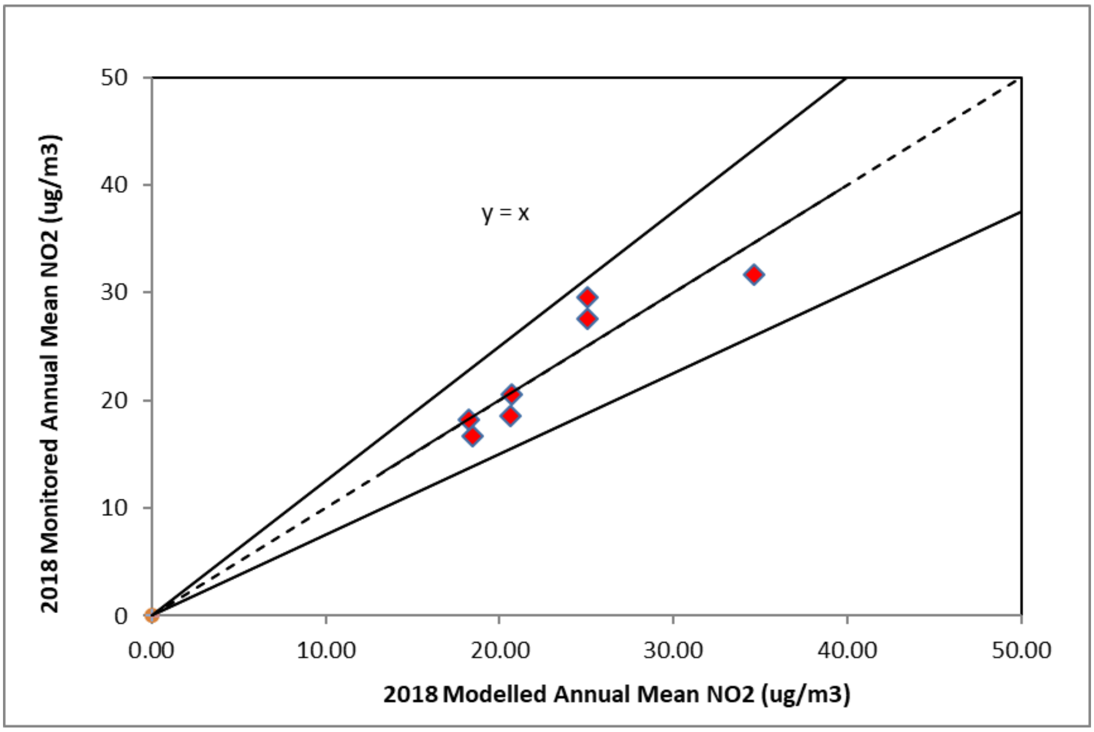
Figure 10-2 Modelled Vs Measured NO_2



The adjustment factor between modelled and monitored concentrations was found to be 2.551 to adjust the combined predicted “road-NO_x” and predicted “airport-NO_x”. The factor was then applied to the modelled road-NO_x contribution at all receptor locations considered in this assessment, before being converted into total NO_2 concentrations, using again using the NO_x:NO_2 calculator. A comparison of predicted NO_2 with measured NO_2 indicates a secondary NO_2 adjustment of 1.06 is required.

Based on the final adjusted modelled NO_2 concentrations, the Root Mean Square Error (RMSE) is 2.5, the Fractional Bias is 0.0, and the correlation coefficient is 0.9. LAQM.TG16 provides guidance on the evaluation of model performance. Model outputs where the RMSE is above 25% of the Limit Value 10 µg/m^3 should be checked. It further notes that “ideally, an RMSE value with 10% of the Limit Value (4 µg/m^3) should be achieved” and the ideal value for the Fractional Bias is 0.0. Based on the aforementioned, the model performance is considered to be good. The final modelled vs measured NO_2 comparison is shown in Figure 10-3.

Figure 10-3: Adjusted Model Comparison



10.6 Assessment of Effects and Significance

10.6.1 Effects During Operation of Proposed Relevant Action

10.6.1.1 Nitrogen Dioxide (NO_2)

Predicted annual mean NO_2 concentrations for Permitted and Proposed scenarios and associated impacts are provided in Table C1 of Appendix A10-C (and section A3 of the Technical Appendix A10-A (Table A3.2 and Table A3.4)).

Table 10-12 summarises the number of receptors that are predicted to fall within the stated concentrations bands for NO_2. A concentration of less than 32 µg/m^3 annual mean NO_2 is predicted at all of the modelled receptors.

The year 2018 (Table B1 of Appendix A10-B and Table A3.1 of Technical Appendix A10-A) has been chosen as the baseline scenario to serve the verification purposes of the assessment, to match the most recent EPA monitoring data publicly available at the time of assessment (noting that the EPA have since published monitoring data for 2019, which is summarised in section *10.4 EPA Pollutant Monitoring*).

Table 10-12: Air Quality Statistics for NO_2 Concentrations at Assessed Receptor Locations

Annual Mean NO_2 (µg/m^3)	Number of Receptors in Each Concentration Band				
	2018	2022[1]		2025[2]	
	Baseline	Permitted	Proposed	Permitted	Proposed
<32	52	52	52	52	52
32 to 36	0	0	0	0	0
36 to 40	0	0	0	0	0
>40 (Limit Value)	0	0	0	0	0

Notes:
[1]Based on Pre-Covid-19 aircraft forecast data for 2022 (Proposed) (A)
[2]Based on Pre-Covid-19 aircraft forecast data for 2027 (Proposed) (A)

The highest predicted concentrations for the future proposed scenarios 2022, and 2025 are respectively 31.3 µg/m^3 (R5 at Creston Ave ~1.5km south of Dublin Airport) and 28.1 µg/m^3 (R32 at Forest Rd ~200m north of Dublin Airport). All of the predicted NO_2 levels fall well below the Limit Values.

Annual mean concentrations of NO_2 for the future proposed scenarios 2022 and 2025 increase in comparison with the same permitted scenarios at the worst affected location (R32) by 1.7 µg/m^3 and 1.9 µg/m^3 respectively, based on the conservative assumption of ATM emissions using pre-Covid forecast data.

10.6.1.2 Particulate Matter (PM)

Predicted annual mean PM_{10} and $PM_{2.5}$ concentrations for Permitted and Proposed scenarios and associated impacts are provided in Table C2 (PM_{10}) and Table C3 ($PM_{2.5}$) of Appendix A10-C (and section A3 of the Technical Appendix A10-A (PM_{10}: Table A3.6 and Table A3.8; $PM_{2.5}$: Table A3.10 and Table A3.12)).

Table 10-13 and Table 10-14 summarise the number of receptors that are predicted to fall within concentrations bands for PM_{10} and $PM_{2.5}$. No exceedances of the annual mean Limit Values for PM_{10} and $PM_{2.5}$ are predicted at any receptor locations across the detailed model area, and the values are all well below the annual mean Limit Values.

Table 10-13: Air Quality Statistics for PM_{10} Concentrations at Assessed Receptor Locations

Annual Mean PM_{10} ($\mu g/m^3$)	Number of Receptors in Each Concentration Band				
	2018	2022[1]		2025[2]	
	Baseline	Permitted	Proposed	Permitted	Proposed
<10	0	0	0	0	0
10 to 20	52	52	52	52	52
20 to 30	0	0	0	0	0
30 to 40	0	0	0	0	0
>40 (Limit Value)	0	0	0	0	0

Notes:
[1]Based on Pre-Covid-19 aircraft forecast data for 2022 (Proposed)
[2]Based on Pre-Covid-19 aircraft forecast data for 2027 (Proposed)

Table 10-14: Air Quality Statistics For $PM_{2.5}$ Concentrations at Assessed Receptor Locations

Annual Mean $PM_{2.5}$ ($\mu g/m^3$)	Number of Receptors in Each Concentration Band				
	2018	2022[1]		2025[2]	
	Baseline	Permitted	Proposed	Permitted	Proposed
<5	0	0	0	0	0
5 to 10	52	52	52	52	52
10 to 15	0	0	0	0	0
15 to 20	0	0	0	0	0
20 to 25	0	0	0	0	0
>25 (Limit Value)	0	0	0	0	0

Notes:
[1]Based on Pre-Covid-19 aircraft forecast data for 2022 (Proposed)
[2]Based on Pre-Covid-19 aircraft forecast data for 2027 (Proposed)

All 52 receptors are predicted to experience PM_{10} concentrations falling within the annual mean range of 10 to 20 $\mu g/m^3$. For $PM_{2.5}$, all 52 receptors lie within the annual mean range of 5 to 10 $\mu g/m^3$.

In both cases of pollutants, there is no change in the number of receptors in the concentration bands when passing from the permitted to the proposed scenarios. Predicted concentrations for both PM_{10} and $PM_{2.5}$ fall well below Limit Values for annual mean levels of 40 and 20 $\mu g/m^3$ respectively at all assessed receptor locations.

The highest predicted PM_{10} concentrations for the future proposed scenarios 2022 and 2025 are respectively 11.34 $\mu g/m^3$ and 10.99 $\mu g/m^3$ at location R5 (Creston Ave ~1.5km south of Dublin Airport). The biggest increase between the permitted and Proposed Scheme relevant year assessments are 0.07 $\mu g/m^3$ (R32) for 2022 and 0.07 $\mu g/m^3$ (also R32) for 2025.

The worst affected location for $PM_{2.5}$ was receptor (R8) with the predicted annual mean concentrations for the proposed scenarios reaching 7.01 $\mu g/m^3$ and 6.74 $\mu g/m^3$ for the assessment years 2022 and 2025 respectively. For 2022 and 2025, the highest observed increase between the permitted and Proposed Scheme relevant year scenarios are also respectively 0.07 $\mu g/m^3$ (R32) and 0.07 $\mu g/m^3$ (also R32).

10.6.1.3 Odour

Potential odour nuisance due to aircraft fuels has also been modelled, and the results can be seen in Table D-1 in Technical Appendix A10-D.

There is no standard assessment approach to quantify the potential odour effects associated with Airport operations. A commonly applied methodology is to define the odour levels based on the change in aircraft-related volatile organic compounds (VOC) emissions. However, there is no evidence to correlate total aircraft-related VOC concentrations with the human perception of odours. Furthermore, airport-odours are unlikely to be related to total VOCs, so any such correlation is expected to be very weak.

It becomes clear that according to the 98th percentile of the 1-hour mean exposure (OUe/m^3), no receptor is anticipated to experience levels > 1 OUe/m^3, thus the potential of odour nuisance occurring is low. The highest proposed predicted odour levels are 0.79 and 0.69 OUe/m^3 for years 2022 and 2025 respectively, all observed at receptor R8.

10.7 Additional Mitigation Measures

10.7.1 Mitigation During Operation of Proposed Relevant Action

No additional mitigation measures are anticipated to be required during the operation of the proposed Relevant Action.

10.8 Residual Effects and Conclusions

A highly conservative assessment of air quality impacts has been undertaken, based on pre-Covid forecast data, to represent permitted and proposed total pollutant concentrations and impacts for post-Covid scenarios. An analysis of ATM data between the pre-Covid forecast and post-Covid forecast has demonstrated that the proposed ATM (and therefore emissions associated with that ATM) of the former, as modelled, are higher than the ATM of the latter. Analysis has also demonstrated that the impact of the proposed Relevant Action on ATM (the change between permitted and proposed) is also much higher with the pre-Covid forecast data, as modelled. Therefore, the total pollutant concentrations and impacts reported in this chapter represent an extreme worst-case and in reality, total pollutant concentrations and impacts would be less than those reported.

The results of the conservative assessment demonstrate that annual mean concentrations of all the pollutants considered are below the relevant Limit Values for all of the assessed receptor locations.

Concentration changes between the permitted and proposed Relevant Action show residual effects to be Not Significant. A summary of the potential effect on air quality is shown in Table 10-15.

Table 10-15: Air Quality Summary Of Potential Effects

Description of Effect	*Sensitivity of Receptor*	*Nature of Effect / Geographic Scale*	*Magnitude of Impact*	*Initial Classification Of Effect (With Embedded Mitigation)*	*Additional Mitigation*	*Residual Effect Significance*
Complete and Occupied						
Changes in annual mean nitrogen dioxide (NO_2) concentrations	High	Permanent	Imperceptible	Not Significant	N/A	Not Significant
Changes in annual mean Particulate Matter (PM_{10}) concentrations	High	Permanent	Imperceptible	Not Significant	N/A	Not Significant
Changes in annual mean Particulate Matter ($PM_{2.5}$) concentrations	High	Permanent	Imperceptible	Not Significant	N/A	Not Significant
Changes in 98th percentile of 1-hour mean odour concentrations	High	Permanent	Imperceptible	Not Significant	N/A	Not Significant

10.8.1 Likely Significant Environmental Effects

The proposed Relevant Action is unlikely to generate any significant effects on air quality, even with the conservative (i.e worst case) assumptions modelled for future aircraft forecasts.

Chapter 11:
Climate

11

11. Climate and Carbon

11.1 Introduction

This chapter of the Environmental Impact Assessment Report (EIAR) reports the findings of an assessment of the likely significant effects on greenhouse gas (GHG) emissions as a result of the proposed Relevant Action.

The scope of the GHG assessment includes additional GHG emissions resulting from the variation in Air Traffic Movements (ATMs) reported in the aircraft schedule developed by Mott MacDonald. GHG emissions from ATMs that have been considered within this assessment include those from the Landing and Take-Off (LTO) cycle (i.e. activities including approach/ landing, taxiing, take-off and climb (up to 3,000 feet), including Auxiliary Power Units (APUs) where applicable, and also during the Climb, Cruise and Descent (CCD) phase for departing flights. Additional surface access passenger journeys as a result of the proposed Relevant Action are also included within the scope of the assessment.

This assessment and EIAR chapter has been produced by AECOM.

11.2 Legislation and Planning Policy Context

The various policies, standards and guidance described in this section outline national and international ambitions and targets for reducing GHG emissions and demonstrate the need for effective GHG reduction measures to be built into future development.

In line with these ambitions and targets, this assessment evaluates the GHG impact of the proposed Relevant Action in the context of the projected National Emissions Inventories for Ireland (EPA, 2019) to provide some context and scale in relation to Ireland's trajectory towards decarbonisation.

Section 11.5 Environmental Design and Management outlines the ways in which GHG emissions as a result of the proposed Relevant Action have been or will be avoided, prevented, reduced and offset by various means.

11.2.1 National Planning Policy

11.2.1.1 National Policy Position on Climate Action and Low Carbon Development (2015)

The National Policy Position (DCCAE, 2013) outlines a requirement for relevant bodies to, "*in the* performance *of [their] functions, have regard to […] the objective of mitigating greenhouse gas emissions and adapting to the effects of climate change in the State*". The policy position provides a high-level policy direction for the adoption and implementation by Government of plans to enable the State to move to a low carbon economy by 2050. Specifically, it suggests the road-mapping and policy development process will be guided by a long-term vision based on:

- An aggregate reduction in carbon dioxide (CO_2) emissions of at least 80% (compared to 1990 levels) by 2050 across the electricity generation, built environment and transport sectors; and
- In parallel, an approach to carbon neutrality in the agriculture and land-use sector, including forestry, which does not compromise capacity for sustainable food production.

The projected National Emissions Inventories for Ireland (EPA, 2019), used within this assessment to evaluate the impact of GHG emissions associated with the proposed Relevant Action on Ireland's ability to meet its carbon reduction targets, were developed in line with this 80% reduction in GHG emissions target.

The draft 2020 amendment (DCCAE, 2020) introduces;

- Ireland's 5 yearly carbon budgets, to start in 2021.
- A requirement for a climate neutral economy by 2050
- Expectation for local authority to develop Climate Action Plans

11.2.1.2 National Spatial Strategy for Ireland 2002-2020

The National Spatial Strategy for Ireland 2002-2020 (Government of Ireland, 2002) highlights the importance of limiting energy demand and CO_2 emissions as a result of the development of Ireland's transport networks and encourages promotion of forestry and initiatives to address the impact of transport on the environment.

11.2.1.3 Project Ireland 2040: National Planning Framework (2018)

The NPF (Government of Ireland, 2018a) discusses the need to reduce GHG emissions.

The Framework also describes the importance of progressively electrifying mobility systems, moving away from "*polluting and carbon intensive propulsion systems to new technologies*".

11.2.1.4 National Development Plan 2018-2027

The National Development Plan 2018-2027 (Government of Ireland, 2018b) sets out the investment priorities that will underpin the implementation of the National Planning Framework (above). This Development Plan emphasises the need for "*investment to support the achievement of climate action objectives and discourage investment in high-carbon technologies*".

11.2.1.5 National Aviation Policy (2015)

The National Aviation Policy (DTTS, 2015) describes GHG emissions as a key issue in relation to aviation and states that while fuel efficiency has increased significantly in recent decades (70% increase in the last 40 years), these improvements are being offset by a rapid increase in activity.

It is recognised that aviation emissions will need to be limited in the future in line with European and global emissions trading/ offsetting initiatives.

11.2.1.6 Climate Action Plan (2019)

The objective of the Climate Action Plan (DCCAE, 2019) is to enable Ireland to meet its EU targets to reduce its carbon emissions by 30 per cent between 2021 and 2030 and lay the foundations for achieving net zero carbon emissions by 2050. The Plan outlines 180 actions that need to be taken across all the key sectors.

Specifically in relation to the transport sector, key actions include encouraging the uptake of biofuels, among others. Non transport-specific targets include increasing carbon tax.

While the Climate Action Plan is described as 'laying the foundations' for net zero carbon emissions by 2050, an official net zero target has not yet been set. Therefore, the net zero target does not supersede the 80% GHG emissions reduction target outlined within the National Policy Position on Climate Action and Low Carbon Development, described above. The 80% emissions reduction target has therefore been used for the purposes of this assessment.

11.2.2 Local Planning Policy

11.2.2.1 Transport Strategy for the Greater Dublin Area 2016-2035

This Transport Strategy (NTA, 2016a) emphasises Ireland's need to "*radically reduce dependence on carbon-emitting fuels in the transport sector*".

11.2.2.2 Dublin City Development Plan 2016-2022

The Dublin City Development Plan (DCC, 2016) explains that Dublin City has set an ambitious target of a 20% reduction in GHG emissions compared with 1990 levels for the whole city and a 33% reduction for the Council's own energy by 2020, and the EU Mayors Adapt Initiative has agreed to reduce carbon dioxide emissions by at least 40% by 2030.

11.2.2.3 Dublin City Council Climate Change Action Plan 2019-2024

The Dublin City Council Climate Action Plan (DCC, 2019) looks at the current climate change impacts and GHG emissions levels in the city, then features a range of actions to reduce these impacts across five key areas - Energy and Buildings, Transport, Flood Resilience, Nature-Based Solutions and Resource Management. A key target of the Climate Action Plan is to achieve a 40% reduction in the Council's greenhouse gas emissions by 2030.

11.2.2.4 Fingal Development Plan 2017-2023

The Fingal Development Plan (FCC, 2017) describes the need to "*minimise the County's contribution to climate change*", with particular reference to the transport sector, among others.

11.2.2.5 Fingal County Council Climate Change Action Plan 2019-2024

The Fingal County Council Climate Action Plan (FCC, 2019), developed alongside the Dublin City Council Climate Action Plan described above, looks at the current and future climate change impacts and GHG emissions levels within the county, and features a range of actions to reduce these impacts across five key areas - Energy and Buildings, Transport, Flood Resilience, Nature-Based Solutions and Resource Management. A key target of the Climate Action Plan is to achieve a 40% reduction in the Council's greenhouse gas emissions by 2030.

The Council also "*recognises the Climate Emergency as declared by the Dáil and commits itself in this plan to prioritising mitigation of, and adaptation to, climate change across its functions*".

11.2.3 Other Relevant Policy, Standards and Guidance

11.2.3.1 European Union (EU) Directive 2014/52/EU

The EU Directive 2014/52/EU (EU, 2014) describes the importance of considering climate change and greenhouse gas emissions within EIAs; "*Climate change will continue to cause damage to the environment and compromise economic development. In this regard, it is appropriate to assess the impact of projects on climate (for example greenhouse gas emissions) and their vulnerability to climate change."*

11.2.3.2 European Union Emission Trading Scheme

The aim of the EU Emissions Trading Scheme (ETS) (EC, 2015) is to help EU Member States achieve their commitments to limit or reduce greenhouse gas emissions in a cost-effective way by allowing participating companies to buy or sell emissions credits. This means savings are made where it is most financially viable to do so.

CO_2 emissions from aviation have been included in the EU emissions trading scheme since 2012. Under the EU ETS all airlines operating in Euro (both European and non-European airlines) are required to monitor, report and verify their emissions, and to surrender allowances against those emissions. They receive tradeable allowances covering a certain level of permitted emissions from their flights each year.

The EU ETS is discussed further in Section 11.5 Environmental Design and Management in relation to offsetting aviation emissions within the EU.

11.2.3.3 International Civil Aviation Organisation (ICAO) Carbon Offsetting Reduction Scheme for International Aviation (CORSIA)

CORSIA (ICAO, 2016) has been developed to address the increase in total CO_2 emissions from international aviation, with the aim of achieving no net increase in aircraft CO_2 emissions from its implementation date of 2021.

As it currently stands, CO_2 emissions from international aviation in 2019 will be used to set the CORSIA baseline for carbon neutral growth post-2020[9]. In any year beyond this point, any international aviation CO_2 emissions covered by the scheme exceeding the baseline quantity will be required to be offset.

CORSIA will be implemented in phases, starting with participation of countries on a voluntary basis until 2026, followed by the second phase (from 2027 to 2035), whereby participation is mandatory for all countries except those which are exempt (i.e. Least Developed Countries (LDCs), Small Island Developing States (SIDS) and Landlocked Developing Countries (LLDCs)).

CORSIA is discussed further in Section 11.5 Environmental Design and Management in relation to offsetting international aviation emissions.

11.3 Assessment Methodology

This section of this EIAR chapter presents the following:

- Information sources that have been consulted throughout the preparation of this chapter;
- Details of consultation undertaken with respect to GHG emissions;

[9] Due to the global COVID-19 pandemic resulting in significantly reduced international aviation operations in 2020, the CORSIA emissions baseline was adjusted. Without this adjustment, the baseline would have been much lower than expected, which would "*disrespect the originally-agreed intention and objectives of ICAO's 193 Member States when they adopted CORSIA in October 2016*", according to ICAO.

- The methodology behind the assessment of effects of GHG emissions, including the criteria for the determination of sensitivity of receptor and magnitude of change from the existing 'baseline' condition;
- An explanation as to how the identification and assessment of potential effects of GHG emissions has been reached; and
- The significance criteria and terminology for the assessment of residual effects of GHG emissions.

11.3.1 Methodology for Determining Baseline Conditions and Sensitive Receptors

The GHG assessment study area considers all GHG emissions from fuel used by aircraft during the additional LTO and CCD phases (collectively referred to as ATMs) and from additional surface access passenger journeys as a result of the proposed Relevant Action.

Only departure flights are considered within this assessment to avoid double counting of aviation emissions between airports. It is assumed that the emissions associated with the arriving flights, above 3000ft, will be accounted for within the carbon accounts of the airports of origin.

The baseline for the GHG emissions assessment is a 'business-as-usual' scenario (i.e. the GHG emissions associated with the forecast ATMs and surface access passenger journeys), without the proposed Relevant Action (the 'permitted / constrained' scenario).

The global climate has been identified as the receptor for the purposes of the GHG emissions assessment. However, there is no specific criteria for determining the significance of GHG emissions.

There is currently no published standard definition for receptor sensitivity to GHG emissions. For the purposes of this assessment, the sensitivity of the receptor, the Irish National Emissions Inventory[10] (used here as a proxy for the global climate to contextualise the scale of the GHG impact), has been defined as 'high'. The rationale for this approach is as follows:

- The extreme importance of limiting global warming to below 2°C this century is broadly asserted by the International Paris Agreement (UNFCC, 2016) and the climate science community. Additionally, a recent report by the Intergovernmental Panel on Climate Change (IPCC) highlighted the importance of limiting global warming below 1.5°C (IPCC, 2018).

11.3.2 Methodology for Determining Construction Effects

The proposed Relevant Action will result in no changes to the design or construction methodology of the North Runway the construction of which is already underway. On that basis, the assessment of construction phase impacts on GHG emissions is not assed further within this EIAR.

11.3.3 Methodology for Determining Operational Effects

There is no new airport infrastructure proposed as part of the proposed Relevant Action. Emissions from the operation of airport buildings and assets are therefore expected to remain similar to the current operations. It is expected that any increase in operational emissions due to an increase in night flights as a result of the proposed Relevant Action will be counterbalanced by the decarbonisation of the national grid and further carbon reductions realised in line with daa's energy reduction targets. It is therefore anticipated that any changes to building operations as a result of the proposed Relevant Action will not have a material impact on the overall carbon footprint and the outcome of this assessment. Emissions associated with operation of airport buildings/ assets are therefore not assessed any further within this EIAR.

Based on the project description and the scope of the proposed Relevant Action, the assessment of the impacts of ATMs and additional surface access passenger journeys on GHG emissions have been included in the assessment.

In line with the approach adopted for the Aviation Emissions Calculator by the European Monitoring and Evaluation Programme (EMEP) and the European Environment Agency (EEA) (EMP/EEA, 2019), the GHG emissions

[10] While it is recognised that the Irish National Emissions Inventory does not include emissions from international aviation, it has been used here as a proxy for the global climate to contextualise the scale of the GHG impact in relation to Ireland's projected trajectory towards decarbonisation.

associated with ATMs will be reported as tonnes of carbon dioxide (tCO_2). However, the GHG emissions associated with the additional surface access passenger journeys will be reported as tonnes of carbon dioxide equivalent (tCO_2e), accounting for the following seven Kyoto Protocol GHGs in line with 'The GHG Protocol' (WBCSD & WRI,n,d):

1. Carbon dioxide (CO_2).
2. Methane (CH_4).
3. Nitrous oxide (N_2O).
4. Sulphur hexafluoride (SF_6).
5. Hydrofluorocarbons (HFCs).
6. Perfluorocarbons (PFCs).
7. Nitrogen trifluoride (NF_3).

Other aircraft engine emissions (oxides of nitrogen (NO_x) and methane (CH_4)), and contrail and cirrus cloud formation have a climate change effect when released at high altitudes (Lee et al., 2009). It has been suggested by researchers that this additional effect almost doubles aviation's contribution to climate change compared to the CO_2 emissions alone (Sausen et al., 2005). However, the science is uncertain, and these additional impacts are not included in EU or international policy making at present. Therefore, these effects are not considered when calculating ATM emissions.

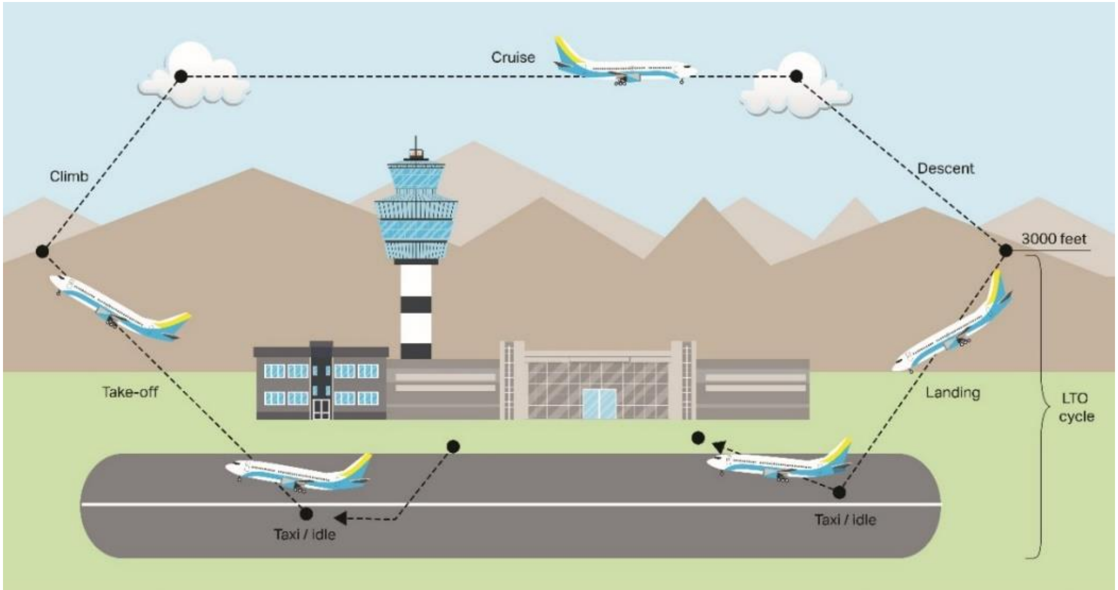


Figure 11-1 Air Traffic Movement (ATM) phases, including Landing and Take-Off (LTO) and Climb, Cruise and Descent (CCD) phases

As defined by ICAO, the LTO cycle consists of four phases of aircraft operations: approach/ landing, taxi, take-off and climb (to 3,000 feet), while the CCD phase consists of the climb, cruise and descent stages for departing flights only (above 3,000 feet).

Projected ATM data developed by Mott MacDonald (displayed in Table 11-1) have been provided for 2022 and 2025 for the 'proposed / unconstrained' and 'permitted / constrained' scenarios, representing airport operations with and without the proposed Relevant Action, respectively. Emissions from ATMs have been calculated for each of these future scenarios using the Aviation Emissions Calculator (EMEP/ EEA, 2019), based on the specific flight schedule and aircraft mix provided. As the aircraft schedules provided contain the projected mix of aircraft models for each of the assessment scenarios, future efficiency gains due to new aircraft models have been accounted for.

The calculator draws on the International Civil Aviation Organisation (ICAO) *Aircraft Engine Emissions Databank*, which contains information on exhaust emissions from various aircraft engines (provided by engine manufacturers).

The calculator models emissions from various aircraft types based on their most frequently used engine types and average European taxi times provided by EUROCONTROL's Central Office of Delay Analysis (CODA).

Table 11-1 Permitted/Constrained and Proposed/Unconstrained annual ATM projections for each assessment year

Year	Scenario		
	Permitted/Constrained	Proposed/Unconstrained	Variation
2022	223,000	229,000	6,000
2025	233,000	241,000	8,000

The Aviation Emissions Calculator methodology does not account for APU use as the use of APUs is highly variable between airports. APU usage at individual airports may depend on site-specific APU restrictions, differences in fuel costs between APUs and alternative power sources, and availability of alternative power sources (e.g. due to proximity of the aircraft to the required airport infrastructure). To account for APU usage, a scaling factor[11] of 8% has been applied to the LTO emissions calculated using the Aviation Emissions Calculator (EMP/EEA, 2019). This scaling factor is a conservative estimate, based on the contribution of APU emissions to overall LTO emissions reported in Heathrow Airport's emissions inventory between 2013 and 2017 (Heathrow Airport Limited, 2018).

Data from Heathrow Airport has been used here as the specific inventory data required for this calculation is not available for Dublin Airport over such a period (5 years), and there is very limited data or guidance available within the literature due to the high variability in APU usage between airports. As APU usage as a proportion of overall LTO emissions is publicly available for Heathrow Airport, this has been used as a proxy for Dublin. It is recognised that this may not be a completely accurate representation of the contribution of APU emissions at Dublin Airport, however as the APU usage only accounts for a small proportion of overall ATM emissions, it is not anticipated that any variation in APU use between Heathrow Airport and Dublin Airport will have an impact the overall outcome of the assessment.

The flight distance between Dublin Airport and each destination airport has been estimated for each flight route, and the emissions from each ATM modelled individually using the Aviation Emissions Calculator. To estimate the flight route distances, the direct distance was obtained from the Great Circle Mapper air distance calculator (Great Circle Mapper, 2020), and an 8% uplift was applied to CCD emissions to account for deviations from the direct route due to inclement weather conditions and stacking above airports, as per the Defra 2020 emissions factor calculation methodology (Defra, 2018).

The 8% scaling factor from the Defra 2020 guidance has been applied here as it is the most up-to-date source available, and the guidance states that following recent analysis, this factor is deemed the most appropriate for flights arriving and departing in the UK. It is assumed that in the context of worldwide airport operations, operations at Dublin Airport would be similar enough to UK airports for this to also be applicable here. An alternative to this scaling factor is a factor of 10% as reported in the IPCC Aviation and the Global Atmosphere report (1999) (IPPC, 1999), however considering the age of the underlying data built into the IPCC scaling factor and how much the aviation industry has changed over the last 20 years, the Defra scaling factor is considered a more appropriate and accurate estimate.

Projected passenger numbers for each of the assessment scenarios reported in the Dublin Airport Operating Restrictions report (Mott MacDonald, 2020) have been used to estimate GHG emissions associated with additional surface access passenger journeys, based on assumptions[12] made around mode of travel and transportation distances, and applying the relevant Defra 2020 emissions factors (Defra, 2020).

11.3.4 Significance Criteria

There are no specific criteria for determining the significance of GHG emissions. The IEMA guidance on GHG in EIA (IEMA, 2017) states that *'any GHG emissions or reductions from a project might be considered to be significant'*. As such, the projected National Emissions Inventories for Ireland (EPA, 2019), as compiled by the EPA, have been used as a proxy for the level of effect of GHG emissions as a result of the proposed Relevant Action on the global climate. Consideration has also been given to the transportation sector within the projected National

[11] A scaling factor is a number which multiplies a quantity by a given amount to estimate another quantity based on the proportionate relationship between the two aspects. In this case, LTO emissions have been scaled up to include an additional 8% of total LTO emissions to account for emissions from APU usage. The 8% factor is based on the relationship between LTO and APU emissions at Heathrow Airport.
[12] Specific assumptions are outlined in the *Limitations and Assumptions* section below.

Emissions Inventories for Ireland to help contextualise the GHG emissions and provide an idea of scale. Additional GHG emissions as a result of the proposed Relevant Action have also been considered in the context of Ireland's carbon reduction ambitions.

In the absence of specific criteria for defining the significance of GHG emissions, the IEMA guidance suggests that professional judgement should be used to contextualise the GHG impact. In GHG accounting it is common practice to consider exclusion of emission sources that are <1% of a given emissions inventory on the basis of a 'de minimis' contribution. The PAS 2050 Specification for the assessment of the life cycle greenhouse gas emissions of goods and services (2011), published by the British Standards Institute (BSI, 2011), allows emissions sources of <1% contribution to be excluded from emission inventories, and for these inventories to still be considered complete for verification purposes.

Therefore, for the purposes of this assessment, where total annual emissions from the operation of the proposed Relevant Action are equal to or more than 1% of the projected total annual Emissions Inventory for Ireland, they will be considered to be of major significance. Where total annual emissions from the operation of the proposed Relevant Action are less than 1% of the projected total annual Emissions Inventory for Ireland, they will be considered to be of minor significance.

11.3.5 Methodology to Assess the Significance of Effects

The significance of effect will be determined based on the variation of GHG emissions between the permitted / constrained and proposed / unconstrained operations. The difference between the GHG emissions associated with the permitted / constrained and proposed / unconstrained operations is considered to represent the emissions arising as a result of the proposed Relevant Action and therefore equates to the GHG impact.

The variation in emissions between the permitted / constrained and proposed / unconstrained operations has been compared against Ireland's projected total National Emissions Inventories and projected total Transport Emissions Inventories for each of the assessment years, and the transport emissions level required to meet Irelands target of an aggregate reduction in carbon dioxide (CO_2) emissions of at least 80% (compared to 1990 levels) by 2050 across the electricity generation, built environment and transport sectors.

It should be noted that these emissions inventory and carbon reduction target figures do not include emissions from international aviation. However, these figures provide an insight into the scale of the impact of the proposed Relevant Action. Specific mechanisms for reducing international aviation emissions (e.g. EU ETS and CORSIA) are described in *Section 11.5 Environmental Design and Management*.

11.3.6 Limitations and Assumptions

Only commercial flights have been included in the ATM GHG emissions calculations, while flights made by private aircraft have been excluded. It is anticipated that GHG emissions from private aircraft would not have a material impact on the overall GHG footprint.

Aircraft schedule forecasts (produced by Mott MacDonald) have been provided for a peak day (as defined within Chapter 13 Air Noise and Vibration, and within the Mott MacDonald Report. The aircraft mix on the peak day has been assumed to be representative of the aircraft mix throughout the year. To calculate annual emissions, the aircraft and ATM schedule produced by Mott MacDonald has been prorated up based on the number of ATMs for the peak day and the total annual ATMs.

Some aircraft models (typically newer models) were not available within the Aviation Emissions Calculator (EMP/EEA, 2019). For the A320neo and A321neo, the A320 and A321 models were used instead. These emissions were then prorated down based on the difference in emissions intensity between the relevant models, as calculated using the Atmosfair Flight Emissions Calculator (Atmosfair, 2020). Where certain aircraft models were not available within either the Aviation Emissions Calculator or the Atmosfair calculator, the closest available model produced by the same manufacturer was selected as a proxy.

For some flights, the total journey length reported in the aircraft schedule exceeded the range limit of the proxy aircraft selected. In this instance, emissions were calculated for the maximum available journey length for the proxy aircraft within the Aviation Emissions Calculator, then scaled up proportionately to account for the total journey distance.

As APU usage is difficult to estimate accurately for individual airports due to the highly variable nature, the calculations for the GHG emissions associated with APU usage assume an 8% uplift on total LTO emissions excluding APU (as calculated using the Aviation Emissions Calculator). This uplift is considered to represent a conservative approach (i.e. the 5-year average APU uplift from the Heathrow Airport data has been rounded up, so may be over-estimating APU emissions).

An 8% uplift has also been applied to CCD emissions to account for deviations from the ideal flight route due to inclement weather conditions and stacking above airports. This is in line with the methodology described by Defra (Defra, 2018).

No assumptions regarding future biofuel use have been factored into the ATM GHG emissions calculations due to uncertainty around the level of uptake in the future[13]. This is considered to represent a conservative approach.

Table 11-2 outlines the mode share percentages (as reported for Dublin Airport in the 2016 National Transport Authority Passenger Survey (NTA, 2016b), journey distances assumed, and Defra 2020 emissions factors applied for the calculation of GHG emissions associated with surface access passenger journeys. The mode share percentages reported are assumed to be the same for each of the assessment years. Any variation between these figures and actual mode share figures for each of the assessment years is not anticipated to have a material impact in the context of the overall footprint, and is therefore not anticipated to affect the overall outcome of the assessment.

Table 11-2 Assumptions made for the calculation of GHG emissions associated with surface access passenger journeys

Transport mode	Assumptions		
	Mode share	Assumed 2-way distance (km)	Emissions factor applied
Bus/ coach	32.6%	60	Defra 2020 - Local bus (not London)
Taxi	25.3%	100	Defra 2020 - Large car - Unknown fuel
Passenger in car	15.8%	N/A	
Own car/ van	14%	100	Defra 2020 - Average car - Unknown fuel
Rental car/ van	6.4%	100	Defra 2020 - Average car - Unknown fuel
Hotel shuttle bus	4.2%	60	Defra 2020 - Local bus (not London)
Bicycle	0.1%	N/A	
On foot	0.2%	N/A	
Other	1.4%	100	Defra 2020 - Average car - Unknown fuel

11.4 Baseline Conditions

The baseline for the GHG impact assessment is the North Runway Permission, i.e the permitted / constrained scenario, assuming the proposed Relevant Action does not receive permission. The quantity of GHG emissions would therefore remain unchanged from the permitted / constrained scenario.

This baseline is compared against the proposed / unconstrained scenario, and the difference between the permitted / constrained and proposed / unconstrained scenarios for each of the assessment years (2022 and 2025) is considered to be the GHG impact.

11.4.1 Future Baseline

The projected emissions for permitted / constrained operations in 2022 (the year in which the North Runway is anticipated to become operational) and 2025 (the year in which 32mppa is expected to be reached) represent the future baseline.

11.5 Environmental Design and Management

During the option selection process, multiple alternative options for the proposed Relevant Action were appraised based on a number of environmental criteria to reduce the overall environmental impact. GHG emission impacts

[13] The International Energy Agency (IEA) states that while the aviation industry demonstrates a strong commitment to sustainable alternative fuels such as biofuels, further technological developments are required before widespread uptake is realistic: https://www.iea.org/commentaries/are-aviation-biofuels-ready-for-take-off

were included within this options appraisal, which found that each of the options for any of the environmental impacts considered were in the same order of magnitude, except for noise impacts. More information on this process can be found in *Chapter 4 Alternatives*.

This section identifies further ways in which GHG emissions from aircraft ATMs have been or will be avoided, prevented, reduced and offset by various means.

Efficiencies have historically reduced the CO_2 intensity of aircraft, and these efficiencies are expected to continue. The estimated fuel efficiency benefits from switching to more fuel-efficient aircraft models in the future have been incorporated into this GHG assessment.

Market based measures such as EU ETS and ICAO's CORSIA scheme will also impact international aviation emissions, with the ETS providing a cap on intra-EU aviation emissions to 2020 and post-2020 and CORSIA aiming for no net increase in aircraft CO_2 emissions from its implementation date of 2021.

The impacts of these market-based measures have not been incorporated into the GHG calculations presented within this chapter - all calculations are gross emissions prior to these measures reducing or off-setting the total emissions. However, the EU ETS and CORSIA will mean any emissions over the level permitted will be offset through those schemes.

Scope 3[14] (indirect) aircraft emissions are outside daa direct control but can be influenced by efficient airside infrastructure design and delivery and services such as Fixed Electrical Ground Power (provided by daa) and how aircraft operate at the Airport (influenced by airlines, the Air Navigation Service Provider and daa). One such example is Airport Collaborative Decision Making (A-CDM) which Dublin Airport is implementing. This brings all stakeholders together to improve the efficiency of the airside operations at the airport. daa is also certified under Level 2 of the Airport Carbon Accreditation scheme and is planning to move to Level 3 of the scheme shortly.

11.6 Assessment of Effects and Significance

11.6.1 Effects During Operation of Proposed Relevant Action

11.6.1.1 GHG Emissions for the Permitted/Constrained and Proposed/Unconstrained Operations

Table 11-3, Table 11-4, Table 11-5 and Table 11-6 present the projected CO_2 emissions associated with the LTO cycle, CCD phase, surface access passenger journeys and total GHG emissions, respectively, for the permitted and proposed operations for each of the assessment years. The variation in emissions between the permitted and proposed operations represents the additional emissions as a result of the proposed Relevant Action.

Table 11-3 LTO emissions projections – Permitted / Constrained vs Proposed / Unconstrained Operations

Year	LTO emissions (tCO_2)			
	Permitted / Constrained	Proposed / Unconstrained	Variation	% variation (Permitted / Constrained to Proposed / Unconstrained)
2022	301,980	312,322	**10,342**	3.4%
2025	321,269	333,474	**12,206**	3.8%

Table 11-4 CCD Emissions Projections – Permitted / Constrained vs Proposed / Unconstrained Operations

Year	CCD emissions (tCO2)			
	Permitted / Constrained	Proposed / Unconstrained	Variation	% variation (Permitted / Constrained to Proposed / Unconstrained)
2022	**2,179,127**	2,305,340	**126,213**	5.8%
2025	**2,608,410**	2,766,197	**157,788**	6.0%

[14] Scope 3 emissions are defined within the Greenhouse Gas Protocol corporate accounting and reporting standard as indirect GHG emissions that occur as "*a consequence of the activities of the company, but occur from sources not owned or controlled by the company*".

Table 11-5 Surface Access Passenger Journey Emissions Projections – Permitted / Constrained vs Proposed / Unconstrained Operations

Year	Surface access passenger journey emissions (tCO_2e)			
	Permitted / Constrained	Proposed / Unconstrained	Variation	% variation (Permitted / Constrained to Proposed/Unconstrained)
2022	431,996	445,543	**13,547**	3.1%
2025	465,110	481,668	**16,557**	3.6%

Table 11-6 Total Annual GHG Emissions Projections – Permitted / Constrained vs Proposed / Unconstrained Operations

Year	Total annual GHG emissions (tCO_2e[15])			
	Permitted / Constrained	Proposed / Unconstrained	Variation	% variation (Permitted / Constrained to Proposed / Unconstrained)
2022	2,913,104	3,063,205	**150,102**	5.2%
2025	3,394,789	3,581,339	**186,551**	5.5%

11.6.2 Assessment of Significance of Effects

Additional GHG emissions arising as a result of the proposed Relevant Action are considered to have a direct, negative effect on the receptor. The effects of GHG emissions are also considered to be long term, irreversible and have the potential to be cumulative with other projects. In terms of effect significance, IEMA (IEMA, 2017) suggests that *"GHG emissions have a combined environmental effect that is approaching a scientifically defined environmental limit, as such any GHG emissions or reduction from a project might be considered significant."*

As described in *Section 11.3 Assessment Methodology*, the impact of the proposed Relevant Action has been compared with Ireland's projected National Emissions Inventories for each of the assessment years (under the With Additional Measures scenario) (EPA, 2019) to determine the level of significance (see Table 11-7). The impact of the proposed Relevant Action has been further contextualised by comparing the CO_2 emissions with the projected Transport Emissions Inventories for each of the assessment years (under the With Additional Measures scenario), and with Ireland's transport sector emissions requirements if the 2050 target is to be met (see Table 11-8).

Table 11-7 GHG Emissions Against Future National Emissions Inventory Scenarios

Year	Emissions (kt CO_2e)	Projected national emissions inventory (kt CO_2e)	Emissions as a % of national emissions inventory	Significance
2022	150.1	61,510	0.244%	Minor
2025	186.6	61,430	0.304%	Minor

Note: While emissions are reported in $ktCO_2e$, the aviation emissions included within the total only account for CO_2 emissions.

Table 11-8 GHG Emissions Against Future Transport Emissions Inventory Scenarios

Year	Emissions (kt CO_2e)	Projected/ required transport emissions inventory (kt CO_2e)	Emissions as a % of transport emissions inventory
2022	150.1	12,970	1.16%
2025	186.6	12,490	1.49%
2050	186.6[16]	1,000	18.66%

Note: While emissions are reported in $ktCO_2e$, the aviation emissions included within the total only account for CO_2 emissions.

[15] *Note: While this is reported in tCO_2e, the aviation emissions included within this total only account for CO_2 emissions.*
[16] GHG emissions as a result of the proposed Relevant Action have not been modelled beyond 2025, so the 2025 figure has been used here for comparison with the 2050 transport emissions target.

As the GHG emissions associated with the proposed Relevant Action do not represent ≥1% of the projected National Emissions Inventory for either of the assessment years, GHG emissions are considered to be of **minor significance.**

11.7 Additional Mitigation Measures

11.7.1 Mitigation During Operation of Proposed Relevant Action

Section 11.5 Environmental Design and Management identifies ways in which GHG emissions from aircraft ATMs have been or will be avoided, prevented, reduced and offset by various means. For example, aircrafts are anticipated to become more fuel efficient over time as new technologies become available, and implementation of A-CDM at Dublin Airport is expected to improve the efficiency of the airside operations at the airport by facilitating collaboration between stakeholders at the airport.

Section 11.5 Environmental Design and Management also describes various market-based measures such as EU ETS and CORSIA, which put a cap on emissions within their respective geographical spheres of influence, to drive carbon reductions in the most effective and cost-effective areas through emissions trading and offsetting between airports.

No additional mitigation and monitoring beyond the measures already described in *Section 11.5 Environmental Design and Management* are required once the proposed Relevant Action is complete and operational.

11.8 Residual Effects and Conclusions

This section identifies the residual effects, following the implementation of mitigation and monitoring measures, known as 'residual effects' which cannot be eliminated through design changes or the application of standard mitigation measures.

There will be unavoidable GHG emissions resulting from the operational phase of the proposed Relevant Action. However, as the effects are considered to be of **minor significance**, it is not appropriate to define any mitigation measures further to the ones detailed in Section 11.5 Environmental Design and Management.

Table 11-9 *Climate Change Summary of Potential Effects*

Description of Effect	Sensitivity of Receptor	Nature of Effect / Geographic Scale	Magnitude of Impact	Initial Classification of Effect (with embedded mitigation)	Additional Mitigation	Residual Effect Significance
Complete and Occupied						
	High	long-term/ Global	Low	Minor	None	Minor (Low significance)

11.8.1 Likely Significant Environmental Effects

The significance of the GHG emissions impact of the proposed Relevant Action considering the receptor's sensitivity (global climate) is anticipated to be minor, which is considered to be of low significance.

Chapter 12:

Water

12

12. Water

12.1 Introduction

This chapter of the Environmental Impact Assessment Report (EIAR) provides baseline information in relation to water and assesses the potential impacts and effects of the proposed Relevant Action on the water environment.

12.2 Legislation and Planning Policy Context

12.2.1 Legislation

The following legislation is relevant to this chapter and has been considered during the assessment presented within it:

The following legislation is relevant to this chapter and has been considered during the assessment presented within it:

- EIA Directive
- European Union (Planning and Development) (Environmental Impact Assessment) Regulations 2018 (S.I. No. 296 of 2018))
- European Union Water Framework Directive (WFD) (2000/60/EC), which was adopted as a single piece of legislation covering rivers, lakes, groundwater and transitional (estuarine) and coastal waters. The following legislation in Ireland governs the shape of the WFD characterisation, monitoring and status assessment programs in terms of monitoring different water categories, determining the quality elements and undertaking characterisation and classification assessments:
  - European Communities (Water Policy) Regulations, 2003 (S.I. No. 722 of 2003)
  - European Communities Environmental Objectives (Surface Water) Regulations, 2009 ('S.I. No. 272 of 2009) as amended in 2012 (by S.I. No. 327/2012), 2015 (by S.I. No. 386/2015) and 2019 (by S.I. No. 77/2019)
- The EU Floods Directive 2007/60/EC
- European Communities (Assessment and Management of Flood Risks) Regulations, 2010 (S.I. No. 122 of 2010)
- River Basin Management Plan 2018-2021 (DHPLG, 2018)
- The Planning & Development Acts 2000 to 2020;
- Fisheries Acts 1959 to 2019;
- Inland Fisheries Acts 1959 to 2017; and,
- Local Government (Water Pollution Acts) 1977-2007.

12.2.2 National Planning Policy

The following national planning policy is also relevant to this chapter and has been considered throughout the assessment presented within it:

- Project Ireland 2040 – National Planning Framework (2018).

12.2.3 Regional and Local Planning Policy

The following local planning policy is considered relevant to this assessment.

- Regional Spatial & Economic Strategy for the Eastern and Midland Region 2019-2031;
- Fingal Development Plan 2017-2023; and,

- Dublin Airport Local Area Plan (2020).

12.2.4 Relevant Guidance

The following guidance documents are considered relevant to this assessment.

- Draft Environmental Protection Agency (EPA) Guidelines on the Information to be Contained in Environmental Impact Assessment Reports (EPA, 2017);
- Relevant Irish governmental guidance such as that available online from the National Parks and Wildlife Service (NPWS);
- Various National Roads Authority (now Transport Infrastructure Ireland) guidance from the 'Environmental Planning and Construction Guidelines', including the *Guidelines for Assessment of Ecological Impacts from National Road Schemes* (NRA, 2009);
- Greater Dublin Strategic Drainage Study Final Strategy Report (Dublin Drainage, April 2005);
- Greater Dublin Strategic Drainage Study – Regional Drainage Policies – Volume 2 – New Development, (Dublin Drainage, March 2005); and
- Greater Dublin Regional Code of Practice for Drainage Works Version 6.0.

12.3 Assessment Methodology

12.3.1 Study Area

North Runway is currently an active construction site operating within a Construction Environmental Management Plan. Operational discharges at the airport continue to be controlled under extant trade effluent licence. The study area for surface water receptors encompasses the airport. For groundwater, the buffer area will extend to 500 m from the airport boundary. There are no sensitive water environment features within the Study Area although the Cuckoo Stream flows west to east through the airport.

12.3.2 Methodology for Determining Baseline Conditions and Sensitive Receptors

The existing water environment has been determined from desktop review, site walkovers and site studies/investigations, as follows:

- Aquatic & Hydrological studies;
- Ordnance Survey Ireland (OSI) website for historical maps of 1:2,500 scale and 1:10,560 scale and aerial photographs;
- OSI discovery series of 1:50,000 scale;
- GSI website for public viewer and groundwater maps;
- EPA website Envision;
- Local authority web portals;
- Topography maps;
- Flood information mapping; and
- Existing site investigation information.

Receptors have been identified during the baseline study and a qualitative assessment has been used to assign a sensitivity rating from negligible to high based on the EPA EIAR guidance (EPA, 2017) and considers their likely adaptability, tolerance and recoverability.

12.3.3 Methodology for Determining Construction Effects

The proposed Relevant Action will result in no additional infrastructure, no changes to the design, construction, catchment area, hydrology, flow control, or approach to operation of pollution control of North Runway itself or any of the wider pollution control infrastructure at the airport. Due to there being no change in the extent of excavation required and no change in physical infrastructure (including drainage) the proposed Relevant Action will not result in new environmental effects to the water environment.

12.3.4 Methodology for Determining Operational Effects

The proposed Relevant Action will not alter the current operational drainage systems and de-icing operations at the airport. An understanding of these operations is provided below.

There are two separate and distinct drainage catchments related to de-icing. These are the runways/taxiways and the apron/stand areas.

12.3.5 Runways and Taxiways

The North Runway pollution system is designed to control pavement de-icer run-off from the North Runway itself, and associated taxiways. These areas of the airfield are de-iced when temperatures fall to 0°C or below. Given the relatively low number of frost nights at Dublin Airport, the frequency of de-icing is low. The extent of de-icing undertaken is independent of the time of day or the usage of the runway. The volume of de-icing fluid and therefore the volume of potentially contaminated surface water arising is directly related to the area of the runways/taxiways being de-iced and subsequent rainfall and is independent of the number of aircraft using the runway system. The design criteria for the pollution control system on the runway is not affected by the runway usage patterns. There will be no changes to the runway drainage system as a result of the proposed Relevant Action.

Once construction of North Runway is completed, run-off from the paved areas will be continuously monitored via online Total Organic Carbon (TOC) analysers (allows for low levels of assessment and irregular flows in the network) to measure TOC values which shall be calibrated to equivalent Biochemical Oxygen Demand (BOD) and Chemical Oxygen Demand (COD) limits to measure compliance with permitted discharge levels. If monitoring shows that the surface water is contaminated, it will be automatically diverted to the polluted water holding tank (PWHT). The control system for the tank discharge will include failsafe mechanisms to ensure that there is no accidental release of contaminated water into receiving waterways.

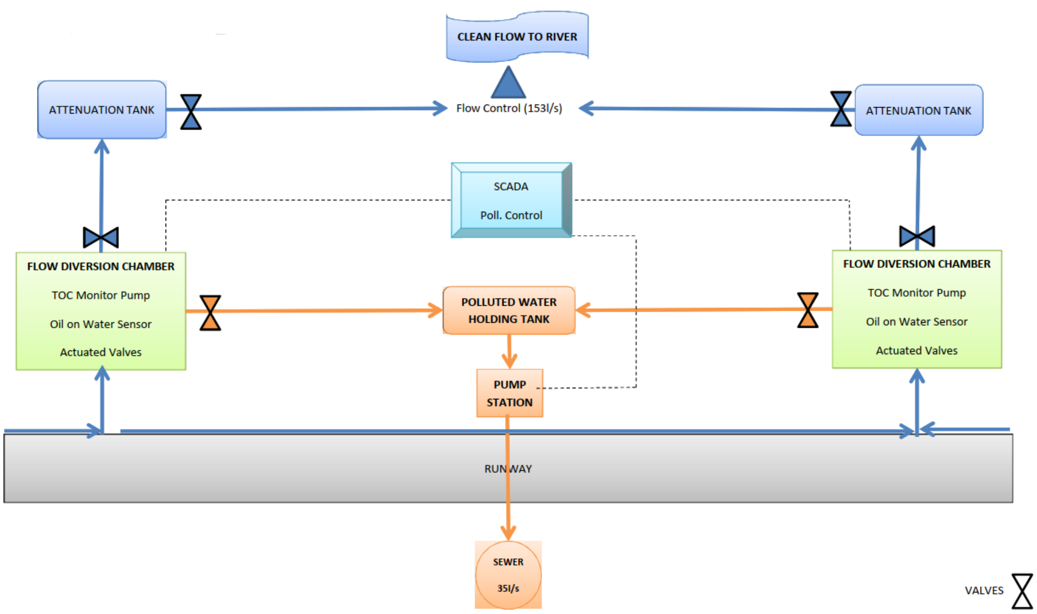


Figure 12-1 Illustrated Drainage Flow

There will also be no change in the frequency of de-icing events, stormwater run-off volumes, attenuation discharge rates, attenuation volume requirements, or proposed discharge locations. For these reasons, drainage relating to the runways/taxiways will remain unchanged and can be scoped out of the EIAR. As a result of the above, it is anticipated that there will be no significant effects arising due to the proposed Relevant Action.

12.3.6 Aprons/Stands

As well as de-icing the runway, departing aircraft are generally de-iced when the air temperature reaches 3 degrees C or lower. All aircraft are de-iced while stationary on their stands prior to departure/pushback. The areas around these stands drain to an existing pollution control facility located within the airfield which discharges to the North Fringe foul sewer under licence. As such, the proposed changes to the operating restrictions of the runways will not result in any change to the current location or extent of the area where aircraft de-icing takes place. There are no new aircraft stands proposed as part of this application and the proposed Relevant Action will not result in any changes to the existing drainage system. For this reason, the drainage infrastructure relating to the aprons/stands will remain unchanged as a result of the proposed Relevant Action and drainage can be screened out of the EIAR. Any future stands or pier developments at the airport will assess drainage in an appropriate level of detail at the time of the development of such infrastructure.

As described above, there would be no amendments to surface water drainage operation relative to that already consented in the 2007 (and amended in 2020) planning permission for North Runway. The proposed Relevant Action will not significantly affect important water environment features during operation as a result of surface water pollution.

12.3.7 Significance Criteria

On the basis that there will be no changes to the design or construction of North Runway, and that the proposed Relevant Action will not result in any changes to the operation of North Runway which could result in significant impacts, it can be concluded that there will be no significant effects from the proposed Relevant Action on the water environment.

12.3.8 Limitations and Assumptions

There are no significant limitations to the assessment of potential effects on water environment features presented in this chapter.

12.4 Environmental Design and Management

The operation of the de-icing & pollution control system is described above. This will be in place in both the permitted / constrained and proposed / unconstrained scenarios.

12.5 Assessment of Effects and Significance

At the time of writing, North Runway was an active construction site operating with a Construction Environmental Management Plan. As there are no sensitive water environment features within the Study Area which will be subject to significant impacts, no detailed assessment of effects is required.

An understanding of how the drainage systems and de-icing operations in use at the airport operate, as provided above, clearly demonstrates that there is no potential for likely significant adverse effects associated with the proposed Relevant Action in terms of drainage.

The Cuckoo Stream, which flows west to east through the airport, discharges into Baldoyle Bay Estuary Special Area of Conservation (SAC). The Cuckoo Stream is unlikely to have any important fisheries or invertebrate populations, due to its legacy of historically poor water quality (Q2-3 when last monitored in 2016, but always ≤Q3 since monitoring started in 1988). The most recent monitoring data available, from June 2019, shows that it is still failing to meet ‘good’ status. The proposed Relevant Action would not have any effect upon the condition or status of the Cuckoo Stream under the Water Framework Directive (WFD).

The primary threat to water quality as a result of the operating system at the airport, has previously been identified as the application of de-icing chemicals following snow or frost events. It is anticipated however that the permitted

North Runway drainage system, once constructed, is likely to represent an improvement on the current pollution management with its dedicated pollution control and attenuation system. This will be in place in both the permitted / constrained and proposed / unconstrained scenarios and the proposed Relevant Action does not affect this.

Table 12-1 and

Table 12-2 below set out the predicted scenarios where the water environment might be affected by the proposed Relevant Action, and a summary of the effect is described.

Table 12-1 North Runway specific details

Scenario	With North Runway Condition 3d and 5 Restrictions (permitted / constrained scenario)	Without North Runway Conditions 3d and 5 Restrictions (propsoed / unconstrained scenario)
Biological loading to sewer	Approx. 100-200 mg/l COD, and BOD of 80 to 150mg/l to sewer	No change. Approx. 100-200 mg/l COD to sewer and BOD of 80 to 150mg/l to sewer
Hydraulic loading	Greenfield run-off rates (see Q100 rates (Figure 12-2 below))	No change Greenfield run-off rates (see Q100 rates (Figure 12-2 below))
Area of Infrastructure	362,400 m2 runway and taxiway paved area	No change to runway and taxiway paved area of 362,400 m2
Estimated extent of de-icer use	3000-5000 litres of pavement de-icer on runway per application No aircraft de-icing takes place in North Runway catchment	No change to 3000-5000 litres of pavement de-icer on runway per application. No aircraft de-icing takes place in North Runway catchment
Irish Water (IW) agreement with regard flows	35 l/s as agreed with IW in letter of support dated 24th October 2016. To be finalised with trade effluent discharge licence and Planning Condition 21 discharge	No change to 35 l/s as agreed in draft agreement. To be finalised with trade effluent discharge licence and Planning Condition 21 discharge
IFI agreement with regard streams	5mg/l BOD winter as per planning approval	No change to 5mg/l BOD winter as per planning approval

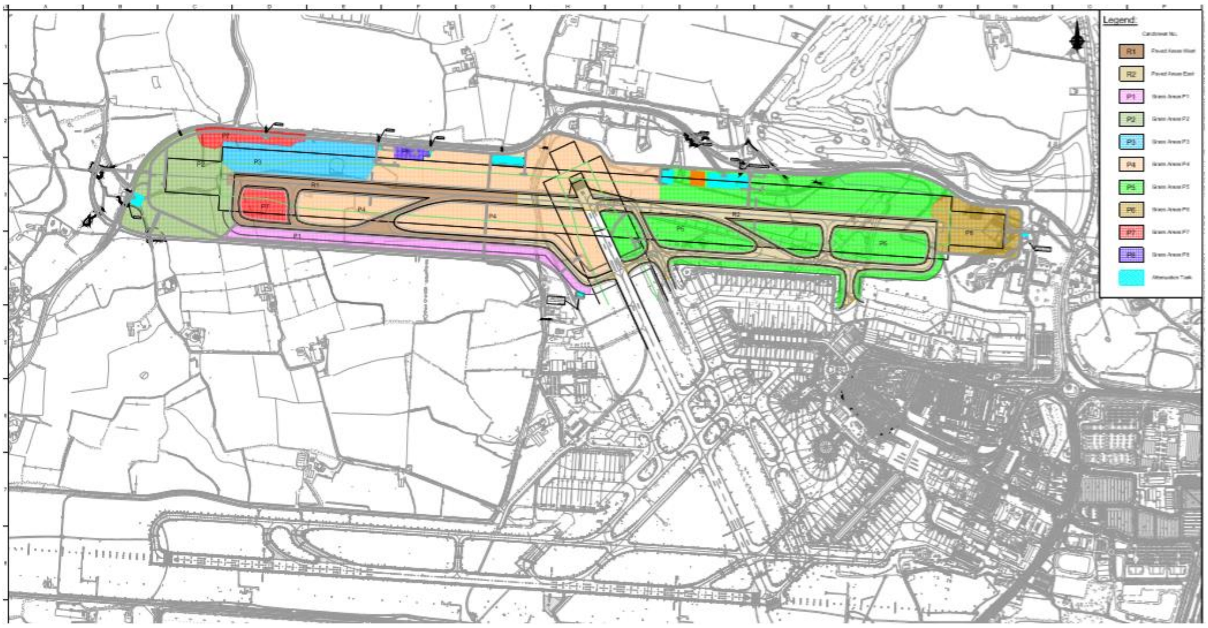


Figure 12-2 Q100 Rates Proposed Catchment Areas

Table 12-2 Existing catchment details

Scenario	With North Runway Condition 3d and 5 Restrictions	Without North Runway Conditions 3d and 5 Restrictions
Biological loading	As per existing trade effluent discharge licence (TEDL)	No change. As per existing trade effluent discharge licence
Hydraulic loading	As per existing drainage network. No new infrastructure in this catchment as part of the Relevant Action application	No change. As per existing drainage network. No new infrastructure in this catchment as part of the Relevant Action application
Area of Infrastructure	-=	No change
Estimated extent of de-icer use	Pavement de-icer used for existing runways and taxiways as required based on weather conditions. Aircraft de-icing on stand dependent on air tempertures. De-icing required for departing aircraft only and can occur any time of day but mostly for first wave of departures in 0600 to 0800 period. 65 movements permitted in 2300 to 0700 hour. Many of the flights that cannot be accomodated in the 0600-0700 hour are not lost completely but will depart at less preferred time after 0700 due to the restrictions. They remain part of the first wave and continue to require de-icing in that period also.	No change to pavement de-icing on existing runway and taxiways Approximately 100 movements in the 2300 to 0700 period and some reduction in the numbers in the 0700 to 0800 period as they can now be accomodated at their preferred departure time. Therefore the actual amount of additional aircraft de-icing is not significant and continues on the same stands as today and no additional infrastructure required. Therefore no significant additional run-off.
IW agreement with regard flows	As per TEDL	No change as result of proposed restriction changes
IFI agreement with regard streams	None at present	No change as part of this project

12.6 Additional Mitigation Measures

As the proposed Relevant Action will not result in any significant effects on surface water environment and drainage, there is no requirement for mitigation to be implemented.

12.7 Residual Effects and Conclusions

There are no residual significant effects on the surface water environment and drainage from the proposed Relevant Action.

Chapter 13:

Aircraft Noise and Vibration (Air)

13

13. Air Noise and Vibration

13.1 Introduction

This chapter of the Environmental Impact Assessment Report (EIAR) reports the findings of an assessment of the likely significant effects from air noise and vibration from aircraft as a result of the proposed Relevant Action, which is described in Chapter 2.

This assessment and EIAR chapter have been produced by Bickerdike Allen Partners LLP.

Air noise and vibration specifically encompasses noise and vibration associated with flights into and out of Dublin Airport while airborne or using the runway system, including any start of roll or reverse thrust activities but excluding noise and vibration related to any other aircraft ground operations such as taxiing and when aircraft are on stands, which are covered in Chapter 14.

Road traffic noise effects have not been assessed for this application, as the Relevant Action is not forecast to cause any significant changes to the road traffic flows in the vicinity of the airport, either when considering the 24-hour period or the night period (23:00 to 07:00). The changes to road traffic flows are discussed in more detail in Chapter 9.

This chapter has considered future forecast scenarios for the selected years of 2022, when the North Runway is scheduled to open, and 2025, the first subsequent year when 32 mppa is expected to be reached; 2025 is therefore expected to constitute a worst case scenario for this Relevant Action application.

For each of the two selected years, this chapter has compared the scenario with the Relevant Action, referred to as the “2022 Relevant Action” and “2025 Relevant Action” scenarios, with three situations:

- The actual situation in 2018, referred to in this chapter as “2018 Baseline”.
- The forecast situation in the corresponding future year, with the North Runway operational and the current conditions in place, referred to in this chapter as the “2022 Baseline” and “2025 Baseline” scenarios.
- The situation that was forecast for 2025 as part of the North Runway planning process in 2004-2007, referred to in this chapter as the “2025 Consented” scenario.

13.1.1 Summary of the proposed Relevant Action

The relevant noise related operating restrictions which currently apply to the North Runway Permission (FCC Reg) are set out in full in Chapter 2. In summary they provide as follows:

- No use of the North Runway at night (23:00 to 07:00). This is provided for in Condition 3d of the North Runway Permission.
- The Crosswind Runway can be only used for essential purposes. This is provided for in Condition 4 of the North Runway Permission.
- A limit on the number of aircraft movements at the airport at night (23:00 to 07:00) to 65/night. This is provided for in Condition 5 of the North Runway Permission.

The proposed Relevant Action is to remove Condition 5 of the North Runway Permission and to replace it with an annual night-time noise quota between 23:30 and 06:00, and also to amend Condition 3d to allow flights to take off from and/or land on the North Runway for an additional 2 hours i.e. 23:00 to 00:00 and 06:00 to 07:00, with the permitted operation in these 2 additional hours being the same as during the daytime hours when the North Runway is already permitted to be used. Overall, this would allow for an increase in the number of flights taking off and/or landing at Dublin Airport between 23:00 and 07:00.

No change is proposed to the permitted passenger capacity which is limited to 32 million passengers per annum (mppa) in the terminals nor is there any proposed change to the permitted operation of the runway system during daytime hours (Option 7b).

13.1.1.1 Option 7b – Conditions 3(a) to 3(c) of the North Runway Permission

The Relevant Action does not alter Conditions 3(a) to (c) of the North Runway Permission which together describe the preferred runway concept put forward in the original North Runway planning process of 2004-2007, known as Option 7b:

> *On completion of construction of the runway hereby permitted, the runways at the airport shall be operated in accordance with the mode of operation – Option 7b – as detailed in the Environmental Impact Statement Addendum, Section 16 as received by the planning authority on the 9th day of August, 2005 and shall provide that -*
>
> *(a) the parallel runways (10R-28L and 10L-28R) shall be used in preference to the cross runway, 16-34,*
>
> *(b) when winds are westerly, Runway 28L shall be preferred for arriving aircraft. Either Runway 28L or 28R shall be used for departing aircraft as determined by air traffic control,*
>
> *(c) when winds are easterly, either Runway 10L or 10R as determined by air traffic control shall be preferred for arriving aircraft. Runway 10R shall be preferred for departing aircraft*

In summary Option 7b provides that the arrivals from the east and departures to the east shall prefer to use the South Runway. Arrivals from the west and departures to the west can use the North Runway or South Runway as determined by air traffic control.

In practice it is expected that air traffic control will prefer to use one runway for arrivals and the other for departures, subject to capacity constraints, and therefore most of the time the North Runway will be preferred for departures to the west and the South Runway will be preferred for arrivals from the west. This is however sensitive to the precise timing of flights, particularly in the busy early morning period of 06:00-08:00, so there is potential for departures off both runways in this period.

13.2 Legislation and Planning Policy Context

The Environmental Impact Assessment (EIA) process is described in Chapter 1 of this EIAR. This notes that the EIA requirements derive from Council Directive 85/337/EEC and sets out the EIA regulations and EPA guidelines that were considered by AECOM in preparing this EIAR.

Chapter 6 of this EIAR sets out the legislative and planning policy context for the proposed Relevant Action. It includes reference to relevant national and local planning policies, including those that have been considered when determining the EIAR scope, method and mitigation. Those considered relevant to this chapter are summarised below with additional material also considered relevant. More detail on this additional material, and selected policies included in Chapter 6, are given in Appendix 13A.

13.2.1 Strategic Planning Context

daa has a number of obligations to fulfil with regard to the management of Dublin Airport. These and the overall framework the airport operates under are set out in the following:

- Section 23(1) of the Air Navigation and Transport (Amendment) Act 1998
- S.I. No. 549/2018– Environmental Noise Regulations 2018 (Government of Ireland, 2018)
- Aircraft Noise (Dublin Airport) Regulation Act, 2019 (Government of Ireland, 2018)

The last of these implements EU Regulation 598/2014 (European Commission, 2014) on the establishment of rules and procedures with regard to the introduction of noise related operating restrictions at European Union Airports within the ICAO Balanced Approach (ICAO, 2010). Further details of this regulation, and the two listed above are contained in Appendix 13A.

13.2.2 National Planning Policy

The following national planning policy is considered relevant to this assessment.

- National Aviation Policy for Ireland (2015) (DTTS, 2015)

- Project Ireland 2040 – National Planning Framework (2018) (Government of Ireland, 2018b)

13.2.3 Local Planning Policy

The following local planning policy is considered relevant to this assessment.

- Fingal Development Plan 2017-2023 (FCC, 2017)
- Dublin Airport Local Area Plan (2020) (FCC, 2020)
- Noise Action Plan for Dublin Airport (2019-2023) (FCC, 2019)

13.2.4 Relevant UK Policy, Standards and Guidance

The following UK policies, standards and guidance documents are considered relevant to this assessment. More detail is given in Appendix 13A.

- National Planning Policy Framework (NPPF, 2020)
- Noise Policy Statement for England (2010) (DEFRA, 2010)
- National Planning Practice Guidance ((DEFRA, 2019)
- UK Aviation Policy Framework (2013) (DfT, 2013)
- Survey of Noise Attitudes 2014 (2017) (UKCAA, 2017)
- UK Airspace Policy: A framework for balanced decisions on the design and use of airspace 2017 consultation (DfT, 2017)
- Aviation 2050 (DfT, 2018)
- BS 8233:2014 Sound insulation and noise reduction in buildings – code of practice (BSI, 2014)
- Department of Education - Acoustic design of schools: performance standards BB93 (2015) (DoE, 2015)
- Department of Health - Specialist Services, Health Technical Memorandum 08-01: Acoustics (2013) (DoH, 2013)
- CAP1616a Airspace Change: Environmental requirements technical annex (CAA, 2020)
- BS7445 Description and measurement of environmental noise BSI, 2003)

13.2.5 Other International Policy, Standards and Guidance

The following other international policies, standards and guidance documents are considered relevant to this assessment. More detail is given in Appendix 13A.

- ICAO Balanced Approach (ICAO, 2010)
- ICAO Convention on International Civil Aviation, Annex 16, Volume 1 (ICAO, 2014)
- Environmental Noise Directive 2002/49/EC (EC, 2002)
- EU Commission Directive 2020/367 (EC, 2020)
- WHO Guidelines for community noise (1999) (Berglund, B. *et al,* 1999)
- WHO Night Noise Guidelines for Europe (2009) (WHO, 2009)
- WHO Environmental Noise Guidelines for the European Region (2018) (WHO, 2018)

13.3 Assessment Methodology

This section of this EIAR chapter describes the approach to the assessment of the air noise effects, covering the following:

- Information sources that have been consulted throughout the preparation of this chapter;
- The methodology behind the assessment of air noise and vibration effects, including the criteria for the determination of sensitivity of receptor and magnitude of change from the existing or 'baseline' condition;

- An explanation as to how the identification and assessment of potential air noise and vibration effects has been reached; and
- The significance criteria and terminology for the assessment of air noise and vibration residual effects.

Key sources of information that have been utilised for this assessment are as follows:

- The physical location of the runway system.
- Flight paths, in particular for departures. This information for existing routes has been taken from a combination of the Aeronautical Information Publication (AIP) for Ireland and an inspection of actual aircraft flight paths using the airport's Noise and Flight Track Monitoring System (NFTMS). Representative future routes for noise modelling purposes have been developed based on the 2016 public consultation for flight paths and ongoing consultation with the Irish Aviation Authority (IAA);
- The number of flights in each relevant assessment period, including their aircraft type, operation, and destination. This has been supplied by daa for both actual (e.g. 2018) and forecast scenarios (forecasts were prepared by Mott Macdonald).

13.3.1 Air Noise Modelling Methodology

The assessment of air noise relies heavily on the modelling of noise levels. This has been carried out using the noise modelling software produced by the Federal Aviation Administration (FAA), the Aviation Environmental Design Tool (AEDT). This industry standard software evaluates aircraft noise in the vicinity of airports based on aircraft type, operation, route, and flight profile, as well as taking into account local terrain and meteorological information. This software is used to produce noise contours and to predict noise levels at specific locations. The model has been validated by taking into account the measurements recorded by Dublin Airport's Noise and Flight Track Monitoring System (NFTMS). Details of the modelling methodology are given in Appendix 13B.

The aircraft movements assessed as part of the air noise assessment include all aircraft taking off from or landing at Dublin Airport, with the exception of helicopter and military aircraft. Operations by helicopter and military aircraft make up a very small proportion of the total and are not able to be assessed to the same level of accuracy. For example, in 2018 there were 820 operations by helicopters and 2 operations by military aircraft, making up 0.4% of the total. As a result, their inclusion would have a negligible effect on the findings of this assessment.

13.3.2 Primary Assessment Metrics

There are various noise metrics available for the assessment of the impacts of air noise. These are described in detail in Appendix 13A. The metrics used here include those that have been used previously to rate air noise around Dublin Airport, as used currently in the UK and also those used around Europe for strategic noise mapping purposes and in noise action plans. Whilst other metrics have been considered in this assessment, emphasis has been placed on the European noise metrics, i.e.:

- L_{den}, which takes into account the annual activity throughout the 24-hour period, with a 5 dB penalty applied to noise in the evening (19:00-23:00) period and a 10 dB penalty applied to noise in the night (23:00-07:00) period. The key effect linked with this metric is annoyance.
- L_{night}, which takes into account the annual activity during the night (23:00-07:00) period. The key effect linked with this metric is sleep disturbance.

These two metrics are required to be used in order to comply with the requirements of EU Regulation 598/2014, and are the metrics used for strategic noise mapping as required under the Environmental Noise Regulations (S.I. No. 140/2006) in Ireland.

The number of people 'highly sleep disturbed' and 'highly annoyed' has also been predicted in accordance with the approach recommended by the World Health Organisation's Environmental Noise Guidelines 2018 as endorsed by the European Commission through Directive 2020/367.

13.3.3 Supplementary Noise Metrics

The primary air noise assessment metrics generally rely on extensive surveying of attitudes to aircraft noise resulting in a dose-response relationship linking levels of community annoyance to the metric. In addition, as used previously in the assessment of air noise around Dublin Airport, noise contours have been prepared in terms of the established UK noise metrics for air noise, the $L_{Aeq,16h}$ metric for the daytime (07:00-23:00) period and the $L_{Aeq,8h}$

metric for the night-time (23:00-07:00) period. These periods relate to an average summer day. Summer in this instance is defined as the 92-day period between 16 June and 15 September inclusive.

Some other supplementary air noise metrics, while having limited research into correlation with community annoyance, can be useful in reflecting how aircraft noise is experienced in the locality around an airport and these are also presented here.

The following supplementary noise metrics have been presented to contextualise the noise around Dublin Airport associated with the Relevant Action:

- The summer $L_{Aeq,16h}$ and $L_{Aeq,8h}$ metrics. These describe the average noise level during a summer day (07:00-23:00) and summer night (23:00-07:00) respectively.
- The annual L_{day} and $L_{evening}$ metrics which are optional under EU Regulation 598/2014. These describe the average noise level during an annual day (07:00-19:00) and evening (19:00-23:00) respectively.
- N65 and N60 indices. N65 for example indicates the number of times a threshold level of 65 dB L_{Amax} is exceeded within the time period of interest and has been determined for the summer daytime period. The N60 has been determined for the summer night-time period.
- SEL and L_{Amax}, which are commonly used to rate the impacts of noise from individual aircraft operations at night.

13.3.4 Methodology for Determining Baseline Conditions and Sensitive Receptors

The study area is based on the largest extent of likely impacts due to air noise, i.e. encompassing an envelope formed by the lowest value noise contours assessed for each metric. The extents of the study area are contained within a rectangle that extends 53 km to the west, 49 km to the east, 32 km to the north and 25 km to the south of the centre of the existing main runway at Dublin Airport.

There are a number of relevant scenarios which could be considered to be the baseline. Firstly there is the situation prior to the making of this application for the proposed Relevant Action, for which information for the actual situation in both 2018 and 2019 has been provided. 2018 was the last full year with a throughput of close to but less than 32mppa at the airport, and therefore this is used for the comparisons with future years. Given that aircraft activity and resulting noise impacts were less in 2018 than 2019, this allows for a conservative comparison with the future scenarios. The chapter also considers the forecast situation in the future years of 2022 and 2025, with the North Runway operational and the current conditions in place.

At the time of the North Runway planning process in 2004-2007, future forecasts were made of the night-time situation that would likely arise in 2025 in a ‘constrained’ scenario which was defined at that time as the scenario predicted to occur without North Runway being developed. This scenario equated to 65 flights per night in the 92-day summer period using the existing (south) runway in 2025 and no use of the North Runway. In terms of noise exposure, this ‘constrained’ scenario can be seen as equivalent to a consented night-time scenario with Condition 3(d) and 5 in place, where there is a 65 movement cap at the airport and no use of the North Runway or the crosswind runway at night.

This scenario, referred to in this chapter as “2025 Consented”, has been modelled using the same modelling methodology as that for the other scenarios given in this chapter. The movements by aircraft type, runway, route and stage length have been taken from the 2004-2007 North Runway planning process. Specifically, these were given in the document *“Response to Information Request by An Bord Pleanala of 9th January 2007”*, pages 25-32. The forecast annual ATMs presented in the 2004-2007 planning process were around 348,000, and the daytime assessments were all based on this total. However no consideration was given to the potential impact on ATMs of Conditions 3(d) and 5. Applying these conditions would reduce the forecasted annual ATMs from around 348,000 to around 307,000 in this scenario. For the purposes of this assessment, the previously modelled flights have therefore been scaled down to this figure.

The following have been considered as potential receptors of high sensitivity for this assessment:

- Dwellings;
- Schools;
- Residential healthcare facilities and

- Places of worship.

Receptors with a lower sensitivity to noise, such as offices and hotels, have not been considered as part of this assessment.

The assessment of dwellings includes an allowance for those which are consented but not yet constructed, including land zoned for residential development. These have been presented separately to the totals for existing dwellings.

13.3.5 Methodology for Determining Construction Effects

As the proposed Relevant Action will result in no changes to the design or construction of the North Runway, the proposed Relevant Action will not cause any construction noise impacts .

13.3.6 Methodology for Determining Operational Effects

The Regulation 598 assessment considered a number of different options for the use of the runway system at night. The resulting chosen option, presented in this chapter as the "Relevant Action" scenario, involves the preferred runway concept used in the daytime (07:00 to 23:00), known as Option 7b, being used in the periods of 23:00 to 00:00 and 06:00 to 07:00. The limit of 65 flights per night (23:00 to 07:00) is also removed and replaced with a Quota Count limit.

The effects of the Relevant Action are determined by comparing this scenario with the baseline for 2018, the future baseline for the relevant year with the current conditions in place, and the 2025 Consented scenario based on the 2007 North Runway application. Based on the number of flights in the forecast, the expectation is that in the "Relevant Action" scenarios which are based on Option 7b, all departures in the periods of 23:00 to 00:00 and 06:00 to 07:00 will use the North Runway for westerly operations, and the South Runway for Easterly operations, with arrivals using the opposite runway.

The following future years have been assessed:

- 2022 – the year the North Runway is expected to open; and
- 2025 – the first year following the opening of the North Runway when 32 mppa is expected to be reached.

The assessment in this chapter considers 2022 and 2025. These represent the year of opening, and the likely worst-case future year. After 2025, the noise impacts are expected to reduce if the airport remains at 32 mppa due to the forecast fleet renewal which will lead to the average aircraft getting quieter.

The general assessment methodology involves the following:

- Derivation of assessment criteria;
- Computation of existing and future noise levels under the various scenarios;
- Assessment of magnitude of impacts (absolute) on sensitive receptors, for each scenario;
- Determination of the change in noise levels, and associated impacts (relative) as a result of the Relevant Action;
- Consideration of the likely significant effects of the Relevant Action, based on both the absolute and relative noise levels;
- Description of the potential effects (beneficial and adverse) associated with the Relevant Action; and
- Description of any mitigation measures, where appropriate, in relation to the Relevant Action and a description of any residual effects.

13.3.7 Significance Criteria – Air Noise

The air noise effects are considered in terms of both the absolute noise level and the change in noise level due to the Relevant Action in order to determine the significance of the effects due to the Relevant Action. Both need to be considered to determine whether a significant effect arises from the Relevant Action in an EIA context; for example if a receptor experiences a high absolute noise level but no change due to the Relevant Action then this is not a significant effect. Conversely if a receptor experiences a large change in noise level but the resulting level is still very low then this receptor is not considered to be significantly affected.

13.3.7.1 Residential Receptors

Absolute noise impacts for residential receptors have been developed against an effect scale and are given in Table 13-1. The derivation of these is discussed in Appendix 13A.

Table 13-1: Air Noise Impact Criteria (absolute) – residential

Scale Description	*Annual dB L_{den}*	*Annual dB L_{night}*
Negligible	<45	<40
Very Low	45 – 49.9	40 – 44.9
Low	50 – 54.9	45 – 49.9
Medium	55 – 64.9	50 – 54.9
High	65 – 69.9	55 – 59.9
Very High	≥70	≥60

The effect scale used to assess the change in noise level is given in Table 13-2. A semantic scale of this type, following the format of examples given in the Institute of Environmental Management and Assessment (IEMA) guidelines, has been applied in previous air noise assessments and accepted in Public Inquiries for airport developments in the UK and Ireland, for example the application for the North Runway at Dublin Airport. The thresholds are derived from the difference contour bands recommended in CAP1616a (DoH, 2013).

Table 13-2: Air Noise Impact Criteria (relative)

Scale Description	Change in noise level, dB(A)
Negligible	0 – 0.9
Very Low	1 – 1-9
Low	2 – 2.9
Medium	3 – 5.9
High	6 – 8.9
Very High	≥9

The effect of a change in noise level tends to increase with the absolute level of noise experienced at a receptor. If, for example, the night-time noise level at a dwelling were to change from 45 dB to 50 dB L_{night}, the overall effect for the occupants would be less than if the night-time noise level were to increase by the same amount from 55 dB to 60 dB L_{night}.

There is no clearly accepted method of how to rate the magnitude of the effect of a change in the absolute air noise level and the associated change in noise level. Some guidance however has been provided in the UK's National Planning Practice Guidance (NPPG, 2020) which states:

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

The magnitude of an effect from changing between one scenario and another (e.g. baseline to future do-something scenario with the Relevant Action) has been established by considering both the absolute noise level in the higher of the two scenarios and the relative change in noise level that occurs at a given receptor.

Table 13-3 shows how the absolute and relative impacts are interpreted into magnitude of effect. This takes into account the criteria presented above, other guidance and professional judgement. The effect rating scale is taken from the EPA Draft EIAR Guidelines (EPA, 2017).

Table 13-3: Summary of magnitude of effect – air noise

Absolute Noise Level Rating	*Change in Noise Level Rating*					
	Negligible	*Very Low*	*Low*	*Medium*	*High*	*Very High*
Negligible	Imperceptible	Imperceptible	Imperceptible	Not Significant	Slight	Moderate

Absolute Noise Level Rating	Change in Noise Level Rating					
	Negligible	Very Low	Low	Medium	High	Very High
Very Low	Imperceptible	Imperceptible	Not Significant	Slight	Moderate	Significant
Low	Imperceptible	Not Significant	Slight	Moderate	Significant	Significant
Medium	Not Significant	Slight	Moderate	Significant	Significant	Very Significant
High	Slight	Moderate	Significant	Significant	Very Significant	Profound
Very High	Moderate	Significant	Significant	Very Significant	Profound	Profound

A potential significant effect (adverse or beneficial) would be considered to arise if in Table 13-3 the magnitude of the effect was rated as significant or higher.

13.3.7.2 Non-Residential Receptors

For receptors other than dwellings, absolute levels rated as medium have been derived from the relevant guidance documents, as described in Appendix 13A. These are given in Table 13-4. The impact on each non-residential receptor has been rated as significant if the absolute noise level is above this threshold and the change in noise level is at least 3 dB(A), i.e. it is rated medium or higher.

Table 13-4: Air Noise Impact Criteria (absolute) – non-residential

Receptor Type	Threshold for Medium Absolute Effect
Schools (08:00-16:00)	55 dB $L_{Aeq,30m}$ (approx. 55 dB L_{den})
Residential Healthcare Facilities – Day (07:00-23:00)	55 dB $L_{Aeq,1h}$ (approx. 55 dB L_{den})
Residential Healthcare Facilities – Night (23:00-07:00)	50 dB $L_{Aeq,1h}$ (approx. 45 dB L_{night})
Places of Worship	55 dB L_{den}

13.3.8 Significance Criteria – Vibration

Low frequency noise from airborne aircraft has the potential to cause perceptible vibration levels within dwellings. For this reason, the most appropriate noise metric to assess the likelihood of these effects is the maximum C-weighted noise level, denoted L_{Cmax}. C-weighting gives more weight to low frequency noise rather than the more commonly used A-weighting, which approximates the average human hearing response to different frequencies of noise.

This vibration effect is most obviously characterised by effects such as windows rattling. As discussed in the Historic England report (HE, 2014), aircraft passbys that produce a maximum noise level above 97 dB L_{Cmax} are likely to produce an audible rattle of windows. While it is appreciated that low frequency noise from aircraft can induce perceptible vibration levels in lightweight structures and loose-fitting components, the vibration levels are below those at which even minor cosmetic damage would be likely to occur.

Vibration effects due to airborne aircraft can vary depending on the specific details of the building, for example, the room dimensions which can cause resonance effects at certain frequencies. Resonances increase the sound level in parts of the room and decrease it in others which can influence any consequential vibration.

The other potential effect from airborne aircraft vibration is vortex damage to buildings.

Aircraft in flight creates vortices, circulating currents of air that are shed from the aircraft wings. For the most part, these vortices are dissipated by the effects of the wind and atmospheric turbulence before they reach the ground and, whilst they may more often be heard after an aircraft has passed, they seldom have any physical impact at ground level. Occasionally, however, vortices may persist long enough to make contact with buildings underneath the flight path. In extreme cases, the variation in pressure within these vortices can cause some damage to roofs if tiles or slates are not sufficiently firmly secured. In practice, such events may be encountered due to the passage of larger wide-bodied jets which create the largest vortices and during landing when aircraft are relatively close to the ground.

The issue of wake vortex damage was considered in some detail in the 2004 EIS (DA, 2004) that supported the application for the permitted North Runway. The previous EIS was based on an assumption of 348,358 movements per annum, significantly higher than the number now envisaged in 2025 for the proposed change in permitted operations which is 241,000 movements per annum. In granting permission for North Runway under those assumptions, the wake vortex impacts of that number of operations was evidently considered acceptable by the planning authorities. Additionally, the Relevant Action does not affect which aircraft are able to use Dublin Airport. On that basis, the wake vortex impacts associated with the proposed change in permitted operations can be expected similarly to be considered acceptable. There have been no reported cases of wake vortex damage at Dublin.

The noise level of 97 dB L_{Cmax} occurring on average at least once per 24 hour day over the year has been taken as a threshold for potential significance of vibration effects due to airborne aircraft events. Whether a significant effect occurs between scenarios depends on the number of dwellings affected and the frequency of the events.

13.3.9 Consultation

Chapter 5 details the consultation on this application.

13.3.10 Limitations and Assumptions

Planned background noise surveys have been hampered by the Covid-19 pandemic which means that even if measurements were taken at this time, the ambient conditions may not currently be representative. However a detailed survey was carried out in 2016, and is supplemented by the continuous measurements taken by Dublin Airport's fixed Noise Monitoring Terminals (NMTs). In any event, the assessment criteria for air noise are dependent on the absolute levels from the aircraft and not the background noise.

There is always some uncertainty associated with forecasting future aircraft traffic, and this has been increased by the recent Covid-19 pandemic, particularly in the short term. It is currently expected that 32 mppa will be reached in 2025 and this is the scenario assessed.

Some aircraft in the forecasts are either not currently in service or have limited noise data available. Assumptions over the future performance of these types have been made using the data available. This is not expected to significantly affect the assessment as aircraft in this category, such as the Airbus A330neo and Boeing 777X, are a minority of the total aircraft movements.

13.4 Baseline Conditions

This section provides a description of the general noise conditions in the vicinity of Dublin Airport. In view of the location of the airport, the surrounding community is affected primarily by noise from the local road network and airport operations.

The assessment of baseline conditions relates to the long-term situation and considers the noise levels in both 2016 and 2018. Due to the ongoing Covid-19 pandemic the noise conditions at the present time are likely to differ but this effect is expected to be temporary, although the precise timescale is uncertain.

Baseline noise surveys have been carried out at key receptor positions around Dublin Airport to establish the prevailing ambient and background noise conditions during both the daytime and night-time. Use has also been made of the extensive database of noise monitoring data obtained from Dublin Airport's continuous noise monitoring system which records in real time noise from both aircraft and non-aircraft related noise sources continuously throughout 24 hours of each day. This database of measurements has been processed to extract both the total noise levels and just those which correlate with aircraft noise events.

Airborne aircraft noise predictions have been made for 2018 and for the situation once the North Runway is operational in both 2022 and 2025. This chapter also includes an assessment of the noise impact that was expected to occur in the 2025 Consented scenario, which could be interpreted as the intended effects of the conditions.

In order to inform the vibration assessment, airborne aircraft noise predictions using the L_{Cmax} metric have been made for 2018 and for the situation once the North Runway is operational in both 2022 and 2025.

These predictions include both the primary assessment metrics, the results of which are presented later in this section, and the supplementary metrics which are presented in Appendix 13C.

13.4.1 Noise Surveys

The baseline noise surveys comprised a combination of attended and unattended noise monitoring. Attended noise monitoring was undertaken at various locations during periods in August, September and October 2016. Appendix 13D contains details of the noise monitoring procedures, survey dates, observations and results and, identifies the nature of the key contributors to the noise environment for each position.

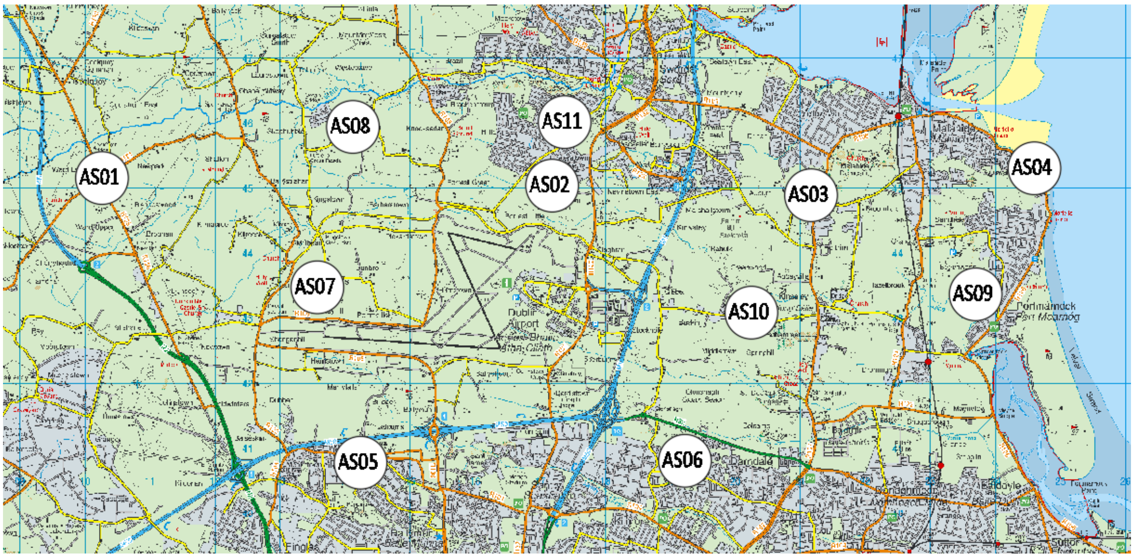
Unattended monitoring was carried out during similar periods to the attended monitoring.

In addition, the long-term monitoring data measured by Dublin Airport's Noise Monitoring Terminals (NMTs) has been utilised for the calendar year of 2018. A comparison of the NMT data for 2016 and 2018 has also been carried out in order to check if the conditions in 2016 were significantly different to those in 2018.

13.4.1.1 Measurement Locations

The locations of the attended and unattended monitoring are shown in Figure 13-1.

Figure 13-1: Baseline Noise Measurement Locations



13.4.1.2 Attended Survey Measurements

All attended noise monitoring measurements were undertaken in general accordance with the British Standard BS 7445 (BS, 2003). This comprised positions with free field conditions and a series of 5 minute measurement samples taken at a specified position for typically at least 30 minutes. Repeat measurements were made at each position on a given day or night. The microphone of the noise monitor was positioned approximately 1.5 m above ground level with the monitor mounted on a tripod and away from any reflective surfaces. Observations were made of the noise climate prevailing at the time. These attended measurements include the noise contribution of aircraft activity as well as non-aircraft related activities. This procedure is commonly used to obtain attended environmental noise information, supplemented where possible with unattended noise measurement data.

13.4.1.3 Unattended Survey Measurements

During the unattended surveys noise measurements were obtained over a period of around three weeks at each position. At four of the positions, locations #7, #8 and #9, noise measurements were obtained under free field conditions. At two of the positions, locations #10 and #11, measurements were made approximately 1 m from a reflective surface and therefore a reflection effect was included in the measurements. Unattended measurements comprised a series of continuous 15 minute measurement samples over the full survey period. The noise monitors were located in environmental cases with the microphones connected via extension cables. The microphones were fitted with windshields and attached to tripods positioned approximately 1.5 m above local ground level with the exception of Portmarnock Community School where the tripod was on a first floor flat roof.

13.4.1.4 Measurement Parameters and Results

The results of the baseline monitoring at survey locations are summarised in Table 13-5 and

Table 13-6, which show the attended and unattended results respectively. The survey results are presented in terms of the following parameters:

- $L_{Aeq,T}$ which is commonly used to denote the ambient noise level, signifies the single steady average noise exposure level which is equivalent in energy terms to that produced by the various fluctuating noise levels that occur in the given measurement period.
- $L_{A90,T}$ which represents the prevailing background noise level in the absence of any noise from aircraft in flight or other individual noise sources, such as passing cars. This index denotes the level of noise which is exceeded for 90% of the time.

Table 13-5: Baseline Noise Measurements – Attended – Dublin Airport

Reference	*Location*	*Daytime (07:00-23:00)*		*Night-time (23:00-07:00)*		*Location Description and Observations*	*Survey dates*
		LAeq,T dB	*LA90,T dB*	*LAeq,T dB*	*LA90,T dB*		
AS01	The Ward Cross	61	52	59	44	Measurement position located approximately 60 metres from R135	9th and 11th August 2016
AS02	Ridgewood	61	47	57	39	Residential area with infrequent local road traffic	9th and 11th August 2016
AS03	South Malahide	50	40	47	32	Residential area, measurement position located approximately 90 metres from Swords Road	16th 17th and 18th August 2016
AS04	Malahide	69	54	55	40	Coastal area, adjacent to the sea and R106	17th and 18th August 2016
AS05	Belcamp Park	57	53	52	46	Residential area with infrequent local road traffic	9th 10th and 11th August 2016
AS06	Hampton Wood	59	56	48	44	Residential area with infrequent local road traffic	10th and 11th August 2016

Table 13-6: Baseline Noise Measurements – Unattended – Dublin Airport

Reference	***Location***	***Daytime (07:00-23:00)***		***Night-time (23:00-07:00)***		***Location Description and Observations***	***Survey dates***
		LAeq,T dB	*LA90,T dB*	*LAeq,T dB*	*LA90,T dB*		
AS07	St Margaret's Dunsoghly	64	45	59	39	Small village in rural area. Aircraft activity the dominant noise source	11th to 29th August 2016
		64	47	57	42		15th to 26th September 2016
AS08	Kilbrook	50	40	44	33	Quiet residential area. No obvious dominant noise source	11th to 29th August 2016
AS09	Portmarnock Community School	51	40	44	33	Measurement position located within the school grounds. No obvious dominant noise source	19th August to 5th September 2016
AS10	The Baskins	58	43	52	37	Residential area Aircraft activity occasionally the dominant noise source	11th to 29th August 2016

AS11	River Valley	56	45	45	39	Measurement position located within the school grounds	10th to 30th October 2016

As illustrated in the tables above, noise levels vary considerably depending on the proximity to noise sources such as roads and aircraft flight paths in the surrounding environment. Consideration is therefore given below to the areas in the vicinity of the airport in turn.

13.4.1.5 Noise Environment Description

This section describes the general noise environment in the vicinity of the attended and unattended monitoring locations based on observations made on site and the results presented in Table 13-5 and

Table 13-6. Reference is made below to ambient noise levels, depicted by the $L_{Aeq,T}$ index, and background noise levels, depicted by the L_{A90} index.

North (Locations #2 & #11)

River Valley is a residential area located just under 2 km north of the airport. The R132 and M1 are located approximately 1km and 2.5km from measurement positions D and M. Daytime ambient and background noise levels ranged between 56 dB – 61 dB $L_{Aeq,T}$ and 45 dB – 47 dB L_{A90} respectively. Night-time ambient noise levels ranged between 45 – 57 dB and background noise levels were around 39 dB at both locations. Local road traffic dominated noise sources, however, at location #2 between 06:30 and 07:00 frequent plane activity was the dominant noise source.

North east (Locations #3 & #4)

Malahide is located near the coast, north east of the airport. The R106 was a dominant noise source in the area during the daytime. Position F was located next to the R106 approximately 7km away from Dublin airport with ambient and background noise levels of around 69 dB $L_{Aeq,T}$ and 54 dB L_{A90}. At night-time ambient and background noise levels at this position were around 55 dB and 40 dB respectively. Position E was located approximately 4km away from Dublin airport in a quieter residential area located away from busy main roads. The daytime ambient and background noise levels were 50 dB and 40 dB respectively. The night-time levels were 47 dB $L_{Aeq,T}$ and 32 dB L_{A90}. Aircraft noise at these locations was considered negligible.

East (Locations #9 & #10)

The area east of the Dublin airport, at a distance of approximately 2.5 km contains rural areas with smaller residential neighbourhoods located away from busy roads. The area is generally quieter than other locations around the airport with the daytime ambient and background noise levels, measured at Position H, of around 58 dB $L_{Aeq,T}$ and 43 dB L_{A90}. The night-time ambient and background noise levels were around 52 dB $L_{Aeq,T}$ and 37 dB L_{A90}. Aircraft noise was occasionally dominant. For Portmarnock School, approximately 6.5km away from Dublin airport, which was closed for the summer holidays during the survey, a similar result was evident with daytime ambient and background noise levels of around 51 dB $L_{Aeq,T}$ and 40 dB $L_{Aeq,T}$. At night, the ambient and background levels were around 44 dB $L_{Aeq,T}$ and 33 dB $L_{Aeq,T}$. Aircraft noise at this location was not considered dominant.

South east (Location #6)

Clonshaugh's business and technology park and Belcamp Park are located approximately 3 km to the south east of the airport. The M1, M50 and R139 are dominant noise sources in the area. The daytime ambient and background noise levels measured were 57 dB and 53 dB respectively. The night-time ambient and background noise levels measured were 52 dB and 46 dB respectively. Aircraft noise was occasionally dominant.

South (Location #5)

The M50 and the Hampton Wood residential area are located south of the airport. The measurement position was located approximately 500 metres from the M50 and 2km from Dublin airport. The daytime ambient and background noise levels were 59 dB and 56 dB respectively. The night-time ambient and background noise levels measured were 48 dB and 44 dB respectively.

West (Location #7)

The area west of the airport contains further rural areas with smaller residential neighbourhoods. Aircraft noise dominated St Margaret's with daytime ambient noise levels of 64 dB and background noise levels ranging from 45 dB – 47 dB. The night-time ambient noise levels ranged between 57 dB – 59 dB and background noise levels ranged between 39 dB – 42 dB. The surrounding road network consisting of N2 and R135 were also audible. Aircraft noise was measured under both easterly and westerly modes of operation at the airport.

North west (Location #1)

North west of the airport approximately 4km away contains further rural areas. The R135 and R121 roads are dominant noise sources. Ambient and background noise levels of 61 dB and 52 dB respectively were measured. The night-time ambient and background noise levels measured were 59 dB and 44 dB respectively. Aircraft noise was not considered dominant.

13.4.1.6 daa Permanent Noise Monitoring Terminal Results

This section describes the locations of the permanent noise monitors in place and operating in the vicinity of Dublin Airport. Results are presented for each noise monitor over the period commencing January 2016 to the end of December 2016, describing the noise environment with and without aircraft activity. The corresponding information for the period commencing January 2018 to the end of December 2018 is also presented to highlight any trends.

The location of each noise monitoring terminal (NMT) is shown in Figure 13-2. There are currently eight permanent NMTs in the vicinity of Dublin Airport. These are located as follows:

- Bay Lane (NMT1), monitoring Runway 28 Departures & Runway 10 Arrivals
- St. Doolaghs (NMT2), monitoring Runway 10 Departures & Runway 28 Arrivals
- Bishopswood (NMT3), monitoring the local area
- Feltrim (NMT4), monitoring the local area
- Balcultry (NMT5), monitoring Runway 34 Departures & Runway 16 Arrivals
- Artane (NMT6), monitoring Runway 16 Departures & Runway 34 Arrivals
- Coast Road (NMT20), monitoring Runway 10 Departures & Runway 28 Arrivals
- North-east of the airport off the Naul Road (NMT21), monitoring noise produced by aircraft on the ground at a location close to the airport.

NMT22 is a mobile NMT, currently located within the airport site, located close to the West Apron in the vicinity of the mid-western boundary of the airport. NMTs 3 and 4 have been installed for permitted operations. daa publish half yearly reports on the outputs of these NMTs, providing a summary of the aircraft noise measurements from the system. The most recent of these reports are available from the Dublin Airport website[17].

[17] https://www.dublinairport.com/corporate/community-and-sustainability/noise/airport-noise-noise-reports

Figure 13-2: Permanent Noise Monitoring Terminals at Dublin Airport

Table 13-7 presents the average measured noise level over the six month period from January to July 2016 inclusive at each monitor, split into daytime (07:00 to 23:00) and night time (23:00 to 07:00) periods. Also presented is the noise level produced by aircraft, i.e. the correlated aircraft noise events. Where the “total” noise level at a given monitor is close in value to the “aircraft” noise level, this indicates that the total noise is dominated by aircraft noise. Where there is a 3 dB or more difference, this indicates that some other noise source(s) dominates the noise environment at the NMT. It can be seen that only at NMTs 1 and 2 does aircraft noise dominate the total noise environment. This is to be expected given the locations of these two monitors within 4 km directly to the east and west respectively of the airport’s existing main runway.

These averages are not directly comparable to noise contours produced by computer modelling as noise contours are typically based on an average summer or annual day, and also include all aircraft movements rather than just those which produce a correlated noise event. Noise contours also include no noise other than that produced by aircraft.

Table 13-7: Average Measured Noise Levels (2016)

	Daytime Noise Level, dB $L_{Aeq,16hr}$				*Night Time Noise Level, dB $L_{Aeq,8hr}$*			
NMT	*Jan-Jun 2016*		*Jul-Dec 2016*		*Jan-Jun 2016*		*Jul-Dec 2016*	
	Total	*Aircraft*	*Total*	*Aircraft*	*Total*	*Aircraft*	*Total*	*Aircraft*
1	63.8	62.5	63.7	62.4	58.4	57.1	58.1	57.0
2	62.4	60.7	61.8	60.3	56.8	55.4	56.8	55.6
3	62.9	49.6	-	-	54.9	47.0	-	-
4	56.6	41.5	56.8	41.2	52.1	38.3	49.7	39.4

5	54.9	49.2	55.3	48.6	57.3	48.1	51.3	49.7
6	61.6	46.7	58.1	44.2	56.5	45.5	51.6	43.4
20	63.7	57.2	62.4	54.9	57.6	52.2	56.3	50.2

Table 13-8: Average Measured Noise Levels (2018)

	Daytime Noise Level, dB $L_{Aeq,16hr}$				*Night Time Noise Level, dB $L_{Aeq,8hr}$*			
NMT	*Jan-Jun 2018*		*Jul-Dec 2018*		*Jan-Jun 2018*		*Jul-Dec 2018*	
	Total	*Aircraft*	*Total*	*Aircraft*	*Total*	*Aircraft*	*Total*	*Aircraft*
1	63.9	62.8	64.0	62.9	58.9	57.2	58.1	56.6
2	61.1	60.5	61.9	61.1	56.5	54.9	57.5	56.5
4	57.2	46.9	55.3	43.8	54.2	36.7	51.0	33.7
5	58.3	49.5	54.8	48.5	55.1	50.2	54.3	50.4
6	57.7	45.8	60.9	48.9	58.0	45.1	59.2	47.0
20	64.3	58.7	63.4	59.6	58.6	47.7	58.9	54.8

Taking the NMTs where the highest noise levels were measured, these are generally consistent between the two years, especially so for NMT1 where the differences are not more than 0.5 dB, At some of the other locations the variations are greater, for example at NMT6 where the aircraft activity is due to use of the cross runway, the amount of which is weather dependent. Despite this, the overall picture presented by the results is similar in regard to where the highest noise levels occur and where aircraft noise contributes the most.

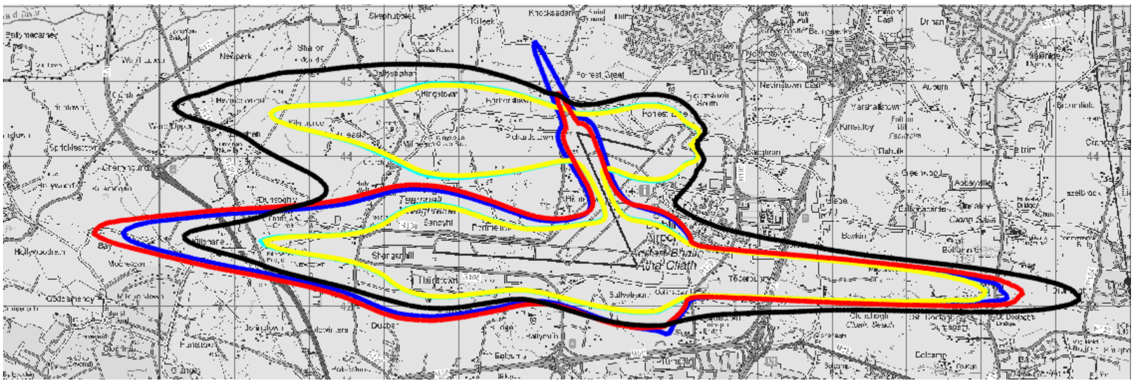
13.4.2 Noise Modelling L_{den} Metric

Noise contours have been produced for the primary assessment metric of L_{den} using the methodology described in Section 0. For the 2018 Baseline and the 2019 Baseline these are based on the actual aircraft movements in 2018 and 2019 respectively. For the future years these are based on forecast aircraft movements.

The results for the years 2018, 2019, 2022 and 2025 are detailed below. 2022 represents the year that the North Runway is first expected to be operational, and 2025 the likely worst-case future year for the Relevant Action application. These results are also presented in Appendix 13C along with the results for the supplementary noise metrics.

Appendix 13C presents the resulting noise contours for each scenario. Figure 13-3 shows the noise contours representing a high impact, 65 dB L_{den}, for the 2018, 2019, 2022, 2025 Baseline scenarios, as well as the 2025 Consented scenario.

Figure 13-3: 65 dB L_{den} Noise Contours, 2018 Baseline (blue), 2019 Baseline (red), 2022 Baseline (cyan), 2025 Baseline (yellow) and 2025 Consented (black)



The 2018 Baseline 65 dB L_{den} contour (blue) extends to the west from the South Runway to Mooretown and to the east to St Doolaghs. From the crosswind runway, the contour extends to Knocksedan to the north and does not reach the M50 to the south.

The 2019 Baseline 65 dB L_{den} contour (red) extends to the west from the South Runway to Mooretown and to the east to St Doolaghs. From the crosswind runway, the contour extends to Forrest Great to the north and does not reach the M50 to the south.

The 2022 Baseline 65 dB L_{den} contour (cyan) does not reach as far west as 2018 in line with the South Runway, extending to Killshane Bridge, and is slightly smaller to the east. In line with the North Runway, the contour extends to Kilmacree to the west and barely leaves the airport site to the east. The exposure from the crosswind runway does not leave the airport site.

The 2025 Baseline 65 dB L_{den} contour (yellow) is a very similar shape to that in 2022, albeit slightly smaller.

The 2025 Consented 65 dB L_{den} contour (black) does not reach as far west as 2018 in line with the South Runway, extending to Killshane, but extends further to the east, reaching Drumnigh. In line with the North Runway, the contour extends to Ward Upper to the west and barely leaves the airport site to the east. There is no contour in line with the crosswind runway as it is not used under this scenario.

To provide further information on changes in the noise environment for specific communities, predictions have also been undertaken of the noise levels at a number of representative locations which are shown on Figure 13-4. The results of these predictions for the Baseline scenarios in terms of the Lden metric are given in Table 13-9.

Figure 13-4: Representative Location Points

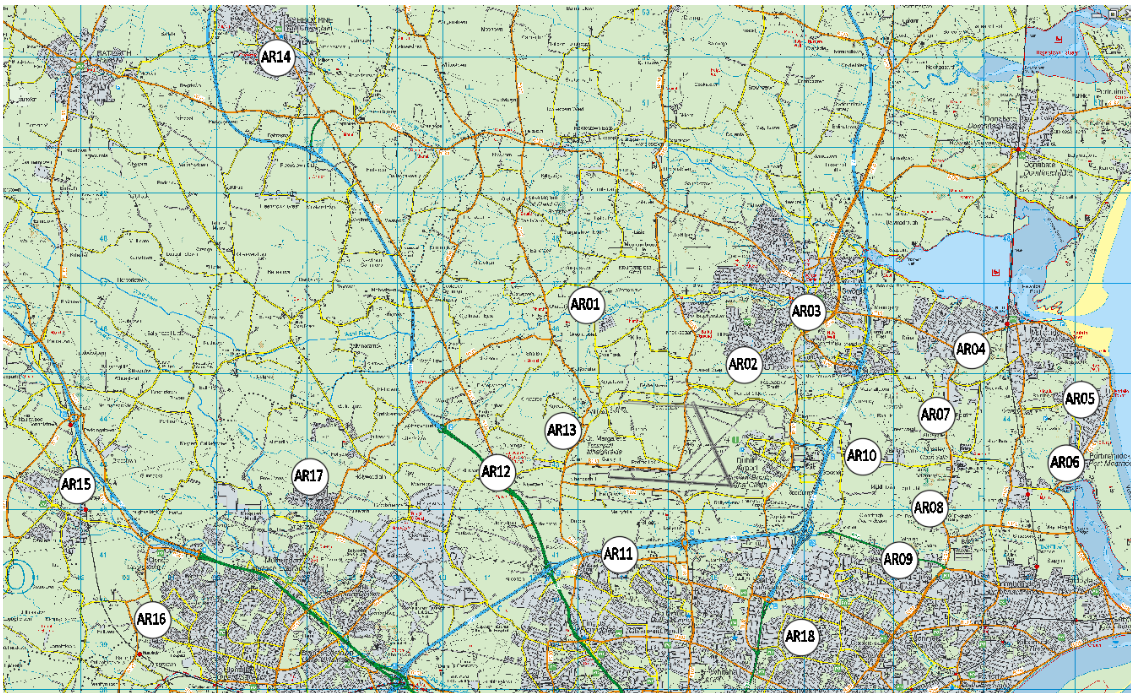


Table 13-9: Baseline Noise levels at Representative Locations (L_{den})

Representative Location	*Reference No.*	*Baseline Noise Level, dB (L_{den})*				
		2018	*2019*	*2022*	*2025*	*2025 Consented*
Tyrellstown, Toberburr	AR01	50	50	53	52	57
Ridgewood	AR02	53	53	57	57	60
Swords	AR03	47	47	48	48	52
Malahide Castle	AR04	45	45	46	46	49
Portmarnock N	AR05	48	48	49	49	51
Portmarnock S	AR06	56	56	56	56	58
Malahide S	AR07	50	50	51	51	55
St Doolaghs	AR08	65	65	64	64	66
Darndale Park	AR09	53	53	53	53	55
The Baskins	AR10	58	58	58	58	60
Mayeston Hall	AR11	57	57	54	54	56
Kilshane Cross	AR12	68	68	64	64	67
St Margret's	AR13	62	63	62	62	66
Ashbourne	AR14	48	48	47	47	49
Dunboyne	AR15	53	54	51	51	54
Ongar	AR16	51	52	49	48	50
Mount Garrett	AR17	61	61	57	57	59
Beaumont	AR18	54	51	49	49	51

Note – noise levels rounded to nearest whole number.

Noise levels remained largely similar between 2018 and 2019, with small increases of 0-1 dB at most locations reflecting the increase in total aircraft movements. There was however a reduction in the number of aircraft using the crosswind runway, and a consequent reduction in noise level for receptors in line with the crosswind runway, for example, Beaumont (#18).

Noise levels at receptors close to flight paths from the existing South Runway or crosswind runway, for example St Doolaghs (#8), Killshane Cross (#12) or Beaumont (#18), are forecast to reduce between the 2018 Baseline and 2022 Baseline scenarios, whereas the opposite is true for receptors closer to flight paths from the North Runway, for example Swords (#3). Going from the 2022 Baseline to the 2025 Baseline, there are small decreases of 0-1 dB at all locations.

In the 2025 Consented scenario, noise levels are typically 2-4 dB louder than those which are now forecast for the 2025 Baseline scenario.

For each of the sets of baseline contours the number of dwellings and the estimated population that they contain have been determined. This has been done based on the existing dwellings and population excluding consented developments, and also based on the existing dwellings and population including consented developments and land zoned for residential development. The results for the 2018 Baseline scenario are given by contour in Table 13-10 along with the areas of the contours.

Table 13-10: Areas, number of dwellings and population in 2018 Baseline Annual L_{den} contours

Scenario		*2018 Baseline*			
Contour L_{den} (dB)	*Area (km^2)*	*Excluding Consented Developments*		*Including Consented Developments*	
		Dwellings	*Population.*	*Dwellings*	*Population*
45	703.2	245,806	716,719	257,385	753,071
50	209.3	61,726	184,770	71,332	215,161
55	85.9	11,887	35,476	18,100	54,562
60	33.5	1,639	4,710	4,953	15,248
65	11.6	92	251	92	251
70	4.1	8	25	8	25

The dwelling and population results for the 2019 Baseline scenario are given by contour in Table 13-11 along with the areas of the contours.

Table 13-11: Areas, number of dwellings and population in 2019 Baseline Annual L_{den} contours

Scenario		*2019 Baseline*			
Contour L_{den} (dB)	*Area (km^2)*	*Excluding Consented Developments*		*Including Consented Developments*	
		Dwellings	*Population.*	*Dwellings*	*Population*
45	745.7	261,053	754,135	272,632	790,487
50	218.7	57,115	174,146	66,707	204,495
55	88.3	11,493	34,097	17,888	53,757
60	35.6	2,115	6,279	5,558	17,182
65	12.2	104	285	104	285

70	4.4	10	31	10	31

The dwelling and population results for the 2022 Baseline scenario are given by contour in Table 13-12 along with the areas of the contours.

Table 13-12: Areas, number of dwellings and population in 2022 Baseline Annual L_{den} contours

Scenario		*2022 Baseline*			
Contour L_{den} (dB)	*Area (km^2)*	*Excluding Consented Developments*		*Including Consented Developments*	
		Dwellings	*Population.*	*Dwellings*	*Population*
45	645.4	144,617	430,569	155,915	466,077
50	196.1	32,637	97,385	40,397	121,240
55	83.7	7,128	20,811	13,099	39,219
60	32.4	896	2,410	2,496	7,408
65	11.5	44	133	44	133
70	4.1	8	26	8	26

The dwelling and population results for the 2025 Baseline scenario are given by contour in Table 13-13 along with the areas of the contours.

Table 13-13: Areas, number of dwellings and population in 2025 Baseline Annual L_{den} contours

Scenario		*2025 Baseline*			
Contour L_{den} (dB)	*Area (km^2)*	*Excluding Consented Developments*		*Including Consented Developments*	
		Dwellings	*Population.*	*Dwellings*	*Population*
45	627.4	140,973	419,838	152,251	455,293
50	193.5	31,566	94,122	39,325	117,974
55	82.6	6,783	19,771	12,754	38,179
60	32.0	881	2,389	2,481	7,387
65	11.2	42	128	42	128
70	4.0	7	23	7	23

The dwelling and population results for the 2025 Consented scenario are given by contour in Table 13-14 along with the areas of the contours.

Table 13-14: Areas, number of dwellings and population in 2025 Consented Annual L_{den} contours

Scenario	*2025 Consented*				
Contour L_{den} (dB)	*Area (km^2)*	*Excluding Consented Developments*		*Including Consented Developments*	
		Dwellings	*Population.*	*Dwellings*	*Population*
45	1110.9	286,358	806,461	297,973	842,905
50	321.3	65,222	193,793	73,923	220,447
55	127.3	16,646	49,135	23,417	69,747
60	50.7	2,048	5,548	4,803	14,065
65	21.0	173	472	173	472
70	7.5	29	89	29	89

The World Health Organisation's Environmental Noise Guidelines 2018, as endorsed by the European Commission through Directive 2020/367, provide a method for calculating the number of people highly annoyed by airborne aircraft noise. This aims to give an overall picture of the noise exposure by assessing a percentage of people as being highly annoyed at different noise levels. For example, around 10% are assessed as being highly annoyed at a noise level of 45 dB L_{den}, increasing to around 67% at a noise level of 75 dB L_{den}. The number of people assessed to be highly annoyed by this method in the Baseline scenarios is given in Table 13-15.

Table 13-15: Number of people highly annoyed – Baseline Scenarios

Scenario	*No. People Highly Annoyed*	
	Excluding Consented Developments	*Including Consented Developments*
2018 Baseline	110,234	120,201
2019 Baseline	115,740	125,923
2022 Baseline	65,227	74,321
2025 Baseline	63,316	72,337
2025 Consented	125,742	136,170

Considering past activity, the number of people exposed to aircraft noise increased from the 2018 Baseline to the 2019 Baseline, although there was a reduction in the number of people within the 50 and 55 dB L_{den} contours, due to lower usage of the crosswind runway in 2019. Consequently, the number of people assessed as highly annoyed by aircraft noise also increased, specifically by 5% from 110,234 to 115,740. The number of people exposed to at least a high level of noise (i.e. 65 dB L_{den} or above) increased from 251 to 285.

The number of people exposed to aircraft noise is forecast to reduce from the 2018 Baseline to the 2022 Baseline, for all contour levels. Consequently, the number of people assessed as highly annoyed by aircraft noise also decreases, specifically by 41% from 110,234 to 65,227. The number of people exposed to at least a high level of noise (i.e. 65 dB L_{den} or above) decreases from 251 to 133.

Going forward to the 2025 Baseline scenario, there are further reductions to 63,316 people assessed as highly annoyed and 128 people exposed to at least a high noise level.

The 2025 Consented scenario results in a significantly greater number of people to be exposed to aircraft noise than what is now forecast in the 2025 Baseline, with 125,742 people assessed as highly annoyed and 472 people exposed to at least a high noise level.

In addition to the consideration of residential properties, other potential receptors of high sensitivity have been included in this assessment, specifically schools, residential healthcare facilities and places of worship. The numbers of each of these above the thresholds given in Table 13-4 for the Baseline scenarios are given in Table 13-16.

Table 13-16: Schools, residential healthcare facilities and places of worship in Baseline L_{den} contours

Scenario	*No. Receptors Above Threshold for Medium Absolute Effect*		
	Schools	*Residential Healthcare Facilities*	*Places of Worship*
2018 Baseline	10	2	6
2019 Baseline	9	2	6
2022 Baseline	8	1	5
2025 Baseline	8	1	5
2025 Consented	11	2	6

The number of non-residential receptors exposed to the thresholds given in Table 13-4 reduced by one between 2018 and 2019, and is forecast to reduce further in the 2022 and 2025 Baseline scenarios. The 2025 Consented scenario exposes 5 additional non-residential receptors to noise levels above these thresholds compared to the 2025 Baseline.

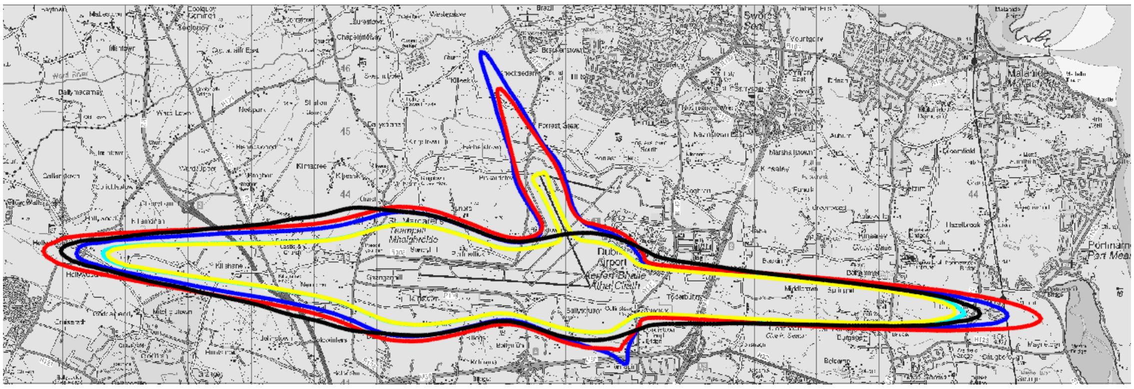
13.4.3 Noise Modelling L_{night} Metric

Noise contours have been produced for the primary assessment metric of L_{night} using the methodology described in Section 0. For the 2018 Baseline and the 2019 Baseline these are based on the actual aircraft movements in 2018 and 2019 respectively. For the future years these are based on forecast movements.

The results for the years 2018, 2019, 2022 and 2025 are detailed below. 2022 represent the year of opening, and 2025 the worst-case year. These results are also presented in Appendix 13C along with the results for the supplementary noise metrics.

Figure 13-5 shows the noise contours representing a high impact, 55 dB L_{night}, for the 2018, 2019, 2022 and 2025 Baseline scenarios, as well as the 2025 Consented scenario.

Figure 13-5: 55 dB L_{night} Noise Contours, 2018 Baseline (blue), 2019 Baseline (red), 2022 Baseline (cyan), 2025 Baseline (yellow) and 2025 Consented (black)



The 2018 Baseline 55 dB L_{night} contour (blue) extends to the west from the South Runway to Hollystown and to the east to Drumnigh. From the crosswind runway, the contour extends to Killeek to the north and just crosses the M50 to the south.

The 2019 Baseline 55 dB L_{night} contour (red) extends to the west from the South Runway to Hollystown and to the east to just beyond Drumnigh. From the crosswind runway, the contour extends to Knocksedan to the north and does not reach the M50 to the south.

The 2022 Baseline 55 dB L_{night} contour (cyan) does not extend as far as the 2018 contour in line with the south runway, reaching to Bay to the west and not reaching Drumnigh to the east. The exposure from the crosswind runway does not leave the airport site. There is no contour in line with the North Runway as it is not used at night under this scenario.

The 2025 Baseline 55 dB L_{night} contour (yellow) is a very similar shape to that in 2022, albeit slightly smaller.

The 2025 Consented 55 dB L_{night} contour (black) extends to the west from the South Runway to Hollystown and to the east to Drumnigh. There is no contour in line with the crosswind runway as it is not used under this scenario.

To provide further information on changes in the noise environment for specific communities, predictions have also been undertaken of the noise levels at a number of representative locations which are shown on Figure 13-4. The results of these predictions for the Baseline scenarios in terms of the L_{night} metric are given in Table 13-17.

Table 13-17: Baseline Noise levels at Representative Locations (L_{night})

Representative Location	*Reference No.*	***Baseline** Noise Level, dB (L_{night})*				
		2018	*2019*	*2022*	*2025*	*2025 Consented*
Tyrellstown, Toberburr	AR01	43	43	38	38	44
Ridgewood	AR02	45	45	41	41	43
Swords	AR03	39	39	36	36	41
Malahide Castle	AR04	36	37	35	35	37
Portmarnock N	AR05	39	40	39	39	40
Portmarnock S	AR06	48	48	47	47	47
Malahide S	AR07	42	42	41	41	43
St Doolaghs	AR08	57	57	56	56	56
Darndale Park	AR09	44	44	44	44	45
The Baskins	AR10	49	49	48	48	50
Mayeston Hall	AR11	48	49	46	46	48
Kilshane Cross	AR12	59	60	59	59	61
St Margret's	AR13	54	54	52	52	55
Ashbourne	AR14	38	39	37	37	39
Dunboyne	AR15	45	46	44	44	47
Ongar	AR16	43	44	41	41	40
Mount Garrett	AR17	52	53	51	51	52
Beaumont	AR18	47	44	40	40	40

Note – noise levels rounded to nearest whole number.

Noise levels remained largely similar between 2018 and 2019, with small increases of 0-1 dB at most locations reflecting the increase in total aircraft movements. There was however a reduction in the number of aircraft using the crosswind runway, and a consequent reduction in noise level for receptors in line with the crosswind runway, for example, Beaumont (#18).

Noise levels are forecast to reduce between the 2018 Baseline and 2022 Baseline scenarios, in particular for receptors close to flight paths from the crosswind runway such as Beaumont (#18). For areas closer to flight paths from the existing South Runway such as St Doolaghs (#8) the forecast reduction is more modest. Going from the 2022 Baseline to the 2025 Baseline there are small decreases of 0-1 dB at all locations.

In the 2025 Consented scenario, noise levels are typically 1-2 dB louder than those which are now forecast for the 2025 Baseline scenario, although there are some locations with larger differences.

For each of the sets of baseline contours the number of dwellings and the estimated population that they contain have been determined. This has been done based on the existing dwellings and population, excluding consented developments, and allowing for consented developments and land zoned for residential development. The results for the 2018 Baseline scenario are given by contour in Table 13-18 along with the areas of the contours.

Table 13-18: Areas, number of dwellings and population in 2018 Baseline Annual L_{night} contours

Scenario		*2018 Baseline*			
Contour L_{night} (dB)	*Area (km^2)*	*Excluding Consented Developments*		*Including Consented Developments*	
		Dwellings	*Population.*	*Dwellings*	*Population*
40	304.4	102,538	307,457	112,422	338,671
45	118.2	18,815	55,492	25,998	77,477
50	48.4	4,131	12,316	7,808	23,926
55	16.8	276	753	328	950
60	5.8	19	56	19	56
65	2.3	3	10	3	10

The dwelling and population results for the 2019 Baseline scenario are given by contour in Table 13-19 along with the areas of the contours.

Table 13-19: Areas, number of dwellings and population in 2019 Baseline Annual L_{night} contours

Scenario		*2019 Baseline*			
Contour L_{night} (dB)	*Area (km^2)*	*Excluding Consented Developments*		*Including Consented Developments*	
		Dwellings	*Population.*	*Dwellings*	*Population*
40	328.4	113,699	344,912	123,802	376,760
45	122.2	19,717	59,307	26,939	81,439
50	52.3	4,522	13,838	8,518	26,369
55	18.6	558	1,533	1,376	4,158
60	6.4	41	110	41	110
65	2.5	4	13	4	13

The dwelling and population results for the 2022 Baseline scenario are given by contour in Table 13-20 along with the areas of the contours.

Table 13-20: Areas, number of dwellings and population in 2022 Baseline Annual L_{night} contours

Scenario		*2022 Baseline*			
Contour L_{night} (dB)	*Area (km^2)*	*Excluding Consented Developments*		*Including Consented Developments*	
		Dwellings	*Population.*	*Dwellings*	*Population*
40	191.6	47,071	143,248	55,266	168,459
45	86.4	10,566	31,447	17,113	51,444
50	35.0	2,195	6,247	5,738	17,450
55	11.8	102	284	102	284
60	4.0	11	34	11	34
65	1.5	0	0	0	0

The dwelling and population results for the 2025 Baseline scenario are given by contour in Table 13-21 along with the areas of the contours.

Table 13-21: Areas, number of dwellings and population in 2025 Baseline Annual L_{night} contours

Scenario		*2025 Baseline*			
Contour L_{night} (dB)	*Area (km^2)*	*Excluding Consented Developments*		*Including Consented Developments*	
		Dwellings	*Population.*	*Dwellings*	*Population*
40	189.3	46,552	141,767	54,809	167,200
45	85.3	10,370	30,882	16,917	50,879
50	34.3	2,132	6,032	5,675	17,235
55	11.5	101	281	101	281
60	3.9	10	31	10	31
65	1.5	0	0	0	0

The dwelling and population results for the 2025 Consented scenario are given by contour in Table 13-21 along with the areas of the contours.

Table 13-22: Areas, number of dwellings and population in 2025 Consented Annual L_{night} contours

Scenario		*2025 Consented*			
Contour L_{night} (dB)	*Area (km²)*	*Excluding Consented Developments*		*Including Consented Developments*	
		Dwellings	*Population.*	*Dwellings*	*Population*
40	299.8	82,730	243,163	91,567	270,268
45	109.0	17,294	51,486	24,304	72,854
50	45.2	3,414	10,511	7,291	22,721
55	16.3	244	495	276	616
60	6.0	59	156	59	156
65	2.1	4	13	4	13

The World Health Organisation's Environmental Noise Guidelines 2018, as endorsed by the European Commission through Directive 2020/367, provide a method for calculating the number of people highly sleep disturbed by airborne aircraft noise. This aims to give an overall picture of the noise exposure by assessing a percentage of people as being highly sleep disturbed at different noise levels. The number of people assessed to be highly sleep disturbed by this method in the Baseline scenarios is given in Table 13-23.

Table 13-23: Number of people highly sleep disturbed – Baseline Scenarios

Scenario	***No. People Highly Sleep Disturbed***	
	Excluding Consented Developments	***Including Consented Developments***
2018 Baseline	42,260	48,062
2019 Baseline	47,044	53,084
2022 Baseline	19,690	24,479
2025 Baseline	19,464	24,270
2025 Consented	33,207	38,415

Considering past activity, the number of people exposed to aircraft noise increased from the 2018 Baseline to the 2019 Baseline, for all contour levels. Consequently, the number of people assessed as highly sleep disturbed by aircraft noise also increases, specifically by 11% from 42,260 to 47,044. The number of people exposed to at least a high level of noise (i.e. 55 dB L_{night} or above) increases from 753 to 1,533.

The number of people exposed to aircraft noise is forecast to reduce from the 2018 Baseline to the 2022 Baseline, for all contour levels. Consequently the number of people assessed as highly sleep disturbed by aircraft noise also decreases, specifically by 53% from 42,260 to 19,690. The number of people exposed to at least a high level of noise (i.e. 55 dB L_{night} or above) decreases from 753 to 284.

Going forward to the 2025 Baseline Scenario, there are further reductions to 19,464 people assessed as highly sleep disturbed and 281 people exposed to at least a high noise level.

The 2025 Consented scenario would result in a significantly greater number of people being exposed to aircraft noise than what is now forecast in the 2025 Baseline, with 33,207 people assessed as highly sleep disturbed and 495 people exposed to at least a high noise level.

In addition to the consideration of residential properties, other potential receptors of high sensitivity have been included in this assessment, specifically schools, residential healthcare facilities and places of worship. Of these, only residential healthcare facilities are highly sensitive to noise at night. The numbers of these above the thresholds given in Table 13-4 for the Baseline scenarios are given in Table 13-24.

Table 13-24: Residential healthcare facilities in Baseline L_{night} contours

Scenario	*No. Residential Healthcare Facilities Above Threshold for Medium Absolute Effect*
2018 Baseline	4
2019 Baseline	2
2022 Baseline	2
2025 Baseline	2
2025 Consented	2

The number of residential healthcare facilities exposed to the threshold given in Table 13-4 reduced from 4 in 2018 to 2 in 2019, and is forecast to remain the same in the 2022 and 2025 Baseline scenarios. The 2025 Consented scenario shows no change from the 2025 Baseline.

13.4.4 Noise Modelling to Inform Vibration Effects

The number of dwellings exceeding the threshold for potential vibration effects due to airborne aircraft, based on experiencing noise levels of at least 97 dB L_{Cmax} at least once per 24 hour day, has been predicted for the 2018, 2022 and 2025 Baseline scenarios. The results are given in Table 13-25.

Table 13-25: Number of dwellings exceeding threshold for potential vibration effects due to airborne aircraft, Baseline scenarios

Scenario	*No. dwellings exceeding threshold for potential vibration effects due to airborne aircraft*
2018 Baseline	4
2022 Baseline	0
2025 Baseline	0

In 2018, there were 4 dwellings which experienced noise levels in excess of 97 dB L_{Cmax} at least once per day. These are located to the south of Old Airport Road, near to the eastern end of the south runway. No dwellings exceed this threshold in either the 2022 or 2025 Baseline scenarios.

13.5 Environmental Design and Management

There are a number of measures already in place at Dublin Airport that reduce or mitigate the noise effects of aircraft operations. These are described in this section.

13.5.1 Reduction of Noise at Source

Over the past 20 years, the models and types of aircraft using Dublin Airport have evolved, and improvements in technology have meant that the typical aircraft using the airport are quieter than they used to be.

The ICAO Noise 'Chapter' defines specific noise performance criteria to which aircraft must be certificated. Since 2002, Chapter 2 aircraft have been banned from use in Europe and the vast majority of aircraft operating in the skies above the EU are now Chapter 4 compliant, with an increasing number of quieter Chapter 14 aircraft entering the fleet as airlines take delivery of newer aircraft.

This trend is expected to continue in the future as airlines renew their fleets, and begin to use new aircraft such as the Airbus A320neo and Boeing 737 MAX 8, which both meet the ICAO Chapter 14 requirements and are quieter than the equivalent types they will be replacing.

Specific fleet renewal plans for the two largest airlines at Dublin Airport, Aer Lingus and Ryanair, were considered when preparing the future forecast scenarios and details are presented in the Mott McDonald Impact of Restrictions Report.

daa plan to incentivise fleet renewal through the introduction of night time noise charges. This action is included in the approved Dublin Airport Noise Action Plan 2019-2023.

13.5.2 Land use Planning and Management

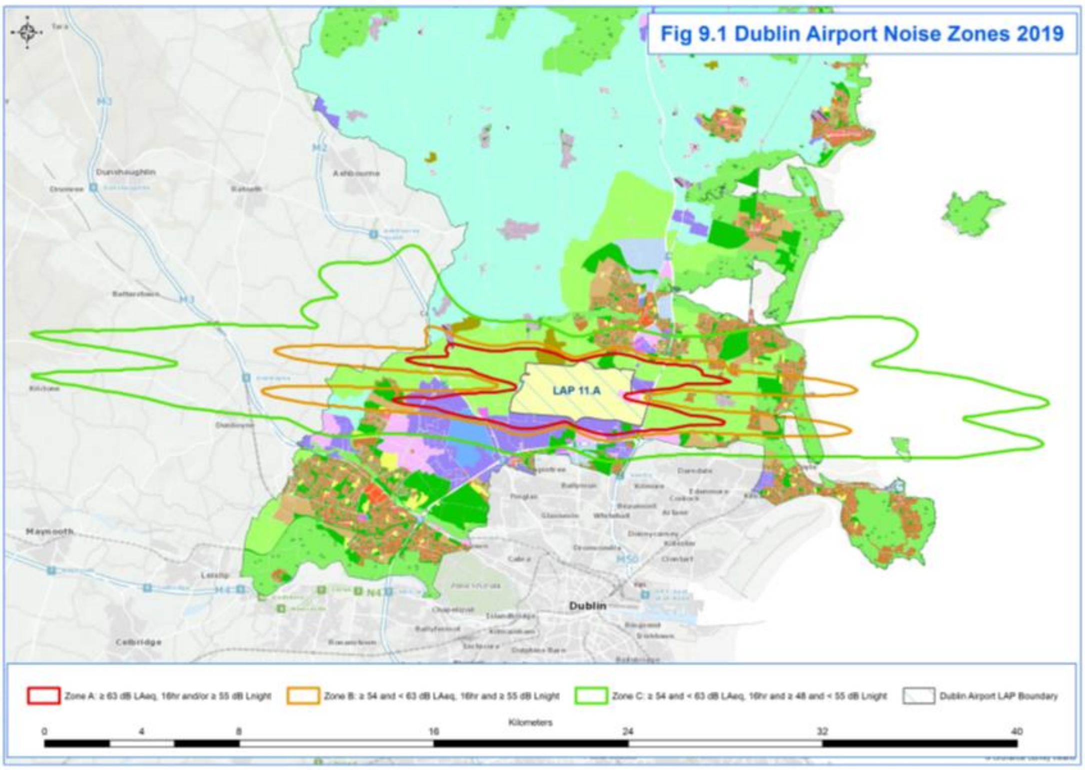
13.5.2.1 Noise Zones

The 2020 Local Area Plan (LAP) includes a dedicated section (section 9.1) to noise. In this section it notes the following. It also includes a figure of the latest Dublin Airport noise zones which is repeated below as Figure 13-6.

"The Dublin Airport LAP is a land use plan for the purposes of effective land-use planning and safeguarding the use of the Airport. Noise zones relating to Dublin Airport have been in place for many years to aid land use planning. Since the publication of previous noise zones in 2005, and over the last decade, further evidence has emerged that has updated understanding of how aircraft noise can affect health and quality of life. With the north runway set to become operational in 2022, updated information is available relating to aircraft noise performance and flight paths. For these reasons, it was considered appropriate to update the noise zones for Dublin Airport to allow for more effective land use planning for development within airport noise zones.

The updated noise zones are set out in Fig. 9.1. Dublin Airport Noise Zones and policies relating to development in Noise Zones are set out in Variation No. 1 to the Fingal Development Plan 2017 - 2023."

Figure 13-6: Extract from Local Area Plan – Noise Zones



The actions to restrict unsuitable development in the noise zones are described in the Fingal Development Plan 2017-2023 Variation No. 1, which states:

"Table 7.2 presents the four aircraft noise zones and the associated objective of each zone along with an indication of the potential noise exposure from operations at Dublin Airport. The zones are based on potential noise exposure levels due to the airport using either the new northern or existing southern runway for arrivals or departures."

Table 7.2 is reproduced below for reference as Table 13-26. The table consider two noise metrics, L_{night} which is one of primary metrics used in this chapter, and $L_{Aeq,16hr}$ which is one of the supplementary noise metrics. Due to the distribution of flights across the day, evening and night periods at larger airports the noise exposure expressed using the $L_{Aeq,16hr}$ metric is typically 2 dB lower than if it is expressed using the L_{den} metric, the primary metric used in this chapter.

Table 13-26: Extract from Fingal Development Plan 2017-2023 (Table 7.2)

Zone	*Indication of Potential Noise Exposure during Airport Operations*	***Objective***
D	≥ 50 and < 54 dB $L_{Aeq,16hr}$ and ≥ 40 and < 48 dB L_{night}	To identify noise sensitive developments which could potentially be affected by aircraft noise and to identify any larger residential developments in the vicinity of the flight paths serving the Airport in order to promote appropriate land use and to identify encroachment. All noise sensitive development within this zone is likely to be acceptable from a noise perspective. An associated application would not normally be refused on noise grounds, however where the development is residential-led and comprises non-residential noise sensitive uses, or comprises 50 residential units or more, it may be necessary for the applicant to demonstrate that a good acoustic design has been followed. Applicants are advised to seek expert advice.
C	≥ 54 and < 63 dB $L_{Aeq,16hr}$ and ≥ 48 and < 55 dB L_{night}	To manage noise sensitive development in areas where aircraft noise may give rise to annoyance and sleep disturbance, and to ensure, where appropriate, noise insulation is incorporated within the development Noise sensitive development in this zone is less suitable from a noise perspective than in Zone D. A noise assessment must be undertaken in order to demonstrate good acoustic design has been followed. The noise assessment must demonstrate that relevant internal noise guidelines will be met. This may require noise insulation measures. An external amenity area noise assessment must be undertaken where external amenity space is intrinsic to the development's design. This assessment should make specific consideration of the acoustic environment within those spaces as required so that they can be enjoyed as intended. Ideally, noise levels in external amenity spaces should be designed to achieve the lowest practicable noise levels. Applicants are strongly advised to seek expert advice.
B	≥ 54 and < 63 dB $L_{Aeq,16hr}$ and ≥ 55 dB L_{night}	To manage noise sensitive development in areas where aircraft noise may give rise to annoyance and sleep disturbance, and to ensure noise insulation is incorporated within the development. Noise sensitive development in this zone is less suitable from a noise perspective than in Zone C. A noise assessment must be undertaken in order to demonstrate good acoustic design has been followed. Appropriate well-designed noise insulation measures must be incorporated into the development in order to meet relevant internal noise guidelines. An external amenity area noise assessment must be undertaken where external amenity space is intrinsic to the developments design. This assessment should make specific consideration of the acoustic environment within those spaces as required so that they can be enjoyed as intended. Ideally, noise levels in external amenity spaces should be designed to achieve the lowest practicable noise levels. Applicants must seek expert advice.
A	≥ 63 dB $L_{Aeq,16hr}$	To resist new provision for residential development and other noise sensitive uses.

and/or ≥ 55 dB L_{night}	All noise sensitive developments within this zone may potentially be exposed to high levels of aircraft noise, which may be harmful to health or otherwise unacceptable. The provision of new noise sensitive developments will be resisted

Notes:

- 'Good Acoustic Design' means following the principles of assessment and design as described in ProPG: Planning & Noise – New Residential Development, May 2017;
- Internal and External Amenity and the design of noise insulation measures should follow the guidance provided in British Standard BS8233:2014 'Guidance on sound insulation and noise reduction for buildings'

13.5.2.2 Residential Sound Insulation Schemes

Dublin Airport operates an insulation scheme for dwellings exposed to 63 dB $L_{Aeq,16h}$ or greater. There are two separate schemes; a one-off voluntary scheme based on 2016 exposure, and a scheme required by the North Runway Permission based on the forecast traffic in 2022. The 63 dB $L_{Aeq,16h}$ contour eligibility as part of the North Runway scheme will be reviewed every two years following the opening of the North Runway as required by the planning conditions.

Dublin Airport takes responsibility for the full implementation of the insulation programmes, from initial survey through to quality assessment after installation works. The assessments have included noise measurements of the overall improvement from the works, and these have found improvements in internal noise levels of at least 5 dB.

Over 200 local residences are currently eligible for insulation under the two schemes.

13.5.2.3 Schools Sound Insulation Scheme

A voluntary insulation scheme is on offer for all schools and registered pre-schools which fall within the predicted 60 dB $L_{Aeq,16h}$ contour. The scheme is designed so maximum noise levels within classrooms and school buildings do not exceed 45 dB L_{Aeq} over 8 hours (a typical school day) after insulation measures are undertaken.

The following schools and pre-schools were specified in the North Runway planning permission and have all been contacted in relation to the insulation scheme:

- Mary Queen of Ireland, Rivermeade
- Little Moo Moo's Pre-School
- St. Margaret's National School
- Nzone Creche & Pre-School
- St Nicholas of Myra NS
- Portmarnock Community School

Following acoustic testing it was determined that 2 of these schools (Portmarnock Community School & Mary Queen of Ireland, Rivermeade) did not exceed the 45 dB threshold and thus no works were required at these schools.

13.5.2.4 Dwelling Purchase Scheme

Following extensive engagement with eligible dwelling owners, their representatives, and the Planning Authority and its advisors, several significant enhancements were made to the draft Voluntary Dwelling Purchase Scheme, and it received approval in 2016. Eligibility for the Scheme is based on the predicted 69 dB $L_{Aeq,16h}$ contour.

Although just five dwellings are located in this contour, daa has voluntarily extended participation in the Scheme to a further 33 dwellings, thus honouring earlier commitments and having regard to the contours used in the original planning application.

The Scheme is completely voluntary and places no obligation on any resident to participate. Offers to purchase will include a 30% premium on the current market value of the residence. Property valuations will be based on operations at Dublin Airport and prior to the North Runway being in place.

Eligible homeowners can have their property independently valued at daa's cost, and daa will also provide allowances in relation to conveyancing fees, stamp duty, tax advice and moving costs.

The Scheme will remain available for three years after the North Runway becomes operational, and homeowners are also eligible to participate in the Voluntary Residential Noise Insulation Scheme.

This Voluntary Dwelling Purchase Scheme compares very favourably to those at other airports such as Heathrow and Gatwick in the UK.

13.5.3 Operational Procedures

Along with airport stakeholders, Dublin Airport have implemented a range of operational procedures to minimise noise. These include:

- Noise Preferential Runway usage: aircraft must use the preferred runway under specific conditions and time of day/night. These are selected for noise abatement purposes, the intent being to utilise whenever possible the runways which enable aircraft to avoid noise-sensitive areas during the initial departure and final approach phases of flight.
- Environmental Noise Corridors: aircraft must stay within designated noise corridors on arrival and departure to minimise noise impact.
- Noise Abatement Procedures: these are specific rules on how aircraft should perform take-off climbs to ensure that noise is minimised.
- Continuous Descent Approach: this reduces the noise experienced on the ground by reducing the overall thrust required during the initial descent and keeping aircraft at higher altitudes for longer.
- Reverse thrust is not permitted at night, unless required for safety reasons.
- There are limitations on the use of the crosswind runway.
- Once the North Runway is operational, Dublin Airport will be operated using “Option 7b” during the daytime (07:00-23:00). This is a mode of operation which uses the concept of a preferred runway to lessen the impact of aircraft noise on local communities. In general this means that departures to the west will use the North Runway, and departures to the east will use the South Runway, with arrivals using the opposite runway to departures.

13.5.4 Operating Restrictions

The relevant operating restrictions are detailed in Conditions 3(d) and 5 relating to the North Runway Permission, as described in Section 12.1.

13.6 Assessment of Effects and Significance

13.6.1 Effects During Operation with Proposed Relevant Action

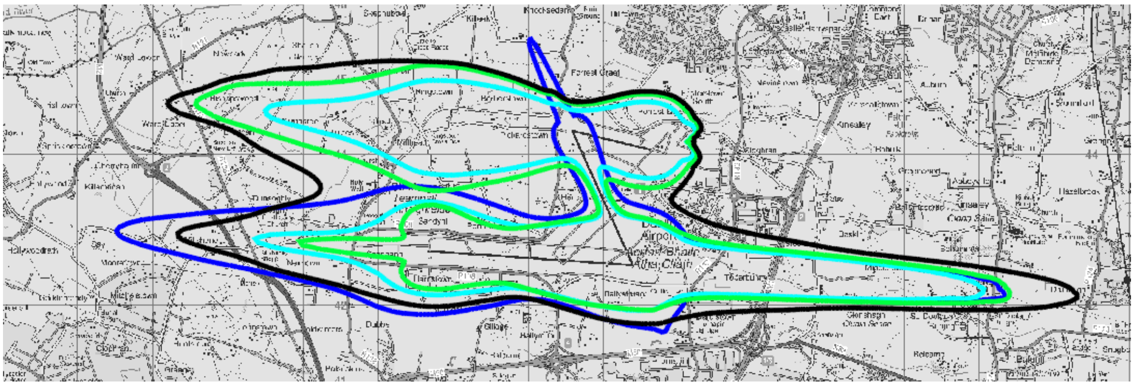
13.6.1.1 Opening Year 2022 L_{den} Metric

Noise contours have been produced for the primary assessment metric of L_{den} using the methodology described in Section 0. For the 2022 Relevant Action scenario these are based on forecast aircraft movements without Conditions 3(d) and 5 of the North Runway Permission, and with the proposed replacement measures in place. Due to the profound impact on the aviation industry worldwide of the Covid-19 pandemic, activity is forecast to be less than 32 mppa by 2022, so the presence of Condition 3 of the Terminal 2 Permission (which limits Dublin Airport to 32 mppa) has no effect.

Appendix 13C presents the resulting noise contours for each scenario. Figure 13-7 shows the noise contours representing a high impact, 65 dB L_{den}, for the 2022 Relevant Action scenario.

Considering past activity the 2018 Baseline scenario is presented for comparison. Considering the future situation the 2022 Baseline scenario is presented for comparison, as well as the 2025 Consented scenario.

Figure 13-7: 65 dB L_{den} Noise Contours, 2022 Relevant Action (green), 2018 Baseline (blue), 2022 Baseline (cyan) and 2025 Consented (black)



The 2022 Relevant Action 65 dB Lden contour (green) does not reach as far west as the 2018 or 2022 Baseline contours in line with the south runway, not reaching Killshane Bridge, and is very similar to the 2018 Baseline contour to the east, reaching St Doolaghs. In line with the North Runway, the contour extends further than the 2022 Baseline to Ward Upper to the west and barely leaves the airport site to the east. The exposure from the crosswind runway does not leave the airport site.

The 2022 Relevant Action 65 dB L_{den} contour (green) lies within the corresponding 2025 Consented contour (black) at all locations.

To provide further information on changes in the noise environment for specific communities, predictions have also been undertaken of the noise levels at a number of representative locations which are shown on Figure 13-4. The results of these predictions for the 2022 Relevant Action scenario in terms of the L_{den} metric are given in Table 13-27, where they are compared with the 2018, 2022 Baseline and 2025 Consented scenarios.

Table 13-27: 2022 Relevant Action Noise levels at Representative Locations (L_{den})

Representative Location	*Reference No.*	*Noise Level, dB (L_{den})*			
		2022 Relevant Action	*Difference to 2018 Baseline*	*Difference to 2022 Baseline*	*Difference to 2025 Consented*
Tyrellstown, Toberburr	AR01	55	+4	+2	-2
Ridgewood	AR02	59	+7	+2	-1
Swords	AR03	50	+3	+1	-2
Malahide Castle	AR04	45	0	-1	-4
Portmarnock N	AR05	49	+1	0	-3
Portmarnock S	AR06	56	+1	+1	-1
Malahide S	AR07	51	+1	0	-4
St Doolaghs	AR08	65	0	+1	-1
Darndale Park	AR09	54	+1	+1	-2
The Baskins	AR10	58	+1	+1	-2
Mayeston Hall	AR11	53	-4	-1	-3
Kilshane Cross	AR12	63	-5	-2	-4
St Margret's	AR13	63	+1	+1	-3
Ashbourne	AR14	48	+1	+1	-1
Dunboyne	AR15	51	-2	0	-3
Ongar	AR16	48	-3	0	-2
Mount Garrett	AR17	54	-6	-3	-4
Beaumont	AR18	49	-5	+1	-2

Note – values rounded to nearest whole number. Differences based on unrounded values.

Comparing the 2022 Relevant Action scenario to the 2018 Baseline, receptors close to flight paths to the west of the existing South Runway or close to flight paths from the crosswind runway, for example Kilshane Cross (#12) or Beaumont (#18), are forecast to see reductions in noise level, whereas the opposite is true for receptors closer to flight paths from the North Runway, for example Swords (#3). Receptors to the east of the airport, such as Malahide (#7) or St Doolaghs (#8), see no change or an increase of 1 dB(A).

Comparing the 2022 Relevant Action scenario to the 2022 Baseline, most receptors see an increase in noise level of around 1 dB(A) or no change, although receptors close to flight paths to the west of the existing South Runway, such as Kilshane Cross (#12) and Mount Garrett (#17), see reductions.

Comparing the 2022 Relevant Action scenario to the 2025 Consented, all receptors are forecast to be quieter in the 2022 Relevant Action scenario, by 1-4 dB.

For the 2022 Relevant Action L_{den} contours, the number of dwellings and the estimated population that they contain have been determined. This has been done based on the existing dwellings and population excluding consented developments, and also based on the existing dwellings and population allowing for consented developments and land zoned for residential development. The results are given by contour in Table 13-28 along with the areas of the contours.

Table 13-28: Areas, number of dwellings and population in 2022 Relevant Action Lden contours

Scenario	*2022 Relevant Action*				
Contour L_{den}	*Area (km²)*	*Excluding Consented Developments*		*Including Consented Developments*	
		Dwellings	*Population.*	*Dwellings*	*Population*
45	742.4	154,877	458,833	166,369	494,941
50	221.3	36,196	107,643	43,956	131,498
55	93.2	8,360	23,830	14,308	41,966
60	36.5	1,172	3,207	3,001	8,870
65	13.7	78	227	78	227
70	4.9	10	32	10	32

The World Health Organisation's Environmental Noise Guidelines 2018, as endorsed by the European Commission through Directive 2020/367, provide a method for calculating the number of people highly annoyed by airborne aircraft noise. This aims to give an overall picture of the noise exposure by assessing a percentage of people as being highly annoyed at different noise levels. The number of people assessed to be highly annoyed by this method in the 2022 Relevant Action scenario is given in Table 13-29, where it is compared with the 2018, 2022 Baseline and 2025 Consented scenarios.

Table 13-29: Number of people highly annoyed – 2022 Relevant Action vs Baseline Scenarios

Scenario	***No. People Highly Annoyed***	
	Excluding Consented Developments	***Including Consented Developments***
2022 Relevant Action	69,428	78,534
2018 Baseline	110,234	120,201
2022 Baseline	65,227	74,321
2025 Consented	125,742	136,170

Comparing the 2022 Relevant Action scenario with the 2018 Baseline, the number of people exposed to aircraft noise is forecast to reduce, for all contour levels except 70 dB L_{den}, which increases from 25 to 32 people. Consequently the number of people assessed as highly annoyed by aircraft noise also decreases, specifically by

37% from 110,234 to 69,428. The number of people exposed to at least a high level of noise (i.e. 65 dB L_{den} or above) decreases from 251 to 227 excluding consented developments.

Comparing the 2022 Relevant Action scenario with the 2022 Baseline, the number of people exposed to aircraft noise is forecast to increase, for all contour levels. The number of people assessed as highly annoyed by aircraft noise increases by 6% from 65,227 to 69,428. The number of people exposed to at least a high level of noise (i.e. 65 dB L_{den} or above) increases from 133 to 227 excluding consented developments.

Comparing the 2022 Relevant Action scenario with the 2025 Consented scenario, the number of people exposed to aircraft noise is forecast to be lower in the 2022 Relevant Action scenario, for all contour levels. The number of people assessed as highly annoyed by aircraft noise is lower by 45% with 125,742 in 2025 Consented compared to 69,428 in 2022 Relevant Action. The number of people exposed to at least a high level of noise (i.e. 65 dB L_{den} or above) is lower, with 472 in 2025 Consented compared to 227 in 2022 Relevant Action, excluding consented developments. The reason for the reduction in noise effects, despite an increase in aircraft movements, is that new aircraft now coming into service are quieter than previously forecast. Additionally, some of the louder historic aircraft types used in the 2025 Consented forecast, such as the Hawker Siddeley HS748, have now been largely phased out of service.

When comparing scenarios, it is also important to consider the change in noise level in order to determine significant changes between the scenarios. Section 0, and specifically Table 13-3, set out the method for interpreting the absolute noise level and change in noise level into a magnitude of effect. The 2022 Relevant Action scenario is compared with the 2018 Baseline in Table 13-30, with the 2022 Baseline in Table 13-31, and with the 2025 Consented in Table 13-30. These tables include all people in existing residential receptors who are exposed to at least 45 dB L_{den} in at least one of the scenarios. People who are exposed to negligible absolute noise levels in both scenarios are not assessed as being subject to significant effects and so have not been included.

Table 13-30: Air Noise (L_{den}) People by Magnitude of effect – 2022 Relevant Action vs 2018 Baseline

Magnitude of effect	*No. people with Beneficial Effect*	*No. people with Adverse Effect*
Imperceptible	87,758	149,862
Not Significant	122,499	26,642
Slight	237,034	4,961
Moderate	75,120	7,354
Significant	24,112	7,738
Very Significant	123	633
Profound	0	75

Table 13-31: Air Noise (L_{den}) People by Magnitude of effect – 2022 Relevant Action vs 2022 Baseline

Magnitude of effect	*No. people with Beneficial Effect*	*No. people with Adverse Effect*
Imperceptible	121,209	290,474
Not Significant	10,675	26,822
Slight	950	7,480
Moderate	7,639	1,563
Significant	1,886	95

Very Significant	0	0
Profound	0	0

Table 13-32: Air Noise (L_{den}) People by Magnitude of effect – 2022 Relevant Action vs 2025 Consented

Magnitude of effect	*No. people with Beneficial Effect*	*No. people with Adverse Effect*
Imperceptible	184,865	253
Not Significant	292,084	157
Slight	278,060	0
Moderate	37,097	0
Significant	13,860	0
Very Significant	84	0
Profound	0	0

Going from the 2018 Baseline to the 2022 Relevant Action scenario, 24,235 people are assessed as having at least a significant beneficial effect, and 8,446 people are assessed as having at least a significant adverse effect. However, at the highest effect levels, i.e. very significant and profound, more people have adverse than beneficial effects.

Going from the 2022 Baseline to the 2022 Relevant Action scenario, 1,886 people are assessed as having a significant beneficial effect, and 95 people are assessed as having a significant adverse effect. No people are assessed as having the highest effect levels, i.e. very significant and profound.

Going from the 2025 Consented to the 2022 Relevant Action scenario, 13,944 people are assessed as having a significant beneficial effect, and no people are assessed as having a significant adverse effect.

In addition to the consideration of residential properties, other potential receptors of high sensitivity have been included in this assessment, specifically schools, residential healthcare facilities and places of worship. The numbers of each of these above the thresholds given in Table 13-4 for the 2022 Relevant Action scenario are given in Table 13-33, where they are compared with the 2018, 2022 Baseline and 2025 Consented scenarios.

Table 13-33: Schools, residential healthcare facilities and places of worship in 2022 Relevant Action L_{den} contours

Scenario	***No. Receptors Above Threshold for Medium Absolute Effect***		
	Schools	***Residential Healthcare Facilities***	*Places of Worship*
2022 Relevant Action	10	1	5
2018 Baseline	10	2	6
2022 Baseline	8	1	5
2025 Consented	11	2	6

The number of non-residential receptors exposed to the thresholds given in Table 13-4 is forecast to reduce between the 2018 Baseline and 2022 Relevant Action scenarios. While the number of receptors does increase between the 2022 Baseline and 2022 Relevant Action scenarios the increases for the individual receptors are all less than 3 dB(A) and so are not rated as significant. The number of receptors exposed in the 2022 Relevant Action scenario is lower than the 2025 Consented.

13.6.1.2 Opening Year 2022 L_{night} Metric

Noise contours have been produced for the primary assessment metric of L_{night} using the methodology described in Section 0. For the 2022 Relevant Action scenario these are based on forecast aircraft movements without Conditions 3(d) and 5 of the North Runway Permission, and with the proposed replacement measures in place. Due to the profound impact on the aviation industry worldwide of the Covid-19 pandemic, activity is forecast to be less than 32 mppa by 2022, so the presence of Condition 3 of the Terminal 2 Permission (which limits Dublin Airport to 32 mppa) has no effect.

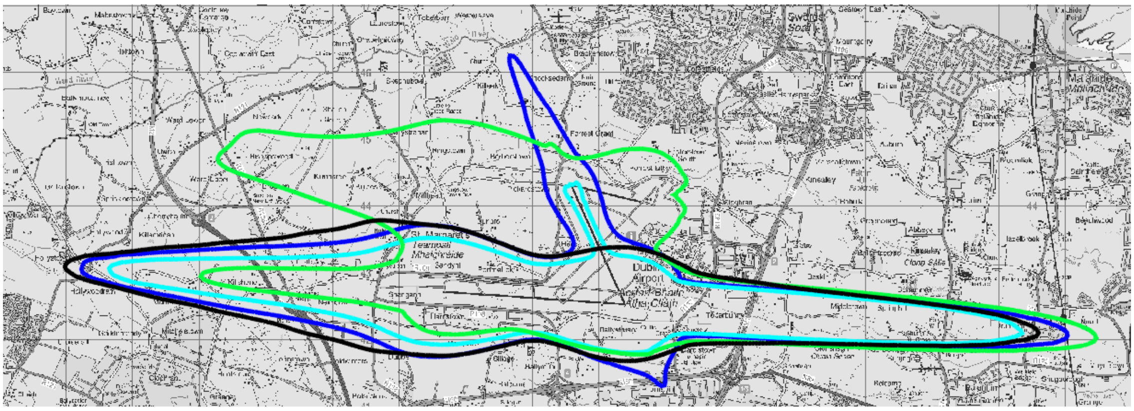
Appendix 13C presents the resulting noise contours for each scenario. Appendix 14C presents the resulting noise contours for each scenario. The noise contours representing a high impact, 55 dB Lnight, do not extend much further than the airport site in the 2022 Relevant Action scenario or any of the Baseline scenarios.

The 2022 Relevant Action noise contours representing a low impact, 45 dB Lnight, are a similar shape to the 2018 Baseline but are larger and shifted slightly to the north. They extend to the west nearly to the R122, to the north into Ridgewood, to the east to just past the M1 and to the south to Santry Demesne.

shows the noise contours representing a high impact, 55 dB L_{night}, for the 2022 Relevant Action scenario.

Considering past activity the 2018 Baseline scenario is presented for comparison. Considering the future situation the 2022 Baseline scenario is presented for comparison, as well as the 2025 Consented scenario.

Figure 13-8: 55 dB L_{night} Noise Contours, 2022 Relevant Action (green), 2018 Baseline (blue), 2022 Baseline (cyan) and 2025 Consented (black)



The 2022 Relevant Action 55 dB L_{night} contour (green) does not extend as far as the 2018, 2022 Baseline or 2025 Consented contours in line with the south runway to the west, reaching Killshane, but extends further to the east, reaching just beyond Drumnigh. In line with the North Runway, the contour extends just beyond Bishopswood to the west and barely leaves the airport site to the east. The exposure from the crosswind runway does not leave the airport site.

To provide further information on changes in the noise environment for specific communities, predictions have also been undertaken of the noise levels at a number of representative locations which are shown on Figure 13-4. The results of these predictions for the 2022 Relevant Action scenario in terms of the L_{night} metric are given in Table 13-34, where they are compared with the 2018, 2022 Baseline and 2025 Consented scenarios.

Table 13-34: 2022 Relevant Action Noise levels at Representative Locations (L_{night})

Representative Location	*Reference No.*	*Baseline Noise Level, dB (L_{night})*			
		2022 Relevant Action	*Difference to 2018 Baseline*	*Difference to 2022 Baseline*	*Difference to 2025 Consented*
Tyrellstown, Toberburr	AR01	46	+3	+7	+1
Ridgewood	AR02	50	+5	+10	+7

Swords	AR03	41	+2	+4	0
Malahide Castle	AR04	37	+1	+2	-1
Portmarnock N	AR05	40	+1	+2	+1
Portmarnock S	AR06	49	+1	+1	+1
Malahide S	AR07	43	+1	+2	0
St Doolaghs	AR08	57	0	+1	+1
Darndale Park	AR09	45	+1	+2	0
The Baskins	AR10	50	+1	+2	0
Mayeston Hall	AR11	45	-3	-1	-3
Kilshane Cross	AR12	57	-2	-2	-4
St Margret's	AR13	55	+1	+3	-1
Ashbourne	AR14	39	+1	+2	0
Dunboyne	AR15	44	-1	0	-3
Ongar	AR16	41	-3	0	0
Mount Garrett	AR17	49	-4	-3	-4
Beaumont	AR18	41	-6	+1	+1

Note – values rounded to nearest whole number. Differences based on unrounded values.

Comparing the 2022 Relevant Action scenario to the 2018 Baseline, receptors close to flight paths to the west of the existing South Runway or close to flight paths from the crosswind runway, for example Kilshane Cross (#12) or Beaumont (#18), are forecast to see reductions in noise level, whereas the opposite is true for receptors close to flight paths from the North Runway, for example Swords (#3).

Comparing the 2022 Relevant Action scenario to the 2022 Baseline, receptors close to flight paths to the west of the existing South Runway, for example Kilshane Cross (#12) or Mount Garrett (#17), see reductions. However receptors closer to flight paths from the North Runway, for example Swords (#3) or Malahide (#7), see increases.

Comparing the 2022 Relevant Action scenario to the 2025 Consented, receptors close to flight paths to the west of the existing South Runway, for example Kilshane Cross (#12) or Mount Garrett (#17), see reductions. However receptors closer to flight paths from the North Runway, for example North Portmarnock (#5), see increases.

For the 2022 Relevant Action L_{night} contours the number of dwellings and the estimated population that they contain have been determined. This has been done based on the existing dwellings and population excluding consented developments, and also based on the existing dwellings and population allowing for consented developments and land zoned for residential development. The results are given by contour in Table 13-35 along with the areas of the contours.

Table 13-35: Areas, number of dwellings and population in 2022 Relevant Action L_{night} contours

Scenario		*2022 Relevant Action*			
Contour L_{night} (dB)	*Area (km^2)*	*Excluding Consented Developments*		*Including Consented Developments*	
		Dwellings	*Population.*	*Dwellings*	*Population*
40	300.9	58,236	173,582	67,810	203,350
45	135.3	15,204	44,013	22,128	65,105
50	52.8	2,441	6,761	6,341	18,722
55	20.3	359	1,152	815	2,643
60	7.0	20	62	20	62

65	2.6	0	0	0	0

The World Health Organisation's Environmental Noise Guidelines 2018, as endorsed by the European Commission through Directive 2020/367, provide a method for calculating the number of people highly sleep disturbed by airborne aircraft noise. This aims to give an overall picture of the noise exposure by assessing a percentage of people as being highly sleep disturbed at different noise levels. The number of people assessed to be highly sleep disturbed by this method in the 2022 Relevant Action scenario is given in Table 13-36, where it is compared with the 2018, 2022 Baseline and 2025 Consented scenarios.

Table 13-36: Number of people highly sleep disturbed – 2022 Relevant Action vs Baseline Scenarios

Scenario	*No. People Highly Sleep Disturbed*	
	Excluding Consented Developments	*Including Consented Developments*
2022 Relevant Action	24,355	29,812
2018 Baseline	42,260	48,062
2022 Baseline	19,690	24,479
2025 Consented	33,207	38,415

Comparing the 2022 Relevant Action scenario with the 2018 Baseline, the number of people exposed to aircraft noise is forecast to reduce at most contour levels but increase at the contour levels of 55 and 60 dB L_{night}. Overall the number of people assessed as highly sleep disturbed by aircraft noise decreases by 42% from 42,260 to 24,355. However, the number of people exposed to at least a high level of noise (i.e. 55 dB L_{night} or above) increases from 753 to 1,152 excluding consented developments.

Comparing the 2022 Relevant Action scenario with the 2022 Baseline, the number of people exposed to aircraft noise is forecast to increase, for all contour levels. Consequently, the number of people assessed as highly sleep disturbed by aircraft noise also increases, specifically by 24% from 19,690 to 24,355. The number of people exposed to at least a high level of noise (i.e. 55 dB L_{night} or above) increases from 284 to 1,152 excluding consented developments.

Comparing the 2022 Relevant Action scenario with the 2025 Consented scenario, the number of people exposed to aircraft noise is forecast to be lower in the 2022 Relevant Action scenario at most contour levels but higher at the contour level of 55 dB L_{night}. The number of people assessed as highly sleep disturbed by aircraft noise is lower by 27% with 33,207 in 2025 Consented compared to 24,355 in 2022 Relevant Action. The number of people exposed to at least a high level of noise (i.e. 55 dB L_{night} or above) is higher, with 495 in 2025 Consented compared to 1,152 in 2022 Relevant Action, excluding consented developments.

When comparing scenarios, it is also important to consider the change in noise level in order to determine significant changes between the scenarios. Section 0, and specifically Table 13-3, set out the method for interpreting the absolute noise level and change in noise level into a magnitude of effect. The 2022 Relevant Action scenario is compared with the 2018 Baseline in Table 13-37, with the 2022 Baseline in Table 13-38, and with the 2025 Consented in Table 13-39. These tables include all people in existing residential receptors who are exposed to at least 40 dB L_{night} in at least one of the scenarios. People who are exposed to negligible absolute noise levels in both scenarios are assessed as not being subject to significant effects and so have not been included.

Table 13-37: Air Noise (L_{night}) People by Magnitude of effect – 2022 Relevant Action vs 2018 Baseline

Magnitude of effect	*No. people with Beneficial Effect*	*No. people with Adverse Effect*
Imperceptible	20,186	55,542
Not Significant	52,660	23,431
Slight	124,277	5,441

Moderate	29,722	7,366
Significant	9,657	1,184
Very Significant	18	273
Profound	0	85

Table 13-38: Air Noise (L_{night}) People by Magnitude of effect – 2022 Relevant Action vs 2022 Baseline

Magnitude of effect	*No. people with Beneficial Effect*	*No. people with Adverse Effect*
Imperceptible	39,288	77,827
Not Significant	11,244	20,048
Slight	3,006	16,950
Moderate	8,851	5,338
Significant	337	11,124
Very Significant	0	505
Profound	0	106

Table 13-39: Air Noise (L_{night}) People by Magnitude of effect – 2022 Relevant Action vs 2025 Consented

Magnitude of effect	*No. people with Beneficial Effect*	*No. people with Adverse Effect*
Imperceptible	57,534	72,206
Not Significant	32,119	8,101
Slight	46,400	7,880
Moderate	20,085	9,046
Significant	6,570	2,841
Very Significant	82	276
Profound	67	50

Going from the 2018 Baseline to the 2022 Relevant Action scenario, 9,675 people are assessed as having at least a significant beneficial effect, and 1,542 people are assessed as having a significant adverse effect. However, at the highest effect levels, i.e. very significant and profound, more people have adverse than beneficial effects.

Going from the 2022 Baseline to the 2022 Relevant Action scenario, 337 people are assessed as having at least a significant beneficial effect, and 11,735 people are assessed as having at least a significant adverse effect.

Going from the 2022 Baseline to the 2025 Consented scenario, 6,719 people are assessed as having at least a significant beneficial effect, and 3,167 people are assessed as having at least a significant adverse effect. However, at the highest effect levels, i.e. very significant and profound, more people have adverse than beneficial effects.

In addition to the consideration of residential properties, other potential receptors of high sensitivity have been included in this assessment, specifically schools, residential healthcare facilities and places of worship. Of these, only residential healthcare facilities are highly sensitive to noise at night. The numbers of these above the thresholds given in Table 13-4 for the 2022 Relevant Action scenario are given in Table 13-40, where they are compared with the 2018, 2022 Baseline and 2025 Consented scenarios.

Table 13-40: Residential healthcare facilities in 2022 Relevant Action L_{night} contours

Scenario	*No. Residential Healthcare Facilities Above Threshold for Medium Absolute Effect*
2022 Relevant Action	2
2018 Baseline	4
2022 Baseline	2
2025 Consented	2

The number of residential healthcare facilities exposed to the threshold given in Table 13-4 in the 2022 Relevant Action scenario is lower than in the 2018 Baseline scenario, and the same as in the 2022 Baseline and 2025 Consented scenarios. Any increases for the individual receptors are all less than 3 dB(A) and so are not rated as significant.

13.6.1.3 Worst-case Year 2025 L_{den} Metric

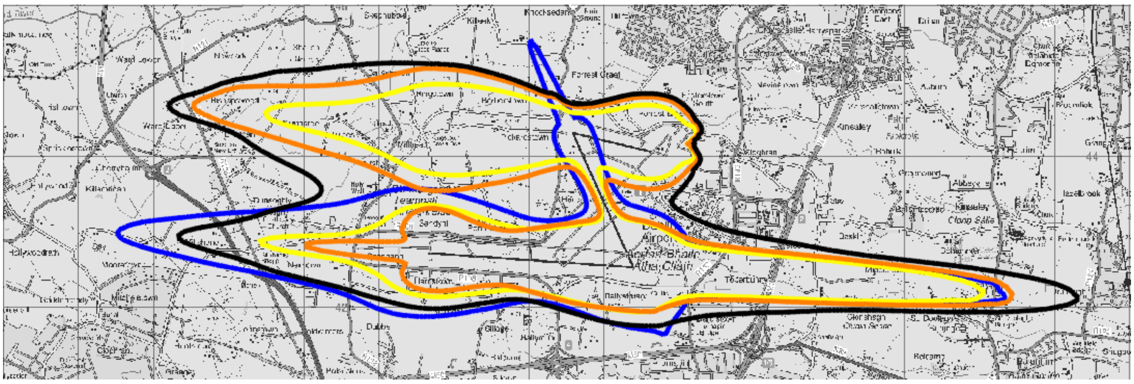
Noise contours have been produced for the primary assessment metric of L_{den} using the methodology described in Section 0. For the 2025 Relevant Action scenario these are based on forecast aircraft movements without Conditions 3(d) and 5 of the North Runway Permission, and with the proposed replacement measures in place. They also assume, based on the available forecasts and hourly runway capacity, that during the peak early morning period of 06:00-08:00, one runway is used for arrivals and the other for departures. As noted earlier depending on the precise timing of flights there may be the need to use both runways during the peak departures period as determined by Air Traffic Control. For westerly operations this is in accordance with mode of operation Option 7b, as Runway 28L would remain the preferred for arriving aircraft.

The proposed Relevant Action relates to operating restrictions arising under Conditions 3(d) and 5 of the planning permission granted for the North Runway. To provide context of the intended effects of these conditions, a comparison is included in this section with the noise impact that was forecast for 2025 when the North Runway permission was given (2025 Consented scenario).

Appendix 13C presents the resulting noise contours for the 2025 Relevant Action scenario. Figure 13-9 shows the noise contours representing a high impact, 65 dB L_{den}, for the 2025 Relevant Action scenario.

Considering past activity the 2018 Baseline scenario is presented for comparison. Considering the future situation the 2025 Baseline scenario is presented for comparison, as well as the 2025 Consented scenario.

Figure 13-9: 65 dB L_{den} Noise Contours, 2025 Relevant Action (orange), 2018 Baseline (blue), 2025 Baseline (yellow) and 2025 Consented (black)



The 2025 Relevant Action 65 dB L_{den} contour (orange) does not reach as far west as the 2018 or 2025 Baseline contours in line with the south runway, not quite reaching Killshane Bridge, and is very similar to the 2018 Baseline contour to the east, reaching St Doolaghs. In line with the North Runway, the contour extends further than the 2025 Baseline to Ward Upper to the west and barely leaves the airport site to the east. The exposure from the crosswind runway does not leave the airport site.

The 2025 Relevant Action 65 dB L_{den} contour (orange) lies within the corresponding 2025 Consented contour (black) at all locations.

To provide further information on changes in the noise environment for specific communities predictions have also been undertaken of the noise levels at a number of representative locations which are shown on Figure 13-4. The results of these predictions for the 2025 Relevant Action situation in terms of the L_{den} metric are given in Table 13-41, where they are compared with the 2018, 2025 Baseline and 2025 Consented scenarios.

Table 13-41: 2025 Relevant Action Noise levels at Representative Locations (L_{den})

Representative Location	*Reference No.*	*Noise Level, dB (L_{den})*			
		2025 Relevant Action	*Difference to 2018 Baseline*	*Difference to 2025 Baseline*	*Difference to 2025 Consented*
Tyrellstown, Toberburr	AR01	54	+4	+2	-2
Ridgewood	AR02	59	+6	+2	-1
Swords	AR03	49	+3	+1	-2
Malahide Castle	AR04	45	0	0	-4
Portmarnock N	AR05	49	+1	0	-3
Portmarnock S	AR06	56	+1	+1	-1
Malahide S	AR07	51	+1	0	-4
St Doolaghs	AR08	65	0	+1	-1
Darndale Park	AR09	54	+1	+1	-2
The Baskins	AR10	58	+1	+1	-2
Mayeston Hall	AR11	53	-4	-1	-3
Kilshane Cross	AR12	62	-5	-2	-4
St Margret's	AR13	63	+1	+1	-3
Ashbourne	AR14	48	+1	+1	-1
Dunboyne	AR15	51	-2	0	-3
Ongar	AR16	48	-3	0	-2
Mount Garrett	AR17	54	-7	-3	-4
Beaumont	AR18	49	-5	+1	-2

Note – values rounded to nearest whole number. Differences based on unrounded values.

Comparing the 2025 Relevant Action scenario to the 2018 Baseline, receptors close to flight paths to the west of the existing South Runway or close to flight paths from the crosswind runway, for example Kilshane Cross (#12) or Beaumont (#18), are forecast to see reductions in noise level, whereas the opposite is true for receptors closer to flight paths from the North Runway, for example Swords (#3). Receptors to the east of the airport, such as Malahide (#7) or St Doolaghs (#8), see an increase of 0-1 dB(A).

Comparing the 2025 Relevant Action scenario to the 2025 Baseline, most receptors see an increase in noise level of around 1 dB(A), although receptors close to flight paths to the west of the existing South Runway, such as Kilshane Cross (#12) and Mount Garrett (#17), see reductions.

Comparing the 2025 Relevant Action scenario to the 2025 Consented, all receptors are forecast to be quieter in the 2025 Relevant Action scenario, by 1-4 dB.

For the 2025 Relevant Action L_{den} contours, the number of dwellings and the estimated population that they contain have been determined. This has been done based on the existing dwellings and population excluding consented developments, and also based on the existing dwellings and population allowing for consented developments and land zoned for residential development. The results are given by contour in Table 13-42 along with the areas of the contours.

Table 13-42: Areas, number of dwellings and population in 2025 Relevant Action Lden contours

Scenario		*2025 Relevant Action*			
Contour L_{den}	*Area (km²)*	*Excluding Consented Developments*		*Including Consented Developments*	
		Dwellings	*Population.*	*Dwellings*	*Population*
45	737.5	151,229	448,076	162,701	484,131
50	220.3	35,276	104,907	43,127	129,029
55	92.8	8,125	23,171	14,027	41,133
60	36.3	1,193	3,247	3,022	8,910
65	13.5	75	218	75	218
70	4.9	10	32	10	32

The World Health Organisation's Environmental Noise Guidelines 2018, as endorsed by the European Commission through Directive 2020/367, provide a method for calculating the number of people highly annoyed by airborne aircraft noise. This aims to give an overall picture of the noise exposure by assessing a percentage of people as being highly annoyed at different noise levels. The number of people assessed to be highly annoyed by this method in the 2025 Relevant Action scenario is given in Table 13-43, where it is compared with the 2018, 2025 Baseline and 2025 Consented scenarios.

Table 13-43: Number of people highly annoyed – 2025 Relevant Action vs Baseline Scenarios

Scenario	***No. People Highly Annoyed***	
	Excluding Consented Developments	***Including Consented Developments***
2025 Relevant Action	67,760	76,809
2018 Baseline	110,234	120,201
2025 Baseline	63,316	72,337
2025 Consented	125,742	136,170

Comparing the 2025 Relevant Action scenario with the 2018 Baseline, the number of people exposed to aircraft noise is forecast to reduce at lower contour levels but increase at higher contour levels. Overall the number of people assessed as highly annoyed by aircraft noise decreases by 39% from 110,234 to 67,760. The number of people exposed to at least a high level of noise (i.e. 65 dB L_{den} or above) decreases from 251 to 218 excluding consented developments.

Comparing the 2025 Relevant Action scenario with the 2025 Baseline, the number of people exposed to aircraft noise is forecast to increase for all contour levels. The number of people assessed as highly annoyed by aircraft noise increases by 7% from 63,316 to 67,760. The number of people exposed to at least a high level of noise (i.e. 65 dB L_{den} or above) increases from 128 to 218, excluding consented developments.

Comparing the 2025 Relevant Action scenario with the 2025 Consented scenario, the number of people exposed to aircraft noise is forecast to be lower in the 2025 Relevant Action scenario, for all contour levels. The number of people assessed as highly annoyed by aircraft noise is lower by 46% with 125,742 in 2025 Consented compared to 67,760 in 2025 Relevant Action. The number of people exposed to at least a high level of noise (i.e. 65 dB L_{den} or above) is lower, with 472 in 2025 Consented compared to 218 in 2025 Relevant Action, excluding consented developments.

When comparing scenarios, it is also important to consider the change in noise level in order to determine significant changes between the scenarios. Section 0, and specifically Table 13-3, set out the method for interpreting the absolute noise level and change in noise level into a magnitude of effect. The 2025 Relevant Action scenario is compared with the 2018 Baseline in Table 13-44, with the 2025 Baseline in Table 13-45, and with the 2025 Consented in Table 13-46. These tables include all people in existing residential receptors who are exposed to at least 45 dB L_{den} in at least one of the scenarios. People who are exposed to negligible absolute noise levels in both scenarios are assessed as not being subject to significant effects and so have not been included.

Table 13-44: Air Noise (L_{den}) People by Magnitude of effect – 2025 Relevant Action vs 2018 Baseline

Magnitude of effect	*No. people with Beneficial Effect*	*No. people with Adverse Effect*
Imperceptible	83,073	149,194
Not Significant	113,033	22,193
Slight	252,199	4,699
Moderate	77,652	7,098
Significant	24,571	7,267
Very Significant	134	626
Profound	0	72

Table 13-45: Air Noise (L_{den}) People by Magnitude of effect – 2025 Relevant Action vs 2025 Baseline

Magnitude of effect	*No. people with Beneficial Effect*	*No. people with Adverse Effect*
Imperceptible	114,758	287,948
Not Significant	10,375	26,710
Slight	1,096	5,271
Moderate	7,427	3,466
Significant	2,110	95

Very Significant	0	0
Profound	0	0

Table 13-46: Air Noise (L_{den}) People by Magnitude of effect – 2025 Relevant Action vs 2025 Consented

Magnitude of effect	*No. people with Beneficial Effect*	*No. people with Adverse Effect*
Imperceptible	151,951	198
Not Significant	297,340	54
Slight	303,762	0
Moderate	39,201	0
Significant	13,861	0
Very Significant	94	0
Profound	0	0

Going from the 2018 Baseline to the 2025 Relevant Action scenario, 24,705 people are assessed as having at least a significant beneficial effect, and 7,965 people are assessed as having at least a significant adverse effect. However, at the highest effect levels, i.e. very significant and profound, more people have adverse than beneficial effects.

Going from the 2025 Baseline to the 2025 Relevant Action scenario, 2,110 people are assessed as having a significant beneficial effect, and 95 people are assessed as having a significant adverse effect. No people are assessed as having the highest effect levels, i.e. very significant and profound.

Going from the 2025 Consented to the 2025 Relevant Action scenario, 13,955 people are assessed as having a significant beneficial effect, and no people are assessed as having a significant adverse effect.

In addition to the consideration of residential properties, other potential receptors of high sensitivity have been included in this assessment, specifically schools, residential healthcare facilities and places of worship. The numbers of each of these above the thresholds given in Table 13-4 for the 2025 Relevant Action scenario are given in Table 13-47, where they are compared with the 2018, 2025 Baseline and 2025 Consented scenarios.

Table 13-47: Schools, residential healthcare facilities and places of worship in 2025 Relevant Action L_{den} contours

Scenario	***No. Receptors Above Threshold for Medium Absolute Effect***		
	Schools	***Residential Healthcare Facilities***	***Places of Worship***
2025 Relevant Action	10	1	5
2018 Baseline	10	2	6
2025 Baseline	8	1	5
2025 Consented	11	2	6

The number of non-residential receptors exposed to the thresholds given in Table 13-4 is forecast to reduce between the 2018 Baseline and 2025 Relevant Action scenarios. While the number of receptors does increase between the 2025 Baseline and 2025 Relevant Action scenarios the increases for the individual receptors are all less than 3 dB(A) and so are not rated as significant. The number of receptors exposed in the 2025 Relevant Action scenario is lower than the 2025 Consented.

13.6.1.4 Worst-case Year 2025 L_{night} Metric

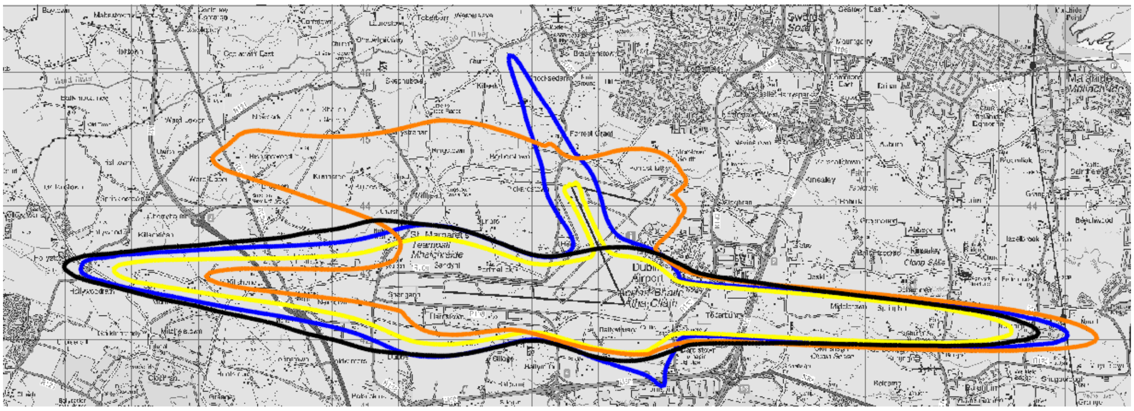
Noise contours have been produced for the primary assessment metric of L_{night} using the methodology described in Section 0. For the 2025 Relevant Action scenario these are based on forecast aircraft movements without Conditions 3(d) and 5 of the North Runway Permission, and with the proposed replacement measures in place. They also assume, based on hourly runway capacity, that during the early morning period 06:00-08:00 one runway is used for arrivals and the other for departures. As noted earlier depending on the precise timing of flights there may be the need to use both runways during the peak departures period as determined by Air Traffic Control. For westerly operations this is in accordance with mode of operation Option 7b, as Runway 28L would remain the preferred for arriving aircraft.

The Relevant Action relates to operating restrictions arising under Conditions 3(d) and 5 of the planning permission granted for the North Runway. To provide context of the intended effects of these conditions, a comparison is included in this section with the noise impact that was forecast for 2025 when the North Runway permission was given (2025 Consented scenario).

Appendix 13C presents the resulting noise contours for the 2025 Relevant Action scenario. Figure 13-10 shows the noise contours representing a high impact, 55 dB L_{night}, for the 2025 Relevant Action scenario.

Considering past activity the 2018 Baseline scenario is presented for comparison. Considering the future situation the 2025 Baseline scenario is presented for comparison, as well as the 2025 Consented scenario.

Figure 13-10: 55 dB L_{night} Noise Contours, 2025 Relevant Action (orange), 2018 Baseline (blue), 2025 Baseline (yellow) and 2025 Consented (black)



The 2025 Relevant Action 55 dB L_{night} contour (orange) does not extend as far as the 2018, 2025 Baseline or 2025 Consented contours in line with the south runway to the west, reaching just past Killshane, but extends further to the east, reaching just beyond Drumnigh. In line with the North Runway, the contour extends to Ward Upper to the west and barely leaves the airport site to the east. The exposure from the crosswind runway does not leave the airport site.

To provide further information on changes in the noise environment for specific communities predictions have also been undertaken of the noise levels at a number of representative locations which are shown on Figure 13-4. The results of these predictions for the 2025 Relevant Action situation in terms of the L_{night} metric are given in Table 13-48, where they are compared with the 2018, 2025 Baseline and 2025 Consented scenarios.

Table 13-48: 2025 Relevant Action Noise levels at Representative Locations (L_{night})

Representative Location	*Reference No.*	*Noise Level, dB (L_{night})*

		2025 Relevant Action	Difference to 2018 Baseline	Difference to 2025 Baseline	Difference to 2025 Consented
Tyrellstown, Toberburr	AR01	46	+3	+7	+1
Ridgewood	AR02	50	+5	+10	+7
Swords	AR03	41	+2	+5	0
Malahide Castle	AR04	37	+1	+2	-1
Portmarnock N	AR05	40	+1	+2	+1
Portmarnock S	AR06	49	+1	+2	+1
Malahide S	AR07	43	+1	+2	0
St Doolaghs	AR08	57	0	+1	+1
Darndale Park	AR09	45	+1	+2	0
The Baskins	AR10	50	+1	+2	0
Mayeston Hall	AR11	45	-3	-1	-3
Kilshane Cross	AR12	57	-2	-2	-4
St Margret's	AR13	55	+1	+3	-1
Ashbourne	AR14	39	+1	+2	0
Dunboyne	AR15	44	-1	0	-3
Ongar	AR16	41	-3	0	0
Mount Garrett	AR17	48	-4	-3	-4
Beaumont	AR18	41	-6	+1	+1

Note – values rounded to nearest whole number. Differences based on unrounded values.

Comparing the 2025 Relevant Action scenario to the 2018 Baseline, receptors close to flight paths to the west of the existing South Runway or close to flight paths from the crosswind runway, for example Kilshane Cross (#12) or Beaumont (#18), are forecast to see reductions in noise level, whereas the opposite is true for receptors closer to flight paths from the North Runway, for example Swords (#3).

Comparing the 2025 Relevant Action scenario to the 2025 Baseline, receptors close to flight paths to the west of the existing South Runway, for example Kilshane Cross (#12) or Mount Garrett (#17), see reductions. However receptors closer to flight paths from the North Runway, for example Swords (#3) or Malahide (#7), see increases.

Comparing the 2025 Relevant Action scenario to the 2025 Consented, receptors close to flight paths to the west of the existing South Runway, for example Kilshane Cross (#12) or Mount Garrett (#17), see reductions. However receptors closer to flight paths from the North Runway, for example North Portmarnock (#5), see increases.

For the 2025 Relevant Action L_{night} contours the number of dwellings and the estimated population that they contain have been determined. This has been done based on the existing dwellings and population excluding consented developments, and also based on the existing dwellings and population allowing for consented developments and land zoned for residential development. The results are given by contour in Table 13-49 along with the areas of the contours.

Table 13-49: Areas, number of dwellings and population in 2025 Relevant Action L_{night} contours

Scenario		*2025 Relevant Action*			
Contour L_{night} (dB)	*Area (km²)*	*Excluding Consented Developments*		*Including Consented Developments*	
		Dwellings	*Population.*	*Dwellings*	*Population*
40	302.0	58,554	174,473	68,050	203,977
45	135.6	15,161	43,855	22,085	64,947

50	52.7	2,433	6,729	6,245	18,358
55	20.3	360	1,157	916	2,948
60	7.0	20	62	20	62
65	2.6	0	0	0	0

The World Health Organisation's Environmental Noise Guidelines 2018, as endorsed by the European Commission through Directive 2020/367, provide a method for calculating the number of people highly sleep disturbed by airborne aircraft noise. This aims to give an overall picture of the noise exposure by assessing a percentage of people as being highly sleep disturbed at different noise levels. The number of people assessed to be highly sleep disturbed by this method in the 2025 Relevant Action scenario is given in Table 13-50, where it is compared with the 2018, 2025 Baseline and 2025 Consented scenarios.

Table 13-50: Number of people highly sleep disturbed – 2025 Relevant Action vs Baseline Scenarios

Scenario	*No. People Highly Sleep Disturbed*	
	Excluding Consented Developments	*Including Consented Developments*
2025 Relevant Action	24,456	29,869
2018 Baseline	42,260	48,062
2025 Baseline	19,464	24,270
2025 Consented	33,207	38,415

Comparing the 2025 Relevant Action scenario with the 2018 Baseline, the number of people exposed to aircraft noise is forecast to reduce at most contour levels but increase at the contour levels of 55 and 60 dB L_{night}. Overall, the number of people assessed as highly sleep disturbed by aircraft noise decreases by 42% from 42,260 to 24,456. However, the number of people exposed to at least a high level of noise (i.e. 55 dB L_{night} or above) increases from 753 to 1,157 excluding consented developments.

Comparing the 2025 Relevant Action scenario with the 2025 Baseline, the number of people exposed to aircraft noise is forecast to increase, for all contour levels. Consequently, the number of people assessed as highly sleep disturbed by aircraft noise increases by 26% from 19,464 to 24,456. The number of people exposed to at least a high level of noise (i.e. 55 dB L_{night} or above) increases from 281 to 1,157 excluding consented developments.

Comparing the 2025 Relevant Action scenario with the 2025 Consented scenario, the number of people exposed to aircraft noise is now forecast to be lower in the 2025 Relevant Action scenario at most contour levels but be higher at the contour level of 55 dB L_{night}. The number of people assessed as highly sleep disturbed by aircraft noise is lower by 26% with 33,207 in 2025 Consented compared to 24,456 in 2025 Relevant Action. The number of people exposed to at least a high level of noise (i.e. 55 dB L_{night} or above) is higher, with 495 in 2025 Consented compared to 1,157 in 2025 Relevant Action, excluding consented developments.

When comparing scenarios, it is also important to consider the change in noise level in order to determine significant changes between the scenarios. Section 0, and specifically Table 13-3, set out the method for interpreting the absolute noise level and change in noise level into a magnitude of effect. The 2025 Relevant Action scenario is compared with the 2018 Baseline in Table 13-51, with the 2025 Baseline in Table 13-52, and with the 2025 Consented in Table 13-53. These tables include all people in existing residential receptors who are exposed to at least 40 dB L_{night} in at least one of the scenarios. People who are exposed to negligible absolute noise levels in both scenarios are assessed as not being subject to significant effects and so have not been included.

Table 13-51: Air Noise (L_{night}) People by Magnitude of effect – 2025 Relevant Action vs 2018 Baseline

Magnitude of effect	*No. people with Beneficial Effect*	*No. people with Adverse Effect*
Imperceptible	20,474	55,853

Not Significant	52,945	23,412
Slight	124,243	5,422
Moderate	29,321	7,514
Significant	9,691	1,187
Very Significant	18	278
Profound	0	85

Table 13-52: Air Noise (L_{night}) People by Magnitude of effect – 2025 Relevant Action vs 2025 Baseline

Magnitude of effect	*No. people with Beneficial Effect*	*No. people with Adverse Effect*
Imperceptible	38,939	78,412
Not Significant	10,804	20,128
Slight	2,485	17,632
Moderate	9,030	5,694
Significant	425	11,166
Very Significant	0	505
Profound	0	112

Table 13-53: Air Noise (L_{night}) People by Magnitude of effect – 2025 Relevant Action vs 2025 Consented

Magnitude of effect	*No. people with Beneficial Effect*	*No. people with Adverse Effect*
Imperceptible	59,358	72,942
Not Significant	29,961	8,015
Slight	46,485	7,983
Moderate	19,711	9,163
Significant	6,713	2,855
Very Significant	80	279
Profound	72	53

Going from the 2018 Baseline to the 2025 Relevant Action scenario, 9,709 people are assessed as having at least a significant beneficial effect, and 1,551 people are assessed as having a significant adverse effect. However, at the highest effect levels, i.e. very significant and profound, more people have adverse than beneficial effects.

Going from the 2025 Baseline to the 2025 Relevant Action scenario, 425 people are assessed as having a significant beneficial effect, and 11,783 people are assessed as having a significant adverse effect.

Going from the 2025 Consented to the 2025 Relevant Action scenario, 6,865 people are assessed as having a significant beneficial effect, and 3,187 people are assessed as having a significant adverse effect. However, at the highest effect levels, i.e. very significant and profound, more people have adverse than beneficial effects.

In addition to the consideration of residential properties, other potential receptors of high sensitivity have been included in this assessment, specifically schools, residential healthcare facilities and places of worship. Of these, only residential healthcare facilities are highly sensitive to noise at night. The numbers of these above the thresholds given in Table 13-4 for the 2025 Relevant Action scenario are given in Table 13-54, where they are compared with the 2018, 2025 Baseline and 2025 Consented scenarios.

Table 13-54: Residential healthcare facilities in 2025 Relevant Action L_{night} contours

Scenario	*No. Residential Healthcare Facilities Above Threshold for Medium Absolute Effect*
2025 Relevant Action	2
2018 Baseline	4
2025 Baseline	2
2025 Consented	2

The number of residential healthcare facilities exposed to the threshold given in Table 13-4 in the 2025 Relevant Action scenario is lower than in the 2018 Baseline scenario, and the same as in the 2025 Baseline and 2025 Consented scenarios. Any increases for the individual receptors are all less than 3 dB(A) and so are not rated as significant.

13.6.2 Cumulative Noise Effects

A potential consideration would be to assess the cumulative noise effect of the different noise sources, such as air noise assessed in this chapter and ground noise assessed in Chapter 14. By convention, this type of cumulative assessment is not typically carried out, and was not for the Heathrow Cranford Agreement planning application (determined in February 2017) and the Stansted 43 million passengers application (determined in January 2020).

Instead each of the main sources associated with operations at the airport was assessed according to its own character, with specific methodologies applied. Air noise at a given receptor is characterised by a series of relatively loud individual noise events, between which there are periods of relative quiet. It can therefore be audible at large distances from the airport. Conversely ground noise at a given receptor is characterised by lower noise levels which have a longer duration and will vary less over time as it is often due to multiple activities occurring at the same time. It is typically only audible to those closer to the airport boundary.

For these reasons each of the noise sources are dealt with separately and it is not feasible to derive a cumulative noise impact for airport operations. Additionally, combining air and ground noise into a single assessment would have the potential to overlook potential significant effects that may arise for the quieter of the two sources.

13.6.3 Noise Modelling to Inform Vibration Effects

The number of dwellings exceeding the threshold for potential vibration effects due to airborne aircraft, based on experiencing noise levels of at least 97 dB L_{Cmax} at least once per 24 hour day, has been predicted for the 2022 and 2025 Relevant Action scenarios. The results are given in Table 13-55 where they are compared with the results for the Baseline scenarios.

Table 13-55: Number of dwellings exceeding threshold for potential vibration effects due to airborne aircraft, Baseline scenarios

Scenario	*No. dwellings exceeding threshold for potential vibration effects due to airborne aircraft*
2018 Baseline	4
2022 Baseline	0
2025 Baseline	0
2022 Relevant Action	0
2025 Relevant Action	0

In 2018, there were 4 dwellings which experienced noise levels in excess of 97 dB L_{Cmax} at least once per day. These are located to the south of Old Airport Road, near to the eastern end of the south runway. No dwellings exceed this threshold in any of the future scenarios. Therefore there are no significant vibration effects predicted.

13.7 Additional Mitigation Measures

13.7.1 Mitigation During Operation of Proposed Relevant Action

In addition to the mitigation measures already in place at Dublin Airport, as part of this application daa are proposing the following:

- An Annual Noise Quota (ANQ) system to replace the limit of 65 flights per night, as described in Chapter 2.
- A preferential runway use system (there is no proposed change to Condition 3a-c of North Runway Permission):
  - The parallel runways (10R-28L and 10L-28R) shall be used in preference to the cross runway, 16-34;
  - When winds are westerly, Runway 28L shall be preferred for arriving aircraft. Either Runway 28L or 28R shall be used for departing aircraft as determined by air traffic control;
  - When winds are easterly, either Runway 10L or 10R as determined by air traffic control shall be preferred for arriving aircraft. Runway 10R shall be preferred for departing aircraft; and
  - Runway 10L-28R shall not be used for take-off or landing between 0000 hours and 0559 hours (except in cases of safety, maintenance considerations, exceptional air traffic conditions, adverse weather, technical faults in air traffic control systems or declared emergencies at other airports or where Runway 10R-28L length is required for a specific aircraft type).
- A night noise insulation scheme.
- A detailed framework for monitoring the noise performance of Dublin Airport.

13.7.1.1 Night Noise Insulation Scheme

The proposed scheme will provide a grant of €20,000 to fund sound insulation improvement works, for dwellings meeting either of the following criteria:

- Forecast to be exposed to night-time noise levels of at least 55 dB L_{night} in the 2025 Relevant Action scenario, or
- Forecast to be exposed to noise levels greater than 50 dB L_{night} in the 2022 Relevant Action scenario, accompanied by an increase of at least 9 dB when compared to 2018.

Eligibility within the 55 dB L_{night} contour will be reviewed every 2 years with revised forecasts.

The proposed night insulation scheme is considered additional to the existing daytime noise insulation scheme currently provided in accordance with Condition 7 of North Runway planning permission.

13.7.1.2 Noise Monitoring Framework

It is proposed to implement a framework for monitoring the noise performance with respect to any Noise Abatement Objective (NAO) set by the Aircraft Noise Competent Authority (ANCA) in due course. Performance will be reported annually to ANCA, in compliance with the relevant sections of the Aircraft Noise (Dublin Airport) Regulation Act 2019.

Performance will be reported for the previous calendar year and for other forecast years depending on the measure (and outlined below), will include, but not be limited to, the following items:

- Effects of aircraft noise:
  - The number of people highly annoyed and highly sleep disturbed by aircraft noise to be calculated using the method set out in EU Directive 2020/367 and reported for the previous calendar year and forecast for 2025.
- Exposure to aircraft noise:
  - Aircraft noise contours and associated area, population and dwelling (and other noise sensitive properties) totals to be produced in 5 dB bands, from 45 dB to 75 dB Lden and 40dB to 70 dB Lnight. For the previous calendar year and forecast for 2025.
- Aircraft Source Noise Measures:
  - As part of the reporting for performance of the proposed Night Quota System, the number of movements and QC will be reported for the previous year and the next year. Annual totals of Air Transport Movements (ATMs) and Quota Count (QC) will be reported, with a breakdown for each of the QC bands (QC0, 0.125, 0.25, 0.5, 1, 2, 4, 8, 16). Data will be provided for the Night Quota Period (NQP, 23:30-06:00) and the Night Period (23:00-07:00).
- Operational Measures:
  - For the previous year calendar year, the number of arriving and departing aircraft and their associated QC totals using each runway during the periods 23:00-00:00, 00:00-06:00 and 06:00-06:59. This will be averaged to indicate “per night” equivalent values. This will also be provided for a monthly breakdown.
- Noise Insulation Scheme Reporting:
  - The number of dwellings eligible and the total grants administered under the proposed night noise insulation scheme to be reported each year.
- Community Noise Reporting:
  - In addition to the requirements for noise reporting specified in Condition 10 of the parent permission. Noise reports will be developed working with ANCA and the local communities to present an overall picture of the airport’s operation and its effects which could include the information above.
  - In consultation with ANCA and local communities, daa will develop a community noise monitoring programme to report specific noise related outcomes from the airport operation.
  - daa will make available noise and flight track information to the local community.
  - The number and nature of noise complaints will be reported monthly and annually.

The historic data for the following metrics are proposed to be reported, for comparison with a baseline year of 2018 that was chosen by daa as part of the candidate NAO.

- The overall number of people exposed to noise >= 55dB L_{den}
- The overall number of people considered highly annoyed.
- The overall number of people exposed to noise >=40dB L_{night}
- The overall number of people considered highly sleep disturbed
- The Area of the contour outlining those exposed to significant levels of noise at night (>55dB L_{night}).

Throughout the reporting described above, where there is a comparison of population or effects with the equivalent for a baseline (e.g. 2018), the population dataset used for deriving the baseline figures will be used consistently for all calculation years.

13.8 Residual Effects

The commonly accepted metrics for assessing air noise all relate to external noise levels. Therefore the assessment of effects presented in Section 13.6 do not allow for any benefit of the residential sound insulation schemes, as this reduces the internal noise level. However, the internal noise level is more representative of the effects, in particular for night noise which is the main focus of this application as most people would be expected to be indoors.

Therefore in order to assess the residual effects, the benefit of the residential sound insulation schemes has been allowed for by considering a residual effective noise level for properties with sound insulation, being 5 dB(A) lower than the modelled noise level.

Dwellings eligible for the existing schemes in a given scenario have been considered here as having a reduction of 5 dB for both their L_{den} and the L_{night} exposure, on the basis that the existing schemes offer to insulate the whole property.

Dwellings not eligible for the existing schemes, but eligible for the new scheme proposed as part of this application, have been considered here as having a reduction of 5 dB for their L_{night} exposure, and a reduction of 5 dB for the night component of their L_{den} exposure, on the basis that the new scheme is intended to cover insulation of bedrooms.

The assumed 5 dB(A) reduction is based on testing carried out in a sample of the properties treated under the existing scheme which found that a reduction of at least 5 dB(A) in the internal noise level has been achieved.

This residual effective noise level has then been used to determine residual effects, following the same methodology as the assessment of effects in Section 13.6.

Allowing for the benefit of the residential sound insulation schemes in general reduces the number of people assessed with residual significant adverse effects and in some cases increases the number of people assessed with residual significant beneficial effects. This analysis does result in a couple of apparent anomalies:

- For some people who have benefitted from the existing insulation scheme, allowing for the insulation scheme reduces an assessed significant beneficial effect to a residual not significant beneficial effect. This is because at lower noise levels a larger change is required to be considered significant, although in practice the people still experience the same reduction in noise but from a lower initial level.
- For some people who would become eligible for the existing insulation scheme based on the noise levels forecast in the 2025 Consented scenario, allowing for the insulation scheme results in a residual significant adverse effect when comparing to the 2022 or 2025 Relevant Action scenarios, despite the external noise level being lower in the Relevant Action scenarios. as due to lower noise levels they are no longer forecast to be eligible for the insulation scheme.

13.8.1 Likely Significant Environmental Effects

The residual effects, after the benefit of the residential sound insulation schemes has been allowed for, are summarised in Table 13-56 and Table 13-57. These tables include all people in existing residential receptors who are exposed to at least 45 dB L_{den} or 40 dB L_{night} in at least one of the scenarios.

Table 13-56: Summary of Residual Air Noise Effects, 2022 Relevant Action

Baseline Scenario	*L_{den} Residual Effects*			*L_{night} Residual Effects*		
	Significant Beneficial	Significant Adverse	Not Significant	Significant Beneficial	Significant Adverse	Not Significant
2018 Baseline	24,223	8,432	711,257	10,436	1,474	317,933
2022 Baseline	1,886	10	467,564	1,039	11,709	181,876
2025 Consented	14,155	116	792,858	7,028	3,152	253,077

Table 13-57: Summary of Residual Air Noise Effects, 2025 Relevant Action

Baseline Scenario	*L_{den} Residual Effects*			*L_{night} Residual Effects*		
	Significant Beneficial	Significant Adverse	Not Significant	Significant Beneficial	Significant Adverse	Not Significant
2018 Baseline	24,699	7,949	709,163	10,485	1,483	318,476
2025 Baseline	2,110	10	457,802	1,125	11,756	182,451
2025 Consented	14,154	119	792,856	7,180	3,172	253,316

Considering the year of opening of the North Runway, 2022, the residual effects of the Relevant Action scenario when compared to the 2018 Baseline are that some people experience significant beneficial effects, and others experience significant adverse effects. The overall result is a net significant beneficial effect for 15,791 people in terms of the L_{den} metric, and a net significant beneficial effect for 8,962 people in terms of the L_{night} metric. If instead comparing with the 2022 Baseline, there is a net significant beneficial effect for 1,876 people in terms of the L_{den} metric and a net significant adverse effect for 10,670 people in terms of the L_{night} metric. Finally, if comparing to the 2025 Consented scenario, there is a net significant beneficial effect for 14,039 people in terms of the L_{den} metric, and a net significant beneficial effect for 3,876 people in terms of the L_{night} metric.

Considering the likely worst-case future year, 2025, the residual effects when compared to the 2018 Baseline are that some people experience significant beneficial effects, and others experience significant adverse effects. The overall result is a net significant beneficial effect for 16,750 people in terms of the L_{den} metric and a net significant beneficial effect for 9,002 people in terms of the L_{night} metric. If instead comparing with the 2025 Baseline, there is a net significant beneficial effect for 2,100 people in terms of the L_{den} metric and a net significant adverse effect for 10,631 people in terms of the L_{night} metric. Finally, if comparing to the 2025 Consented scenario, there is a net significant beneficial effect for 14,035 people in terms of the L_{den} metric, and a net significant beneficial effect for 4,008 people in terms of the L_{night} metric.

While the 2022 Baseline scenario represents the current forecast for the future operation of a Dublin Airport with the North Runway operational and the current conditions in place, this has significantly lower impacts than what was forecast when the North Runway Permission was granted, i.e. the 2025 Consented scenario. The 2018 Baseline is expected to be broadly representative of the expected conditions immediately prior to the opening of the North Runway, i.e. what is permitted without the North Runway. It is currently forecast that by 2022, passenger throughput will have recovered to around 94% of the 2018 level, and aircraft movements to around 98% of the 2018 level, if the restrictions attached to the North Runway Permission have not come into force.

Using a similar method to calculate the residual effects, the residual noise levels assessed as high or very high can be calculated. These are presented in Table 13-58.

Table 13-58: Summary of People Exposed to High Residual Noise Levels

Scenario	***No. People Exposed to High or Very High Residual L_{den} Noise Level***	***No. People Exposed to High or Very High Residual L_{night} Noise Level***
2018 Baseline	44	548
2022 Baseline	26	82
2025 Baseline	23	76
2025 Consented	89	203

2022 Relevant Action	32	62
2025 Relevant Action	32	62

Considering the L_{den} results, the number of people exposed to a high residual noise level is under 100 in all scenarios. The number of people so exposed in the Relevant Action scenarios is lower than in the 2018 Baseline or 2025 Consented scenarios, but higher than in the 2022 or 2025 Baseline scenarios.

Considering the L_{night} results, the number of people exposed to a high residual noise level is under 100 in most scenarios, with the exceptions being the 2018 Baseline and 2025 Consented scenarios. The number of people so exposed in the Relevant Action scenarios is lower than in any of the other scenarios, due to the proposed new sound insulation scheme.

13.9 Summary

The assessment in this chapter presents the likely significant effects from air noise and vibration from aircraft as a result of the proposed Relevant Action.

Taking first the vibration assessment, no significant effects were found as a result of the Relevant Action.

Considering the air noise, this chapter has considered future forecast scenarios for the selected years of 2022 and 2025, and has compared the situation with the Relevant Action with three situations, that in 2018 (2018 Baseline), that in the corresponding future year with the North Runway operational and the current conditions in place (2022 or 2025 Baseline), and the consented situation that was forecast for 2025 as part of the North Runway planning process in 2004-2007 (2025 Consented). The latter situation is included to provide as illustration of the how aircraft technology and noise levels have improved over the years at a greater rate than forecast in 2004-2007.

Two primary assessment metrics have been considered, one relating to the overall situation (L_{den}) and the other just to the situation at night (L_{night}). For each of these metrics the number of people exposed to various noise levels have been determined for each assessment scenario. From these the number of people predicted to be highly annoyed and the number predicted to be highly sleep disturbed have been computed.

An assessment of significant effects has also been carried out for the comparison with each of the three situations described above. This takes into account the change in noise level for individual receptors and their resulting noise exposure.

Looking at the predicted number of people highly annoyed, in 2022 with the Relevant Action this is 6% higher than the 2022 Baseline scenario, but 37% lower than the 2018 Baseline and 45% lower than the 2025 Consented scenario. In 2025 with the Relevant Action it is predicted to be 7% higher than the 2025 Baseline scenario, but 39% lower than the 2018 Baseline and 46% lower than the 2025 Consented scenario.

Looking at the predicted number of people highly sleep disturbed, in 2022 with the Relevant Action this is 24% higher than the 2022 Baseline scenario, but 42% lower than the 2018 Baseline and 27% lower than the 2025 Consented scenario. In 2025 with the Relevant Action it is predicted to be 26% higher than the 2025 Baseline scenario, but 42% lower than the 2018 Baseline and 26% lower than the 2025 Consented scenario.

Looking at the number of people with significant residual effects after the proposed mitigation measures, firstly considering the overall situation (L_{den} metric), in 2022 or 2025 with the Relevant Action there is a forecast net beneficial effect when compared with the corresponding 2022 or 2025 Baseline scenarios. Comparison with the 2018 Baseline or 2025 Consented scenarios leads to a larger assessed net beneficial effect. Considering the night situation (L_{night} metric), in 2022 or 2025 with the Relevant Action there is a forecast net adverse effect when compared with the corresponding 2022 or 2025 Baseline scenarios. However comparison with the 2018 Baseline or 2025 Consented scenarios leads to an assessed net beneficial effect.

Finally looking at non-residential receptors, no significant effects were found as a result of the Relevant Action.

Chapter 14: Ground Noise and Vibration

14

14. Ground Noise and Vibration

14.1 Introduction

This chapter of the Environmental Impact Assessment Report (EIAR) reports the findings of an assessment of the likely significant effects from ground noise as a result of the proposed Relevant Action, which is described in Chapter 2.

This assessment and EIAR chapter have been produced by Bickerdike Allen Partners LLP.

Ground noise specifically encompasses noise associated with aircraft on the ground at Dublin Airport. This excludes any start of roll or reverse thrust activities, which are considered to be part of the air noise and covered in Chapter 13. In particular the key aircraft ground operations are aircraft taxiing and aircraft using Auxiliary Power Units (APUs) when on stands.

Aircraft ground activities do not typically produce any significant vibration effects at sensitive receptors outside of the airport site, and therefore the assessment of vibration due to aircraft ground operations has been scoped out of the EIA.

Road traffic noise effects have not been assessed for this application, as the Relevant Action is not forecast to cause any significant changes to the road traffic flows in the vicinity of the airport, either when considering the 24-hour period or the night period (23:00 to 07:00). The changes to road traffic flows are discussed in more detail in Chapter 9.

This chapter has considered future forecast scenarios for the selected years of 2022, when the North Runway is scheduled to open, and 2025, the first subsequent year when 32 mppa is expected to be reached; 2025 is therefore expected to constitute a worst case scenario for this Relevant Action application.

For each of the two selected years, this chapter has compared the scenario with the Relevant Action, referred to as the “2022 Relevant Action” and “2025 Relevant Action” scenarios, with two situations:

- The actual situation in 2018, referred to in this chapter as “2018 Baseline”.
- The forecast situation in the corresponding future year, with the North Runway operational and the current conditions in place, referred to in this chapter as the “2022 Baseline” and “2025 Baseline” scenarios.

Consideration has also been given to the cumulative effects of a separate planning application which has been submitted to the planning authority that seeks to develop an area in the north east of the airport site, known as Apron 5H, which will result in 10 aircraft stands being located there. The future “Relevant Action” scenarios have been assessed separately with this change also in place. These are referred to in this chapter as the “2022 Apron 5H” and “2025 Apron 5H” scenarios.

14.1.1 Summary of the Proposed Relevant Action

The relevant noise related operating restrictions which currently apply to the North Runway Permission are as follows:

- No use of the North Runway at night (23:00 to 07:00). This is provided for in Condition 3d of the North Runway Permission.
- The Crosswind Runway can be only used for essential purposes. This is provided for in Condition 4 of the North Runway Permission.
- A limit on the number of aircraft movements at the airport at night (23:00 to 07:00) to 65/night. This is provided for in Condition 5 of the North Runway Permission.

The proposed Relevant Action is to remove Condition 5 of the North Runway Permission and to replace it with an annual night-time noise quota between 23:30 and 06:00, and also to amend Condition 3d to allow flights to take off from and/or land on the North Runway for an additional 2 hours i.e. 23:00 to 00:00 and 06:00 to 07:00, with the permitted operation in these 2 additional hours being the same as during the daytime hours when the North Runway is already permitted to be used. Overall, this would allow for an increase in the number of flights taking off and/or landing at Dublin Airport between 23:00 and 07:00.

No change is proposed to the overall permitted passenger capacity of the terminals at Dublin Airport, which is limited to 32 million passengers per annum (mppa), nor is there any proposed change to the permitted operation of the runway system during daytime hours (Option 7b).

14.1.1.1 Option 7b – Conditions 3(a) to 3(c) of the North Runway Permission

The Relevant Action does not alter Conditions 3(a) to (c) of North Runway Permission which which together describe the preferred runway concept put forward in the original North Runway planning process of 2004-2007, known as Option 7b:

> *On completion of construction of the runway hereby permitted, the runways at the airport shall be operated in accordance with the mode of operation – Option 7b – as detailed in the Environmental Impact Statement Addendum, Section 16 as received by the planning authority on the 9th day of August, 2005 and shall provide that -*
>
> *(a) the parallel runways (10R-28L and 10L-28R) shall be used in preference to the cross runway, 16-34,*
>
> *(b) when winds are westerly, Runway 28L shall be preferred for arriving aircraft. Either Runway 28L or 28R shall be used for departing aircraft as determined by air traffic control,*
>
> *(c) when winds are easterly, either Runway 10L or 10R as determined by air traffic control shall be preferred for arriving aircraft. Runway 10R shall be preferred for departing aircraft*

In summary Option 7b provides that the arrivals from the east and departures to the east shall prefer to use the South Runway. Arrivals from the west and departures to the west can use the North Runway or South Runway as determined by air traffic control.

In practice it is expected that air traffic control will prefer to use one runway for arrivals and the other for departures, subject to capacity constraints, and therefore most of the time the North Runway will be preferred for departures to the west and the South Runway will be preferred for arrivals from the west. This is however sensitive to the precise timing of flights, particularly in the busy early morning period of 06:00-08:00, so there is potential for departures off both runways in this period.

14.2 Legislation and Planning Policy Context

The Environmental Impact Assessment (EIA) process is described in Chapter 1 of this EIAR. This notes that the EIA requirements derive from Council Directive 85/337/EEC and sets out the EIA regulations and EPA guidelines that were considered by AECOM in preparing this EIAR.

Chapter 6 of this EIAR sets out the legislative and planning policy context for the proposed Relevant Action. It includes reference to relevant national and local planning policies, including those that have been considered when determining the EIAR scope, method and mitigation. Those considered relevant to this chapter are summarised below with additional material also considered relevant. More detail on this additional material, and selected policies included in Chapter 6, are given in Appendix 14A.

14.2.1 Strategic Planning Context

daa has a number of obligations to fulfil with regard to the management of Dublin Airport. These and the overall framework the airport operates under are set out in the following:

- Section 23(1) of the Air Navigation and Transport (Amendment) Act 1998
- S.I. No 549/2018 – Environmental Noise Regulations 2018 (Government of Ireland (2018)
- Aircraft Noise (Dublin Airport) Regulations Act, 2019 (Government of Ireland, 2019)

The last of these implements EU Regulation 598/2014 (EC, 2014) on the establishment of rules and procedures with regard to the introduction of noise related operating restrictions at European Union Airports within the ICAO Balanced Approach (ICAO, 2010). Further details of this regulation, and the two listed above are contained in Appendix 14A.

14.2.2 National Planning Policy

The following national planning policy is considered relevant to this assessment.

- A National Aviation Policy for Ireland (2015) (DTTS, 2015)
- Project Ireland 2040 – National Planning Framework (2018) (Government of Ireland, 2018)

14.2.3 Local Planning Policy

The following local planning policy is considered relevant to this assessment.

- Fingal Development Plan 2017-2023 (FCC, 2017)
- Dublin Airport Local Area Plan (2020) (FCC, 2020)
- Noise Action Plan for Dublin Airport (2019-2023) (FCC, 2019)

14.2.4 Relevant UK Policy, Standards and Guidance

The following UK policies, standards and guidance documents are considered relevant to this assessment. More detail is given in Appendix 14A.

- National Planning Policy Framework (NPPF, 2020)
- Noise Policy Statement for England (2010) (DEFRA, 2010)
- National Planning Practice Guidance (DEFRA, 2019)
- UK Aviation Policy Framework (2013) (DfT, 2013)
- BS 8233:2014 Sound insulation and noise reduction in buildings – code of practice (BS, 2014)
- Department of Education - Acoustic design of schools: performance standards BB93 (2015)
- Department of Health - Specialist Services, Health Technical Memorandum 08-01: Acoustics (2013)
- CAP1616a Airspace Change: Environmental requirements technical annex (Civil Aviation Authority, 2020)
- BS7445 Description and measurement of environmental noise (BS, 2003)

14.2.5 Other International Policy, Standards and Guidance

The following other international policies, standards and guidance documents are considered relevant to this assessment. More detail is given in Appendix 14A.

- ICAO Convention on International Civil Aviation, Annex 16, Volume 1 (ICAO, 2014)
- Environmental Noise Directive 2002/49/EC (EC, 2002)
- WHO Guidelines for community noise (1999) (Berglund, B. *et al,* 1999)
- WHO Night Noise Guidelines for Europe (2009) (WHO, 2009)
- WHO Environmental Noise Guidelines for the European Region (2018) (WHO, 2018)
- ISO 9613-2:1996 Acoustics – Attenuation of sound during propagation outdoors – Part 2: General method of calculation (IOS, 1996)

14.3 Assessment Methodology

This section of this EIAR chapter describes the approach to the assessment of the ground noise effects, covering the following:

- Information sources that have been consulted throughout the preparation of this chapter;
- The methodology behind the assessment of ground noise effects, including the criteria for the determination of sensitivity of receptor and magnitude of change from the existing of ‘baseline’ condition;

- An explanation as to how the identification and assessment of potential ground noise effects has been reached; and
- The significance criteria and terminology for the assessment of ground noise residual effects.

Key sources of information that have been utilised for this assessment are as follows:

- The physical location of the airport, in particular the runways, taxiways and stands;
- The number of flights in each relevant assessment period, including their aircraft type, operation, and destination. This has been supplied by daa for both actual (e.g. 2018) and forecast scenarios (forecasts were prepared by Mott Macdonald).

14.3.1 Ground Noise Modelling Methodology

The assessment of ground noise relies heavily on the modelling of noise levels. This has been carried out using the CadnaA noise modelling software produced by Datakustik. This industry standard software model uses the methodology set out in ISO 9613-2:1996 (ISO, 1996). This software is used to produce noise contours and to predict noise levels at specific locations. Details of the modelling methodology are given in Appendix 14B.

The aircraft movements assessed as part of the ground noise assessment include the ground operations associated with all aircraft taking off from or landing at Dublin Airport, with the exception of helicopter and military aircraft. Operations by helicopter and military aircraft make up a very small proportion of the total and are not able to be assessed to the same level of accuracy. For example, in 2018 there were 820 operations by helicopters and 2 operations by military aircraft, making up 0.4% of the annual total of aircraft movements. As a result, their inclusion would have a negligible effect on the findings of this assessment.

14.3.2 Primary Assessment Metrics

There are various noise metrics available for the assessment of the impacts of ground noise. These are described in detail in Appendix 14A.

The noise produced by aircraft when on the ground at airports has historically been assessed using different metrics and criteria depending on the application. It is however common for ground noise at busy airports such as Dublin Airport to be assessed using a metric based on L_{Aeq}, i.e. one that averages the noise energy over a defined time period, which accounts for both the number, duration and noise level of the aircraft ground activities over a typical day. Adopted ground noise thresholds are typically not dissimilar from those used for air noise, and therefore the metrics used here mirror those that have been used for the air noise assessment:

- L_{den}, which takes into account the annual activity throughout the 24-hour period, with a 5 dB penalty applied to noise in the evening (19:00-23:00) period and a 10 dB penalty applied to noise in the night (23:00-07:00) period. The key effect linked with this metric is annoyance.
- L_{night}, which takes into account the annual activity during the night (23:00-07:00) period. The key effect linked with this metric is sleep disturbance.

14.3.3 Supplementary Noise Metrics

Particularly in other jurisdictions such as the UK, ground noise is often assessed in terms of the $L_{Aeq,16h}$ metric for the daytime (07:00-23:00) period and the $L_{Aeq,8h}$ metric for the night-time (23:00-07:00) period. These periods relate to an average summer day. Summer in this instance is defined as the 92-day period between 16 June and 15 September inclusive. Noise contours and population assessments have also been carried out using these metrics.

Compared to noise produced by airborne aircraft, ground noise is typically characterised by steady noise levels at a lower level, but with a longer duration. As a result, for air noise it is common to utilise a number of supplementary metrics in order to fully describe the nature of air noise and its effects on the community. For ground noise, the metrics based on L_{Aeq} are considered sufficient as single events are not typically a concern.

The exception to this is when high power engine testing is carried out. This refers to the noise produced by aircraft running engines for testing and maintenance purposes. When engines are run at high power, this can cause very high noise levels near the test location. However, this only occurs 1-2 times per day on average, only during daytime hours and is only permitted at a designated location, away from populated neighbouring areas. The noise from engine testing is considered negligible in the context of the overall airport ground noise.

14.3.4 Methodology for Determining Baseline Conditions and Sensitive Receptors

The extents of the study area are contained within a rectangle that extends approximately 3.5 km to the west, 5 km to the east, 4.5 km to the north and 3 km to the south of the centre of the existing main runway at Dublin Airport. The study area contains all receptors exposed to ground noise levels of at least 50 dB L_{den} or 45 dB L_{night}. This includes all of the receptors that experience potential significant effects. Although significant effects can in theory be found down to 45 dB L_{den} and 40 dB L_{night}, the change in noise level required for this finding was not experienced at any of the assessed receptors.

The baseline considers the situation prior to the Relevant Action, for which information for the actual situation in 2018 has been provided. It also considers the forecast situation in the future years of 2022 and 2025, with the North Runway operational and the current conditions in place.

The following have been considered as potential receptors of high sensitivity for this assessment:

- Dwellings;
- Schools;
- Residential healthcare facilities and
- Places of worship.

Receptors with a lower sensitivity to noise, such as offices and hotels, have not been considered as part of this assessment.

The assessment of dwellings includes an allowance for those which are consented but not yet constructed. These have been presented separately to the totals for existing dwellings.

14.3.5 Methodology for Determining Construction Effects

As the proposed Relevant Action will result in no changes to the design or construction of the North Runway, the proposed Relevant Action will not cause any construction noise impacts related to the proposed Relevant Action.

14.3.6 Methodology for Determining Operational Effects

The Regulation 598 assessment considered a number of different options for the use of the runway system at night. The resulting chosen option, presented in this chapter as the “Relevant Action” scenario, involves the preferred runway concept used in the daytime (07:00 to 23:00), known as Option 7b, being used in the night periods of 23:00 to 00:00 and 06:00 to 07:00. The limit of 65 flights per night (23:00 to 07:00) is also removed.

The effects of the Relevant Action are determined by comparing this scenario with the baseline for 2018 and the future baseline for the relevant year with the current conditions in place. Based on the number of flights in the forecast, the expectation is that in the “Relevant Action” scenarios which are based on Option 7b, all departures in the periods of 23:00 to 00:00 and 06:00 to 07:00 will use the North Runway for westerly operations, and the South Runway for Easterly operations, with arrivals using the opposite runway.

Consideration has also been given to the cumulative effects of a separate planning application which has been submitted to the planning authority that seeks to develop an area in the north east of the airport site, known as Apron 5H, which will result in 10 aircraft stands being located there. That application, if successful, would not result in any change to the number of aircraft operations, but would re-distribute some of them to the Apron 5H stands. In general this would result in a small increase in noise levels for receptors to the north of the airport and a small decrease for receptors to the south. The future “Relevant Action” scenarios have been assessed separately with this change also in place. These are known as the “Apron 5H” scenarios.

The following future years have been assessed:

- 2022 – the year the North Runway is expected to open; and
- 2025 – the first year following the opening of the North Runway when a throughput of 32 mppa is expected to be reached.

The assessment in this chapter considers 2022 and 2025. These represent the year of opening, and the likely worst-case future year. After 2025, the noise impacts are expected to remain similar, but reduce slightly if the airport remains at a throughput of 32 mppa due to the forecast fleet renewal. Details on likely fleet renewal ae presented in the Mott McDonald Impact of Restrictions Report.

The general assessment methodology involves the following:

- Derivation of assessment criteria;
- Computation of existing and future noise levels under the various scenarios;
- Assessment of magnitude of impacts (absolute) on sensitive receptors, for each scenario;
- Determination of the change in noise levels, and associated impacts (relative) as a result of the Relevant Action;
- Consideration of the likely significant effects of the Relevant Action, based on both the absolute and relative noise levels;
- Description of the potential effects (beneficial and adverse) associated with the Relevant Action; and
- Description of any mitigation measures, where appropriate, in relation to the Relevant Action and describe any residual effects.

14.3.7 Significance Criteria – Ground Noise

The ground noise effects are considered in terms of both the absolute noise level and the change in noise level due to the Relevant Action in order to determine the significance of the effects due to the Relevant Action. Both need to be considered to determine whether a significant effect arises from the Relevant Action in an EIA context; for example if a receptor experiences a high absolute noise level but no change due to the Relevant Action then this is not a significant effect. Conversely if a receptor experiences a large change in noise level but the resulting level is still very low then this receptor is not considered to be significantly affected.

14.3.7.1 Residential Receptors

Absolute noise impacts for residential receptors have been developed against an effect scale and are given in Table 14-1. The derivation of these is discussed in Appendix 14A.

Table 14-1: Ground Noise Impact Criteria (absolute) – residential

Scale Description	*Annual dB L_{den}*	*Annual dB L_{night}*
Negligible	<45	<40
Very Low	45 – 49.9	40 – 44.9
Low	50 – 54.9	45 – 49.9
Medium	55 – 64.9	50 – 54.9
High	65 – 69.9	55 – 59.9
Very High	≥70	≥60

The effect scale used to assess the change in noise level is given in noise level is given in Table 14-2. A semantic scale of this type, following the format of examples given in the Institute of Environmental Management and Assessment guidelines, has been applied in previous ground noise assessments and accepted in Public Inquiries for airport developments in the UK and Ireland, for example the application for the North Runway at Dublin Airport. The thresholds are derived from the difference contour bands recommended in CAP1616a.

Table 14-2: Ground Noise Impact Criteria (relative)

Scale Description	*Change in noise level, dB(A)*
Negligible	0 – 0.9
Very Low	1 – 1-9
Low	2 – 2.9
Medium	3 – 5.9

Scale Description	*Change in noise level, dB(A)*
High	6 – 8.9
Very High	≥9

The effect of a change in noise level tends to increase with the absolute level of noise experienced at a receptor. If, for example, the night-time noise level at a dwelling were to change from 45 dB to 50 dB L_{night}, the overall effect for the occupants would be less than if the night-time noise level were to increase by the same amount from 55 dB to 60 dB L_{night}.

There is no clearly accepted method of how to rate the magnitude of the effect of a change in the absolute ground noise level and the associated change in noise level. Some guidance however has been provided in the UK's National Planning Practice Guidance (NPPG, 2020) which states:

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

The magnitude of an effect from changing between one scenario and another (e.g. baseline to future with the Relevant Action) has been established by considering both the absolute noise level in the higher of the two scenarios and the relative change in noise level that occurs at a given receptor.

Table 14-3 shows how the absolute and relative impacts are interpreted into magnitude of effect. This takes into account the criteria presented above, other guidance and professional judgement. The effect rating scale is taken from the EPA Draft EIAR Guidelines (EPA, 2017).

Table 14-3: Summary of magnitude of effect – ground noise

Absolute Noise Level Rating	*Change in Noise Level Rating*					
	Negligible	*Very Low*	*Low*	*Medium*	*High*	*Very High*
Negligible	Imperceptible	Imperceptible	Imperceptible	Not Significant	Slight	Moderate
Very Low	Imperceptible	Imperceptible	Not Significant	Slight	Moderate	Significant
Low	Imperceptible	Not Significant	Slight	Moderate	Significant	Significant
Medium	Not Significant	Slight	Moderate	Significant	Significant	Very Significant
High	Slight	Moderate	Significant	Significant	Very Significant	Profound
Very High	Moderate	Significant	Significant	Very Significant	Profound	Profound

A potential significant effect (adverse or beneficial) would be considered to arise if in Table 14-3 the magnitude of the effect was rated as significant or higher.

14.3.7.2 Non-Residential Receptors

For receptors other than dwellings, absolute levels rated as medium have been derived from the relevant guidance documents, as described in Appendix 14A. These are given in Table 14-4. The impact on each non-residential receptor has been rated as significant if the absolute noise level is above this threshold and the change in noise level is at least 3 dB(A), i.e. it is rated medium or higher.

Table 14-4: Ground Noise Impact Criteria (absolute) – non-residential

Receptor Type	*Threshold for Medium Absolute Effect*
Schools (08:00-16:00)	55 dB $L_{Aeq,30m}$ (approx. 55 dB L_{den})
Residential Healthcare Facilities – Day (07:00-23:00)	55 dB $L_{Aeq,1h}$ (approx. 55 dB L_{den})
Residential Healthcare Facilities – Night (23:00-07:00)	50 dB $L_{Aeq,1h}$ (approx. 45 dB L_{night})
Places of Worship	55 dB L_{den}

14.3.8 Limitations and Assumptions

Planned background noise surveys have been hampered by the Covid-19 pandemic which means that even if measurements were taken at this time, the ambient conditions may not currently be representative. However a detailed survey was carried out in 2016, and is supplemented by the continuous measurements taken by Dublin Airport's fixed Noise Monitoring Terminals (NMTs). In conformance with the recommended European noise assessment indicators (L_{den} and L_{night}), the ground noise assessment criteria are dependent on the absolute levels from the aircraft, rather than the background noise. The background noise level, and the existing prevailing (non-aircraft) related ambient noise conditions, can however be useful in contextualising ground noise in a particular area.

There is always some uncertainty associated with forecasting future aircraft traffic, and this has been increased by the recent Covid-19 pandemic, particularly in the short term. It is currently expected that a throughput of 32 mppa will be reached in 2025 and this is the scenario assessed.

Some aircraft in the forecasts are either not currently in service or have limited data available. There is limited data available that suggests newer aircraft types will perform similarly or slightly better than those they replace. A conservative assumption of no improvement over current aircraft types has been made.

Although a number of aircraft using Dublin Airport use Fixed Electrical Ground Power (FEGP) rather than Auxiliary Power Units (APUs) which produce more noise, this ground noise assessment has taken a conservative assumption that all aircraft use APUs. In practice there is likely to be significant use of FEGP in all assessment years.

14.4 Baseline Conditions

This section provides a description of the general noise conditions in the vicinity of Dublin Airport. In view of the location of the airport, the surrounding community is affected primarily by noise from the local road network and airport operations.

The assessment of baseline conditions relates to the long term situation and considers the noise levels in 2018, based on field studies undertaken in 2016. Due to the ongoing Covid-19 pandemic the noise conditions at the present time are likely to differ but this effect is expected to be temporary, although the precise timescale is uncertain.

Baseline noise surveys have been carried out at key receptor positions around Dublin Airport to establish the prevailing ambient and background noise conditions during both the daytime and night-time. Additionally, an attended survey of aircraft taxi operations was undertaken in 2019 to measure aircraft taxi noise levels for use in the modelling of current and future ground noise scenarios. These surveys are summarised in this section and reported in more detail in Appendix 14D.

Aircraft ground noise predictions have been made for 2018 and for the situation once the North Runway has been constructed for both 2022 and 2025. These predictions include both the primary assessment metrics, the results of which are presented later in this section, and the supplementary metrics which are presented in Appendix 14C.

14.4.1 Noise Surveys

14.4.1.1 Methodology

The survey work described here comprises three discrete elements; the long-term and short-term surveys undertaken by AWN in 2016; and the aircraft taxi noise survey undertaken by BAP in 2019.

The survey locations and dates are summarised in Table 14-5 and illustrated in Figure 14-1. Baseline noise monitoring locations were selected to obtain representative ambient and background noise levels close to the airport. Because ground noise does not reach as far as air noise, the area covered is more focused compared to the air noise baseline receptor set.

Table 14-5: Ground noise baseline survey locations and dates

Receptor	*Survey*	*Location*	*Dates of Survey*
GS01	Short-term	Cloughran House car park off the R132, E of airport	25/07/2016 - 28/07/2016
GS02	Short-term	Creche off Naul Road, NE of airport	25/07/2016 - 28/07/2016

GS03	Short-term	Residential properties on the R108, W of airport	25/07/2016 - 28/07/2016
GS04	Short-term	Field off the R122 at St. Margaret's, W of airport	25/07/2016 - 28/07/2016
GS05	Long-term	daa owned site on the R132, SE of airport	02/08/2016 - 10/08/2016
GS06	Long-term	daa owned site on Old Stockhole Lane, NE of airport	02/08/2016 - 10/08/2016
GS07	Long-term	Field adjacent to Cooks Road and Forest Road, N of airport	24/08/2016 - 01/09/2016
GS08	Long-term	Field adjacent to St. Margaret's School, W of airport	28/07/2016 - 29/07/2016
GS09	Long-term	daa owned site on Dunbro lane, W of airport	10/08/2016 - 17/08/2016
GS10	Long-term	daa owned site on Old Airport Road, S of airport	11/08/2016 - 17/08/2016
GS11	Aircraft Taxi	Airport perimeter road, facing taxiways S5 and S6	02/10/2019

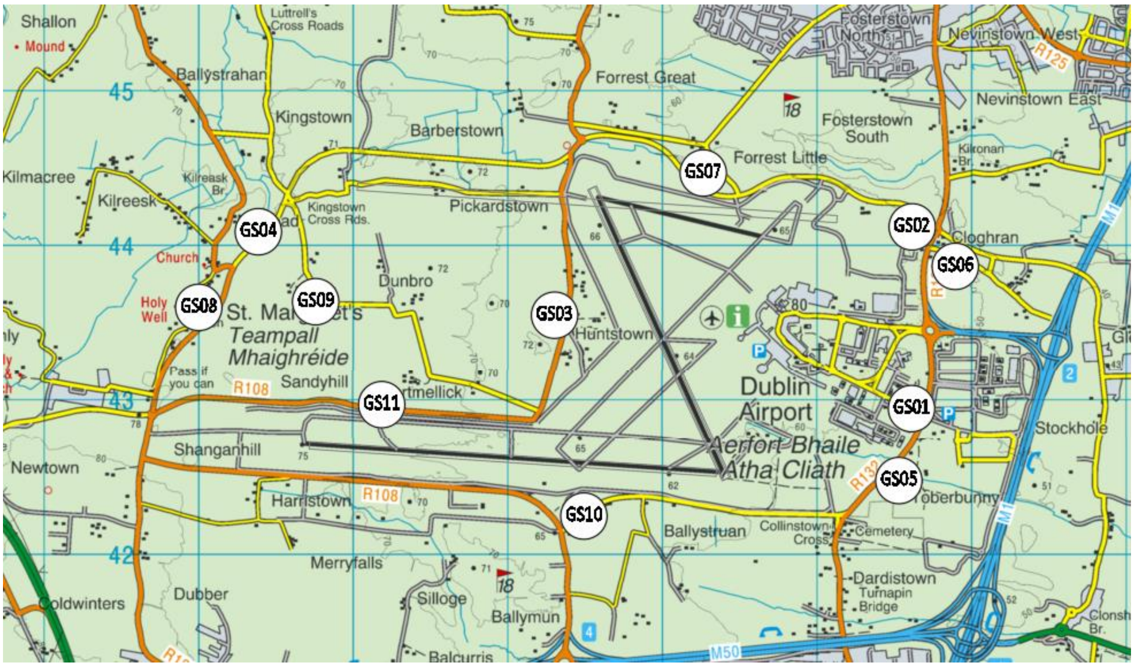


Figure 14-1: Ground noise baseline survey locations

For both long- and short-term baseline noise surveys, continuous measurements were taken with a base measurement period, T, of 15 minutes used unless otherwise stated.

Noise levels have been presented in terms of the $L_{Aeq,T}$ and $L_{AF90,T}$ metrics for the 16 hour daytime (07:00-23:00) and 8 hour night-time (23:00-07:00) periods.

$L_{Aeq,T}$ is commonly used to denote the ambient noise level and signifies the average noise level which is equivalent in energy terms to that produced by the various fluctuating noise levels that occur in the measurement period.

$L_{AF90,T}$ is commonly used to denote the prevailing background noise level and, specifically, denotes the level of noise which is exceeded for 90% of the time.

For the aircraft taxi noise survey, $L_{eq,T}$ measurements were taken, both A-weighted and for each individual octave band. Each measurement typically lasted around 90 seconds and was taken at a fixed position on the airport perimeter road, approximately 70 m from the junction of taxiway S6 and taxiway S. This was the primary exit from the runway used by R28 arrivals on the day of the survey.

14.4.2 Results – Short-Term Noise Monitoring

A summary of average values for each measurement location is given in Table 14-6. Detailed results are provided in Appendix 14D.

Table 14-6: Short-term noise monitoring results summary

Metric		Location			
		GS01	GS02	GS03	GS04
Daytime (07:00 to 23:00)	$L_{Aeq,T}$ (dB)	59	57	56	70
	L_{AF90} (dB)[1]	55	53	44	51
Night-time (23:00 to 07:00)	$L_{Aeq,T}$ (dB)	54	53	52	64
	L_{AF90} (dB)[1]	49	48	41	49

[1] Arithmetic average of $L_{AF90,15min}$ measurements

14.4.3 Results – Long-Term Noise Monitoring

A summary of average values for each measurement location is given in Table 14-7. Detailed results are provided in Appendix 14D.

The results indicate that the general ambient noise level around Dublin Airport lies in the range of 50 to 70 dB $L_{Aeq,16h}$ during the daytime with an underlying background noise level in the range of 45 to 55 dB L_{AF90}. The wide range of ambient noise levels indicate that this is dependent on the proximity to local noise sources, for example airborne aircraft, road traffic, or local schools.

During the night, ambient noise levels are generally around 3-5 dB lower than during the day and background noise levels are typically 5-10 dB quieter. Road traffic is again a factor, with roadside locations tending to have higher ambient noise levels.

Table 14-7: Long-term noise monitoring results summary

Metric	Location					
	GS05	GS06	GS07	GS08[2]	GS09	GS10
$L_{Aeq,16h}$ (dB)	71	53	58	65	59	66
$L_{AF90,day}$ (dB)[1]	50	49	52	51	47	55
$L_{Aeq,8h}$ (dB)	68	50	56	57	54	63
$L_{AF90,night}$ (dB)[1]	45	45	48	38	39	48

[1] Arithmetic average of $L_{AF90,15min}$ measurements

[2] 5 minute base measurement period

14.4.4 Results – Aircraft Taxi Noise Survey

The results of the aircraft taxi noise survey are summarised in Table 14-8 by aircraft type. Movements by Airbus A320 and Boeing 737-800 aircraft types constitute the bulk of operations at Dublin Airport, and this is reflected in the data.

Table 14-8: Location GS11, aircraft taxi noise survey results by aircraft type

Aircraft Type	No. Measured	Sound Power, dB L_{WA}
Airbus A220	1	123
Airbus A320	14	128
Airbus A321	1	130
Airbus A330	2	135
Boeing 737-800	15	129
Boeing 787	1	129
Embraer E190	1	127

Learjet 60	1	121

14.4.5 Baseline Noise Modelling L_{den} Metric

Noise contours have been produced for the primary assessment metric of L_{den} using the methodology described in Section 0. For the 2018 Baseline these are based on the actual aircraft movements in 2018. For the future years these are based on forecast aircraft movements.

The results for the years 2018, 2022 and 2025 are detailed below. 2022 represents the year that the North Runway is first expected to be operational, and 2025 the likely worst-case future year for the Relevant Action application. These results are also presented in Appendix 14C along with the results for the supplementary noise metrics.

Appendix 14C presents the resulting noise contours for each scenario. The noise contours representing a high impact, 65 dB L_{den}, do not extend much further than the airport site in any of the Baseline scenarios. The 2018 Baseline noise contours representing a low impact, 50 dB L_{den}, extend to the west just past the R122 road, to the north to Brackenstown, to the east to Glebe and to the south just past the R104 into Santry.

The noise contours in the 2022 Baseline and 2025 Baseline are a similar size, but are shifted slightly to the north compared to the 2018 Baseline.

To provide further information on changes in the noise environment for specific communities, predictions have also been undertaken of the noise levels at a number of representative locations which are shown on Figure 14-2. The results of these predictions for the Baseline scenarios in terms of the L_{den} metric are given in Table 14-9.

Figure 14-2: Representative Location Points

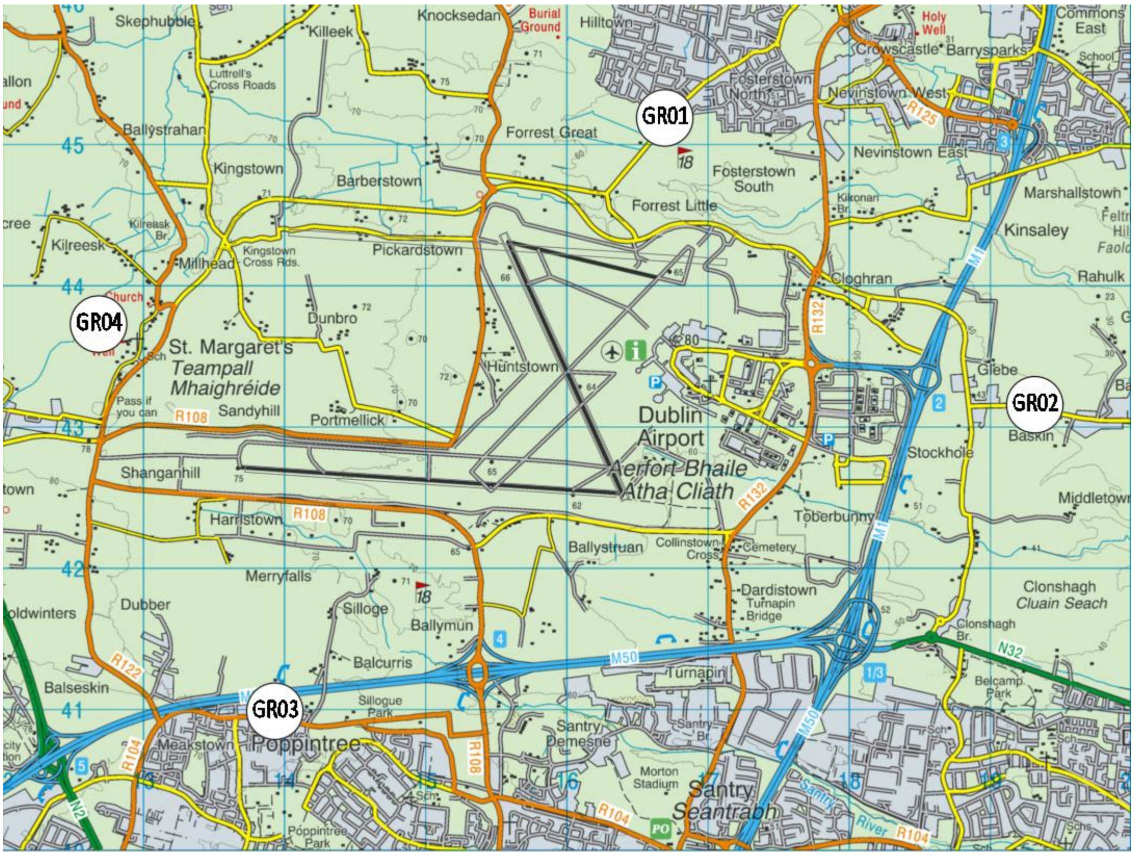


Table 14-9: Baseline Noise levels at Representative Locations (L_{den})

Representative Location	*Reference No.*	*Baseline Noise Level, dB (L_{den})*		
		2018	*2022*	*2025*
Ridgewood	GR01	54	55	56

The Baskins	GR02	48	48	48
Mayeston Hall	GR03	56	55	55
St Margret's	GR04	49	49	49

Note – noise levels rounded to nearest whole number.

L_{den} noise levels at receptors close to the north of the airport site, for example Ridgewood (#01), are forecast to increase by around 1 dB(A) between the 2018 Baseline and 2022 Baseline scenarios, whereas the opposite is true for receptors to the south of the airport site, for example Mayeston Hall (#03). Receptors in other locations are forecast to decrease by a similar amount or not change. Going from the 2022 Baseline to the 2025 Baseline there are small decreases of 0-1 dB at all locations.

For each of the sets of baseline contours the number of dwellings and the estimated population that they contain have been determined. This has been done based on the existing dwellings and population excluding consented developments, and also based on the existing dwellings and population including consented developments. The results for 2018 Baseline are given by contour in Table 14-10.

Table 14-10: Areas, number of dwellings and population in 2018 Baseline Annual L_{den} contours

Scenario	*2018* ***Baseline***			
Contour L_{den} (dB)	*Excluding Consented Developments*		*Including Consented Developments*	
	Dwellings	*Population.*	*Dwellings*	*Population*
50	9,376	26,361	9,908	28,014
55	155	379	155	379
60	19	56	19	56
65	2	6	2	6
70	0	0	0	0

The dwelling and population results for 2022 Baseline are given by contour in Table 14-11.

Table 14-11: Areas, number of dwellings and population in 2022 Baseline Annual L_{den} contours

Scenario	*2022* ***Baseline***			
Contour L_{den} (dB)	*Excluding Consented Developments*		*Including Consented Developments*	
	Dwellings	*Population.*	*Dwellings*	*Population*
50	8,527	23,826	9,001	25,274
55	113	324	113	324
60	19	56	19	56
65	1	3	1	3
70	0	0	0	0

The dwelling and population results for 2025 Baseline are given by contour in Table 14-11.

Table 14-12: Areas, number of dwellings and population in 2025 Baseline Annual L_{den} contours

Scenario	*2025 Baseline*			
Contour L_{den} (dB)	*Excluding Consented Developments*		*Including Consented Developments*	
	Dwellings	*Population.*	*Dwellings*	*Population*
50	8,739	24,518	9,229	26,026
55	133	389	133	389
60	20	60	20	60
65	1	3	1	3
70	0	0	0	0

The number of people exposed to ground noise when measured using the L_{den} metric is forecast to reduce from the 2018 Baseline to the 2022 Baseline, for all contour levels. For example the number of people exposed to at least a low level of ground noise (i.e. 50 dB L_{den} or above) decreases from 26,361 to 23,826, and the number of people exposed to at least a high level of ground noise (i.e. 65 dB L_{den} or above) decreases from 6 to 3.

Going forward to the 2025 Baseline Scenario, there is a small increase compared to the 2022 Baseline to 24,518 people exposed to at least a low ground noise level and no change to the 3 people exposed to a high ground noise level.

In addition to the consideration of residential properties, other potential receptors of high sensitivity have been included in this assessment, specifically schools, residential healthcare facilities and places of worship.

There are no schools, residential healthcare facilities or places of worship above the L_{den} thresholds given in Table 14-4 for any of the Baseline scenarios.

14.4.6 Baseline Noise Modelling L_{night} Metric

Noise contours have been produced for the primary assessment metric of L_{night} using the methodology described in Section 0. For the 2018 Baseline these are based on the actual aircraft movement in 2018. For the future years these are based on forecast movements.

The result for the years 2018, 2022 and 2025 are detailed below. 2022 represents the year that the North Runway is first expected to be operational, and 2025 the likely worst-case future year for the Relevant Action application. These results are also presented in Appendix 14C along with the results for supplementary noise metrics.

Appendix 14C presents the resulting noise contours for each scenario. The noise contours representing a high impact, 55 dB L_{night}, do not extend much further than the airport site in any of the Baseline scenarios. The 2018 Baseline noise contours representing a low impact, 45 dB L_{night}, extend to the west to Shanganhill, to the north to Ridgewood, to the east to the M1 and to the south to Santry Demesne.

The noise contours in the 2022 Baseline and 2025 Baseline are a similar shape to the 2018 Baseline but are 100-200 m smaller in all directions.

To provide further information on changes in the noise environment for specific communities predictions have also been undertaken of the noise levels at a number of representative locations which are shown on Figure 14-2. The results of these predictions for the Baseline scenarios in terms of the L_{night} metric are given in Table 14-13.

Table 14-13: Baseline Noise levels at Representative Locations (L_{night})

Representative Location	*Reference No.*	*Baseline Noise Level, dB (L_{night})*		
		2018	*2022*	*2025*
Ridgewood	GR01	45	44	44

The Baskins	GR02	40	39	39
Mayeston Hall	GR03	48	46	46
St Margret's	GR04	41	40	40

Note – noise levels rounded to nearest whole number.

L_{night} noise levels at all receptors are forecast to decrease by 1-2 dB(A) between the 2018 Baseline and 2022 Baseline scenarios. Going from the 2022 Baseline to the 2025 Baseline there are small decreases of 0-1 dB at all locations.

For each of the sets of baseline contours the number of dwellings and the estimated population that they contain have been determined. This has been done based on the existing dwellings and population, excluding consented developments, and allowing for consented developments. The results for 2018 Baseline are given by contour in Table 14-14.

Table 14-14: Areas, number of dwellings and population in 2018 Baseline Annual L_{night} contours

Scenario	*2018 Baseline*			
Contour L_{night} (dB)	*Excluding Consented Developments*		*Including Consented Developments*	
	Dwellings	*Population.*	*Dwellings*	*Population*
45	1,359	3,424	1,359	3,424
50	29	78	29	78
55	9	29	9	29
60	0	0	0	0
65	0	0	0	0

The dwelling and population results for 2022 Baseline are given by contour in Table 14-15.

Table 14-15: Areas, number of dwellings and population in 2022 Baseline Annual L_{night} contours

Scenario	*2022 Baseline*			
Contour L_{night} (dB)	*Excluding Consented Developments*		*Including Consented Developments*	
	Dwellings	*Population.*	*Dwellings*	*Population*
45	262	631	262	631
50	23	62	23	62
55	2	6	2	6
60	0	0	0	0
65	0	0	0	0

The dwelling and population results for 2025 Baseline are given by contour in Table 14-16.

Table 14-16: Areas, number of dwellings and population in 2025 Baseline Annual L_{night} contours

Scenario	*2025 Baseline*			
Contour L_{night} (dB)	*Excluding Consented Developments*		*Including Consented Developments*	
	Dwellings	*Population.*	*Dwellings*	*Population*
45	246	578	246	578
50	23	62	23	62
55	2	6	2	6
60	0	0	0	0
65	0	0	0	0

The number of people exposed to ground noise when measured using the L_{night} metric is forecast to reduce from the 2018 Baseline to the 2022 Baseline, for all contour levels. For example the number of people exposed to at least a low level of ground noise (i.e. 45 dB L_{night} or above) decreases from 3,424 to 631, and the number of people exposed to at least a high level of ground noise (i.e. 55 dB L_{night} or above) decreases from 29 to 6.

Going forward to the 2025 Baseline Scenario, there are further reductions to 578 people exposed to at least a low ground noise level and no change to the 6 people exposed to a high ground noise level.

In addition to the consideration of residential properties, other potential receptors of high sensitivity have been included in this assessment, specifically schools, residential healthcare facilities and places of worship. Of these, only residential healthcare facilities are highly sensitive to noise at night. The numbers of these above the thresholds given in Table 14-4 for the Baseline scenarios are given in Table 14-17.

Table 14-17: Residential healthcare facilities in Baseline L_{night} contours

Scenario	*No. Residential Healthcare Facilities Above Threshold for Medium Absolute Effect*
2018 Baseline	1
2022 Baseline	0
2025 Baseline	0

The one residential healthcare facility exposed to an L_{night} level above the threshold given in Table 14-4 (i.e. 45 dB L_{night} or above) in the 2018 Baseline is forecast to reduce to below the threshold in the 2022 and 2025 Baseline scenarios. The property is located in Santry Demesne.

14.5 Environmental Design and Management

There are a number of measures already in place at Dublin Airport that reduce or mitigate the ground noise effects of aircraft operations. These are described in this section.

14.5.1 Reduction of Noise at Source

Over the past 20 years, the models and types of aircraft using Dublin Airport have evolved, and improvements in technology have meant that the typical aircraft using the airport are quieter than they used to be.

The ICAO Noise ‘Chapter’ rating defines specific air noise performance criteria which aircraft must meet in order to be certificated. Equivalent certification for ground noise does not exist, and therefore it is difficult to predict the noise level of aircraft which do not currently operate in significant numbers at Dublin Airport currently, but are forecast to do so in the future, such as the Airbus A320neo and Boeing 737 MAX 8.

It is expected that aircraft such as these will be quieter than those they replace when carrying out ground operations, although the improvement is expected to be of a smaller magnitude than for air noise. For this assessment, a conservative assumption has been made that future aircraft perform similarly to those operating today.

daa plan to incentivise fleet renewal through the introduction of noise charges. This action is included in the approved Dublin Airport Noise Action Plan 2019-2023.

14.5.2 Land use Planning and Management

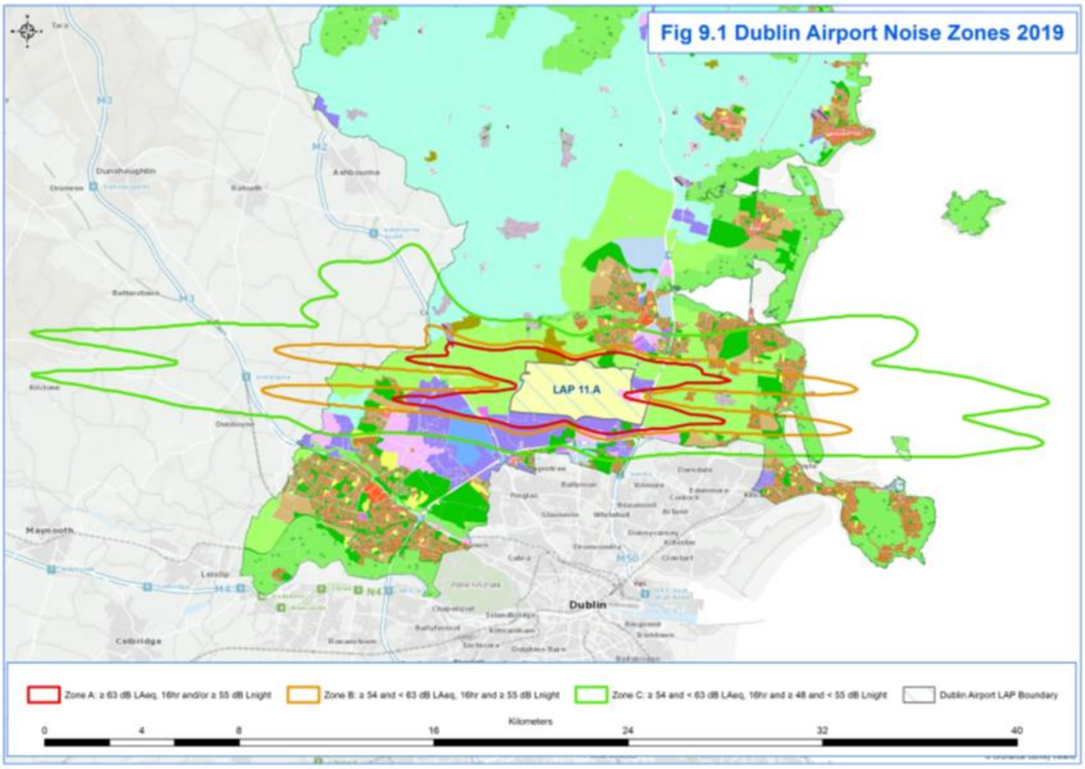
14.5.2.1 Noise Zones

The 2020 Local Area Plan (LAP) includes a dedicated section (section 9.1) to noise. In this section it notes the following. It also includes a figure of the latest Dublin Airport noise zones which is repeated below as Figure 14-3. These zones are based on air noise levels, but also act to restrict development in areas exposed to high levels of ground noise.

“The Dublin Airport LAP is a land use plan for the purposes of effective land-use planning and safeguarding the use of the Airport. Noise zones relating to Dublin Airport have been in place for many years to aid land use planning. Since the publication of previous noise zones in 2005, and over the last decade, further evidence has emerged that has updated understanding of how aircraft noise can affect health and quality of life. With the north runway set to become operational in 2022, updated information is available relating to aircraft noise performance and flight paths. For these reasons, it was considered appropriate to update the noise zones for Dublin Airport to allow for more effective land use planning for development within airport noise zones.

The updated noise zones are set out in Fig. 9.1. Dublin Airport Noise Zones and policies relating to development in Noise Zones are set out in Variation No. 1 to the Fingal Development Plan 2017 - 2023.”

Figure 14-3: Extract from Local Area Plan – Noise Zones



The actions to restrict unsuitable development in the noise zones are described in the Fingal Development Plan 2017-2023 Variation No. 1, which states:

"Table 7.2 presents the four aircraft noise zones and the associated objective of each zone along with an indication of the potential noise exposure from operations at Dublin Airport. The zones are based on potential noise exposure levels due to the airport using either the new northern or existing southern runway for arrivals or departures."

Table 7.2 is reproduced below for reference as Table 14-18. The table consider two noise metrics, L_{night} which is one of primary metrics used in this chapter, and $L_{Aeq,16hr}$ which is one of the supplementary noise metrics. Due to the distribution of flights across the day, evening and night periods at larger airports the noise exposure expressed using the $L_{Aeq,16hr}$ metric is typically 2 dB lower than if it is expressed using the L_{den} metric, the other primary metric used in this chapter.

Table 14-18: Extract from Fingal Development Plan 2017-2023 (Table 7.2)

Zone	*Indication of Potential Noise Exposure during Airport Operations*	*Objective*
D	≥ 50 and < 54 dB $L_{Aeq,16hr}$ and ≥ 40 and < 48 dB L_{night}	To identify noise sensitive developments which could potentially be affected by aircraft noise and to identify any larger residential developments in the vicinity of the flight paths serving the Airport in order to promote appropriate land use and to identify encroachment. All noise sensitive development within this zone is likely to be acceptable from a noise perspective. An associated application would not normally be refused on noise grounds, however where the development is residential-led and comprises non-residential noise sensitive uses, or comprises 50 residential units or more, it may be necessary for the applicant to demonstrate that a good acoustic design has been followed. Applicants are advised to seek expert advice.
C	≥ 54 and < 63 dB $L_{Aeq,16hr}$	To manage noise sensitive development in areas where aircraft noise may give rise to annoyance and sleep disturbance, and to ensure, where appropriate, noise insulation is incorporated within the development

	and ≥ 48 and < 55 dB L_{night}	Noise sensitive development in this zone is less suitable from a noise perspective than in Zone D. A noise assessment must be undertaken in order to demonstrate good acoustic design has been followed. The noise assessment must demonstrate that relevant internal noise guidelines will be met. This may require noise insulation measures. An external amenity area noise assessment must be undertaken where external amenity space is intrinsic to the development's design. This assessment should make specific consideration of the acoustic environment within those spaces as required so that they can be enjoyed as intended. Ideally, noise levels in external amenity spaces should be designed to achieve the lowest practicable noise levels. Applicants are strongly advised to seek expert advice.
B	≥ 54 and < 63 dB $L_{Aeq,16hr}$ and ≥ 55 dB L_{night}	To manage noise sensitive development in areas where aircraft noise may give rise to annoyance and sleep disturbance, and to ensure noise insulation is incorporated within the development. Noise sensitive development in this zone is less suitable from a noise perspective than in Zone C. A noise assessment must be undertaken in order to demonstrate good acoustic design has been followed. Appropriate well-designed noise insulation measures must be incorporated into the development in order to meet relevant internal noise guidelines. An external amenity area noise assessment must be undertaken where external amenity space is intrinsic to the developments design. This assessment should make specific consideration of the acoustic environment within those spaces as required so that they can be enjoyed as intended. Ideally, noise levels in external amenity spaces should be designed to achieve the lowest practicable noise levels. Applicants must seek expert advice.
A	≥ 63 dB $L_{Aeq,16hr}$ and/or ≥ 55 dB L_{night}	To resist new provision for residential development and other noise sensitive uses. All noise sensitive developments within this zone may potentially be exposed to high levels of aircraft noise, which may be harmful to health or otherwise unacceptable. The provision of new noise sensitive developments will be resisted

Notes:

- 'Good Acoustic Design' means following the principles of assessment and design as described in ProPG: Planning & Noise – New Residential Development, May 2017;
- Internal and External Amenity and the design of noise insulation measures should follow the guidance provided in British Standard BS8233:2014 'Guidance on sound insulation and noise reduction for buildings'

14.5.2.2 Residential Sound Insulation Schemes

Dublin Airport operates insulation schemes for dwellings and schools based on the level of air noise they are exposed to. Although not based on the ground noise levels, this means that many of the properties with the highest ground noise levels are eligible for insulation works through these existing schemes.

14.5.3 Operational Procedures

Dublin Airport have in place a range of operational procedures which serve to minimise ground noise. These include:

- Engine test runs are only permitted at certain times to minimise ground noise.
- The aircraft engine test site which was located at the northern end of the airfield has been relocated to the centre of the airfield, away from populated neighbouring areas.
- Fixed Electrical Ground Power (FEGP) is a ground power system that allows aircraft to plug directly into a fixed, electricity powered energy source while they are parked on the airfield. This has noise (and other environmental) benefits when compared to aircraft using Auxiliary Power Units (APUs) or engine-driven Ground Power Units (GPUs).

- FEGP is available at a number of stands at Dublin Airport, and aircraft are required to use it where available, in preference to APUs or GPUs.

14.5.4 Operating Restrictions

The relevant operating restrictions are detailed in Conditions 3(d) and 5 relating to the North Runway Permission, as described in Section 12.1.

14.6 Assessment of Effects and Significance

The effects have been assessed first for the Relevant Action in isolation, and then for the cumulative effect of the Relevant Action and the Apron 5H application.

14.6.1 Effects During Operation with Proposed Relevant Action

14.6.1.1 Opening Year 2022 Relevant Action L_{den} Metric

Noise contours have been produced for the primary assessment metric of L_{den} using the methodology described in Section 0. For the 2022 Relevant Action scenario these are based on forecast aircraft movements without Conditions 3(d) and 5 of the North Runway Permission. Due to the profound impact on the aviation industry worldwide of the Covid-19 pandemic, activity is forecast to be less than 32 mppa by 2022, so the presence of Condition 3 of the Terminal 2 Permission (which limits Dublin Airport to 32 mppa) has no effect.

Appendix 14C presents the resulting noise contours for each scenario. The noise contours representing a high impact, 65 dB L_{den}, do not extend much further than the airport site in the 2022 Relevant Action scenario or any of the Baseline scenarios.

The 2022 Relevant Action noise contours representing a low impact, 50 dB L_{den}, are a similar shape to the 2022 Baseline but extend around 100-200 m further in all directions.

To provide further information on changes in the noise environment for specific communities, predictions have also been undertaken of the noise levels at a number of representative locations which are shown on Figure 14-2. The results of these predictions for the 2022 Relevant Action scenario in terms of the L_{den} metric are given in Table 14-19, where they are compared with the 2018 and 2022 Baseline scenarios.

Table 14-19: 2022 Relevant Action Noise levels at Representative Locations (L_{den})

Representative Location	*Reference No.*	*Noise Level, dB (L_{den})*		
		2022 Relevant Action	*Difference to 2018 Baseline*	*Difference to 2022 Baseline*
Ridgewood	GR01	57	+3	+2
The Baskins	GR02	49	+1	+1
Mayeston Hall	GR03	56	+0	+1
St Margret's	GR04	50	+1	+1

Note – values rounded to nearest whole number. Differences based on unrounded values.

L_{den} noise levels at receptors close to the north of the airport site, for example Ridgewood (#01), are forecast to increase by around 3 dB(A) between the 2018 Baseline and 2022 Relevant Action scenarios. Receptors in other locations are forecast to increase by 0-1 dB(A).

Comparing the 2022 Relevant Action scenario to the 2022 Baseline, there are increases of 1-2 dB at all locations.

For the 2022 Relevant Action L_{den} contours the number of dwellings and the estimated population that they contain have been determined. This has been done based on the existing dwellings and population excluding consented developments, and also based on the existing dwellings and population allowing for consented developments. The results are given by contour in Table 14-20.

Table 14-20: Areas, number of dwellings and population in 2022 Relevant Action Lden contours

Scenario	*2022 Relevant Action*			
Contour L_{den} (dB)	*Excluding Consented Developments*		*Including Consented Developments*	
	Dwellings	*Population.*	*Dwellings*	*Population*
50	10,541	29,994	11,195	32,090
55	679	1,892	679	1,892
60	25	75	25	75
65	2	6	2	6
70	0	0	0	0

Comparing the 2022 Relevant Action scenario with the 2018 Baseline, the number of people exposed to at least a low level of ground noise (i.e. 50 dB L_{den} or above) increases from 26,361 to 29,994, and the number of people exposed to at least a high level of ground noise (i.e. 65 dB L_{den} or above) does not change from 6.

Comparing the 2022 Relevant Action scenario with the 2022 Baseline, the number of people exposed to at least a low level of ground noise (i.e. 50 dB L_{den} or above) is forecast to increase from 23,826 to 29,994, and the number of people exposed to at least a high level of ground noise (i.e. 65 dB L_{den} or above) is forecast to increase from 3 to 6.

When comparing scenarios, it is also important to consider the change in noise level in order to determine significant changes between the scenarios. Section 0, and specifically Table 14-3, set out the method for interpreting the absolute noise level and change in noise level into a magnitude of effect. The 2022 Relevant Action scenario is compared with the 2018 Baseline in Table 14-21 and with the 2022 Baseline in Table 14-22. These tables include all people in existing residential receptors who are within the study area and are exposed to at least 45 dB L_{den} in at least one of the scenarios. People who are exposed to negligible absolute noise levels in both scenarios or are outside the study area are assessed as not being subject to significant effects and so have not been included.

Table 14-21: Ground Noise (L_{den}) People by Magnitude of effect – 2022 Relevant Action vs 2018 Baseline

Magnitude of effect	*No. people with Beneficial Effect*	*No. people with Adverse Effect*
Imperceptible	11,669	19,209
Not Significant	29	13,576
Slight	3	5,548
Moderate	0	1,054
Significant	0	20
Very Significant	0	0
Profound	0	0

Table 14-22: Ground Noise (L_{den}) People by Magnitude of effect – 2022 Relevant Action vs 2022 Baseline

Magnitude of effect	*No. people with Beneficial Effect*	*No. people with Adverse Effect*
Imperceptible	0	36,758
Not Significant	0	12,810
Slight	0	1,401
Moderate	0	0
Significant	0	0
Very Significant	0	0
Profound	0	0

Going from the 2018 Baseline to the 2022 Relevant Action scenario, no people are assessed as having a significant beneficial effect, and 20 people are assessed as having a significant adverse effect. No people are assessed as having the highest effect levels, i.e. very significant and profound.

Going from the 2022 Baseline to the 2022 Relevant Action scenario, no people are assessed as having a significant effect, either beneficial or adverse.

In addition to the consideration of residential properties, other potential receptors of high sensitivity have been included in this assessment, specifically schools, residential healthcare facilities and places of worship.

There are no schools, residential healthcare facilities or places of worship above the L_{den} thresholds given in Table 14-4 for the 2022 Relevant Action scenario or any of the Baseline scenarios.

14.6.1.2 Opening Year 2022 Relevant Action L_{night} Metric

Noise contours have been produced for the primary assessment metric of L_{night} using the methodology described in Section 0. For the 2022 Relevant Action scenario these are based on forecast aircraft movements without Conditions 3(d) and 5 of the North Runway Permission. Due to the profound impact on the aviation industry worldwide of the Covid-19 pandemic activity is forecast to be less than 32 mppa by 2022, so the presence of Condition 3 of the Terminal 2 Permission (which limits Dublin Airport to 32 mppa) has no effect.

Appendix 14C presents the resulting noise contours for each scenario. The noise contours representing a high impact, 55 dB L_{night}, do not extend much further than the airport site in the 2022 Relevant Action scenario or any of the Baseline scenarios.

The 2022 Relevant Action noise contours representing a low impact, 45 dB L_{night}, are a similar shape to the 2018 Baseline but are larger and shifted slightly to the north. They extend to the west nearly to the R122, to the north into Ridgewood, to the east to just past the M1 and to the south to Santry Demesne.

To provide further information on changes in the noise environment for specific communities, predictions have also been undertaken of the noise levels at a number of representative locations which are shown on Figure 14-2. The results of these predictions for the 2022 Relevant Action scenario in terms of the L_{night} metric are given in Table 14-23. where they are compared with the 2018 and 2022 Baseline scenarios.

Table 14-23: 2022 Relevant Action Noise levels at Representative Locations (L_{night})

Representative Location	***Reference No.***	***Baseline Noise Level, dB (L_{night})***		
		2022 Relevant Action	*Difference to 2018 Baseline*	*Difference to 2022 Baseline*

Ridgewood	GR01	48	+3	+4
The Baskins	GR02	41	+1	+2
Mayeston Hall	GR03	48	0	+2
St Margret's	GR04	42	+1	+2

Note – values rounded to nearest whole number. Differences based on unrounded values.

L_{night} noise levels at receptors close to the north of the airport site, for example Ridgewood (#01), are forecast to increase by around 3 dB(A) between the 2018 Baseline and 2022 Relevant Action scenarios. Receptors in other locations are forecast to increase by 0-1 dB(A).

Comparing the 2022 Relevant Action scenario to the 2022 Baseline, there are increases of 4 dB(A) at Ridgewood, and 2 dB(A) at other locations.

For the 2022 Relevant Action L_{night} contours the number of dwellings and the estimated population that they contain have been determined. This has been done based on the existing dwellings and population excluding consented developments, and also based on the existing dwellings and population allowing for consented developments. The results are given by contour in Table 14-24.

Table 14-24: Areas, number of dwellings and population in 2022 Relevant Action L_{night} contours

Scenario	*2022 Relevant Action*			
Contour L_{night} (dB)	*Excluding Consented Developments*		*Including Consented Developments*	
	Dwellings	*Population.*	*Dwellings*	*Population*
45	3,620	9,843	3,829	10,435
50	35	96	35	96
55	12	35	12	35
60	1	3	1	3
65	0	0	0	0

Comparing the 2022 Relevant Action scenario with the 2018 Baseline, the number of people exposed to at least a low level of ground noise (i.e. 45 dB L_{night} or above) increases from 3,424 to 9,843, and the number of people exposed to at least a high level of ground noise (i.e. 55 dB L_{night} or above) increases from 29 to 35.

Comparing the 2022 Relevant Action scenario with the 2022 Baseline, the number of people exposed to at least a low level of ground noise (i.e. 45 dB L_{night} or above) is forecast to increase from 631 to 9,843, and the number of people exposed to at least a high level of ground noise (i.e. 55 dB L_{night} or above) is forecast to increase from 6 to 35.

When comparing scenarios, it is also important to consider the change in noise level in order to determine significant changes between the scenarios. Section 0, and specifically Table 14-3, set out the method for interpreting the absolute noise level and change in noise level into a magnitude of effect. The 2022 Relevant Action scenario is compared with the 2018 Baseline in Table 14-25, and with the 2022 Baseline in Table 14-26. These tables include all people in existing residential receptors who are within the study area and are exposed to at least 40 dB L_{night} in at least one of the scenarios. People who are exposed to negligible absolute noise levels in both scenarios or are outside the study area are assessed as not being subject to significant effects and so have not been included.

Table 14-25: Ground Noise (L_{night}) People by Magnitude of effect – 2022 Relevant Action vs 2018 Baseline

Magnitude of effect	*No. people with Beneficial Effect*	*No. people with Adverse Effect*

Imperceptible	1,265	35,266
Not Significant	6	8,749
Slight	0	530
Moderate	3	28
Significant	0	3
Very Significant	0	0
Profound	0	0

Table 14-26: Ground Noise (L_{night}) People by Magnitude of effect – 2022 Relevant Action vs 2022 Baseline

Magnitude of effect	*No. people with Beneficial Effect*	*No. people with Adverse Effect*
Imperceptible	0	23,209
Not Significant	0	9,664
Slight	0	9,916
Moderate	0	2,896
Significant	0	34
Very Significant	0	0
Profound	0	0

Going from the 2018 Baseline to the 2022 Relevant Action scenario, no people are assessed as having a significant beneficial effect, and 3 people are assessed as having a significant adverse effect. No people are assessed as having the highest effect levels, i.e. very significant and profound.

Going from the 2022 Baseline to the 2022 Relevant Action scenario, no people are assessed as having a significant beneficial effect, and 34 people are assessed as having a significant adverse effect. No people are assessed as having the highest effect levels, i.e. very significant and profound.

In addition to the consideration of residential properties, other potential receptors of high sensitivity have been included in this assessment, specifically residential healthcare facilities and places of worship. Of these, only residential healthcare facilities are highly sensitive to noise at night. The numbers of these above the thresholds given in Table 14-4 for the 2022 Relevant Action scenario are given in Table 14-27, where they are compared with the 2018 and 2022 Baseline scenarios.

Table 14-27: Residential healthcare facilities in 2022 Relevant Action L_{night} contours

Scenario	*No. Residential Healthcare Facilities Above Threshold for Medium Absolute Effect*
2022 Relevant Action	1

2018 Baseline	1
2022 Baseline	0

There is one residential healthcare facility exposed to an Lnight level above the threshold given in Table 14-4 (i.e. 45 dB Lnight or above) in the 2018 Baseline, which is forecast to remain so in the 2022 Relevant Action scenario, although it would reduce to below the threshold in the 2022 Baseline scenario. The property is located in Santry Demesne.

14.6.1.3 Worst-case Year 2025 Relevant Action L_{den} Metric

Noise contours have been produced for the primary assessment metric of L_{den} using the methodology described in Section 0. For the 2025 Relevant Action scenario these are based on forecast aircraft movements without Conditions 3(d) and 5 of the North Runway Permission.

Appendix 14C presents the resulting noise contours for each scenario. The noise contours representing a high impact, 65 dB L_{den}, do not extend much further than the airport site in the 2025 Relevant Action scenario or any of the Baseline scenarios.

The 2025 Relevant Action noise contours representing a low impact, 50 dB L_{den}, are a similar shape to the 2025 Baseline but extend around 100-200 m further in all directions.

To provide further information on changes in the noise environment for specific communities predictions have also been undertaken of the noise levels at a number of representative locations which are shown on Figure 14-2. The results of these predictions for the 2025 Relevant Action scenario in terms of the L_{den} metric are given in Table 14-28.

Table 14-28: 2025 Relevant Action Noise levels at Representative Locations (L_{den})

Representative Location	*Reference No.*	*Noise Level, dB (L_{den})*		
		2025 Relevant Action	*Difference to 2018 Baseline*	*Difference to 2025 Baseline*
Ridgewood	GR01	57	+4	+2
The Baskins	GR02	49	+1	+1
Mayeston Hall	GR03	56	0	+1
St Margret's	GR04	50	+1	+1

Note – values rounded to nearest whole number. Differences based on unrounded values.

L_{den} noise levels at receptors close to the north of the airport site, for example Ridgewood (#01), are forecast to increase by around 4 dB(A) between the 2018 Baseline and 2025 Relevant Action scenarios. Receptors to the south or west of the airport site, such as Mayeston Hall (#03), are forecast to increase by 0-1 dB(A).

Comparing the 2025 Relevant Action scenario to the 2025 Baseline, there are increases of 1-2 dB at all locations.

For the 2025 Relevant Action L_{den} contours the number of dwellings and the estimated population that they contain have been determined. This has been done based on the existing dwellings and population excluding consented developments, and also based on the existing dwellings and population allowing for consented developments. The results are given by contour in Table 14-29.

Table 14-29: Areas, number of dwellings and population in 2025 Relevant Action L_{den} contours

Scenario	*2025 Relevant Action*

Contour L_{den} (dB)	*Excluding Consented Developments*		*Including Consented Developments*	
	Dwellings	*Population.*	*Dwellings*	*Population*
50	10,988	31,323	11,642	33,419
55	767	2,160	767	2,160
60	26	75	26	75
65	2	6	2	6
70	0	0	0	0

Comparing the 2025 Relevant Action scenario with the 2018 Baseline, the number of people exposed to at least a low level of ground noise (i.e. 50 dB L_{den} or above) increases from 26,361 to 31,323, and the number of people exposed to at least a high level of ground noise (i.e. 65 dB L_{den} or above) does not change from 6.

Comparing the 2025 Relevant Action scenario with the 2025 Baseline, the number of people exposed to at least a low level of ground noise (i.e. 50 dB L_{den} or above) is forecast to increase from 24,518 to 31,323, and the number of people exposed to at least a high level of ground noise (i.e. 65 dB L_{den} or above) is forecast to increase from 3 to 6.

When comparing scenarios, it is also important to consider the change in noise level in order to determine significant changes between the scenarios. Section 0, and specifically Table 14-4, set out the method for interpreting the absolute noise level and change in noise level into a magnitude of effect. The 2025 Relevant Action scenario is compared with the 2018 Baseline in Table 14-30, and with the 2025 Baseline in Table 14-31. These tables include all people in existing residential receptors who are within the study area and are exposed to at least 45 dB L_{den} in at least one of the scenarios. People who are exposed to negligible absolute noise levels in both scenarios or are outside the study area are assessed as not being subject to significant effects and so have not been included.

Table 14-30: Ground Noise (L_{den}) People by Magnitude of effect – 2025 Relevant Action vs 2018 Baseline

Magnitude of effect	*No. people with Beneficial Effect*	*No. people with Adverse Effect*
Imperceptible	6,206	23,536
Not Significant	10	7,862
Slight	3	11,963
Moderate	0	1,584
Significant	0	26
Very Significant	0	0
Profound	0	0

Table 14-31: Ground Noise (L_{den}) People by Magnitude of effect – 2025 Relevant Action vs 2025 Baseline

Magnitude of effect	*No. people with Beneficial Effect*	*No. people with Adverse Effect*
Imperceptible	0	36,110
Not Significant	0	13,275

Slight	0	1,681
Moderate	0	0
Significant	0	0
Very Significant	0	0
Profound	0	0

Going from the 2018 Baseline to the 2025 Relevant Action scenario, no people are assessed as having a significant beneficial effect, and 26 people are assessed as having a significant adverse effect. No people are assessed as having the highest effect levels, i.e. very significant and profound.

Going from the 2025 Baseline to the 2025 Relevant Action scenario, no people are assessed as having a significant effect, either beneficial or adverse.

In addition to the consideration of residential properties, other potential receptors of high sensitivity have been included in this assessment, specifically schools, residential healthcare facilities and places of worship.

There are no schools, residential healthcare facilities or places of worship above the L_{den} thresholds given in Table 14-4 for the 2025 Relevant Action scenario or any of the Baseline scenarios.

14.6.1.4 Worst-case Year 2025 Relevant Action L_{night} Metric

Noise contours have been produced for the primary assessment metric of L_{night} using the methodology described in Section 0. For the 2025 Relevant Action scenario these are based on forecast aircraft movements without Conditions 3(d) and 5 of the North Runway Permission.

Appendix 14C presents the resulting noise contours for each scenario. The noise contours representing a high impact, 55 dB L_{night}, do not extend much further than the airport site in the 2025 Relevant Action scenario or any of the Baseline scenarios.

The 2025 Relevant Action noise contours representing a low impact, 45 dB L_{night}, are a similar shape to the 2018 Baseline but are larger and shifted slightly to the north. They extend to the west to the R122, to the north into Ridgewood, to the east to Glebe and to the south to the R104 in Santry Demesne.

Table 14-32: 2025 Relevant Action Noise levels at Representative Locations (L_{night})

Representative Location	*Reference No.*	*Noise Level, dB (L_{night})*		
		2025 Relevant Action	*Difference to 2018 Baseline*	*Difference to 2025 Baseline*
Ridgewood	GR01	49	+3	+4
The Baskins	GR02	41	+1	+2
Mayeston Hall	GR03	48	0	+2
St Margret's	GR04	42	+1	+2

Note – values rounded to nearest whole number. Differences based on unrounded values.

L_{night} noise levels at receptors close to the north of the airport site, for example Ridgewood (#01), are forecast to increase by around 3 dB(A) between the 2018 Baseline and 2025 Relevant Action scenarios. Receptors in other location are forecast to increase by 0-1 dB(A).

Comparing the 2025 Relevant Action scenario to the 2025 Baseline, there are increases of 4 dB(A) at Ridgewood, and 2 dB(A) at other locations.

For the 2025 Relevant Action L_{night} contours the number of dwellings and the estimated population that they contain have been determined. This has been done based on the existing dwellings and population excluding consented developments, and also based on the existing dwellings and population allowing for consented developments. The results are given by contour in Table 14-33.

Table 14-33: Areas, number of dwellings and population in 2025 Relevant Action L_{night} contours

Scenario	*2025 Relevant Action*			
Contour L_{night} (dB)	*Excluding Consented Developments*		*Including Consented Developments*	
	Dwellings	*Population.*	*Dwellings*	*Population*
45	3,893	10,521	4,225	11,503
50	38	102	38	102
55	12	35	12	35
60	1	3	1	3
65	0	0	0	0

Comparing the 2025 Relevant Action scenario with the 2018 Baseline, the number of people exposed to at least a low level of ground noise (i.e. 45 dB L_{night} or above) increases from 3,424 to 10,521, and the number of people exposed to at least a high level of ground noise (i.e. 55 dB L_{night} or above) increases from 29 to 35.

Comparing the 2025 Relevant Action scenario with the 2025 Baseline, the number of people exposed to at least a low level of ground noise (i.e. 45 dB L_{night} or above) is forecast to increase from 578 to 10,521, and the number of people exposed to at least a high level of ground noise (i.e. 55 dB L_{night} or above) is forecast to increase from 6 to 35.

When comparing scenarios, it is also important to consider the change in noise level in order to determine significant changes between the scenarios. Section 0, and specifically Table 14-4, set out the method for interpreting the absolute noise level and change in noise level into a magnitude of effect. The 2025 Relevant Action scenario is compared with the 2018 Baseline in Table 14-34, and with the 2025 Baseline in Table 14-35. These tables include all people in existing residential receptors who are within the study area and are exposed to at least 40 dB L_{night} in at least one of the scenarios. People who are exposed to negligible absolute noise levels in both scenarios or are outside the study area are assessed as not being subject to significant effects and so have not been included.

Table 14-34: Ground Noise (L_{night}) People by Magnitude of effect – 2025 Relevant Action vs 2018 Baseline

Magnitude of effect	*No. people with Beneficial Effect*	*No. people with Adverse Effect*
Imperceptible	299	34,242
Not Significant	3	9,771
Slight	3	1,877
Moderate	0	31
Significant	0	3
Very Significant	0	0
Profound	0	0

Table 14-35: Ground Noise (L_{night}) People by Magnitude of effect – 2025 Relevant Action vs 2025 Baseline

Magnitude of effect	*No. people with Beneficial Effect*	*No. people with Adverse Effect*
Imperceptible	0	22,855
Not Significant	0	5,465
Slight	0	11,761
Moderate	0	6,107
Significant	0	34
Very Significant	0	0
Profound	0	0

Going from the 2018 Baseline to the 2025 Relevant Action scenario, no people are assessed as having a significant beneficial effect, and 3 people are assessed as having a significant adverse effect. No people are assessed as having the highest effect levels, i.e. very significant and profound.

Going from the 2025 Baseline to the 2025 Relevant Action scenario, no people are assessed as having a significant beneficial effect, and 34 people are assessed as having a significant adverse effect. No people are assessed as having the highest effect levels, i.e. very significant and profound.

In addition to the consideration of residential properties, other potential receptors of high sensitivity have been included in this assessment, specifically schools, residential healthcare facilities and places of worship. Of these, only residential healthcare facilities are highly sensitive to noise at night. The numbers of these above the thresholds given in Table 14-4 for the 2025 Relevant Action scenario are given in Table 14-36, where they are compared with the 2018 and 2025 Baseline scenarios.

Table 14-36: Residential healthcare facilities in 2025 Relevant Action L_{night} contours

Scenario	*No. Residential Healthcare Facilities Above Threshold for Medium Absolute Effect*
2025 Relevant Action	1
2018 Baseline	1
2025 Baseline	0

There is one residential healthcare facility exposed to an L_{night} level above the threshold given in Table 14-4 (i.e. 45 dB L_{night} or above) in the 2018 Baseline, which is forecast to remain so in the 2025 Relevant Action scenario, although it would reduce to below the threshold in the 2025 Baseline scenario. The property is located in Santry Demesne.

14.6.2 Effects During Operation with Proposed Relevant Action and Apron 5H

14.6.2.1 Opening Year 2022 Apron 5H L_{den} Metric

Noise contours have been produced for the primary assessment metric of L_{den} using the methodology described in Section 0. For the 2022 Apron 5H scenario these are based on forecast aircraft movements without Conditions

3(d) and 5 of the North Runway Permission. Due to the profound impact on the aviation industry worldwide of the Covid-19 pandemic activity is forecast to be less than 32 mppa by 2022, so the presence of Condition 3 of the Terminal 2 Permission (which limits Dublin Airport to 32 mppa) has no effect. It has been assumed that the Apron 5H application is successful and the proposed stands are operational.

Appendix 14C presents the resulting noise contours for each scenario. The noise contours representing a high impact, 65 dB L_{den}, do not extend much further than the airport site in the 2022 Apron 5H scenario or any of the Baseline scenarios.

The 2022 Apron 5H noise contours representing a low impact, 50 dB L_{den}, are a similar shape to the 2022 Baseline but extend around 100-200 m further in all directions.

To provide further information on changes in the noise environment for specific communities, predictions have also been undertaken of the noise levels at a number of representative locations which are shown Figure 14-2. The results of these predictions for the 2022 Apron 5H scenario in terms of the L_{den} metric are given in Table 14-37, where they are compared with the 2018 and 2022 Baseline scenarios.

Table 14-37: 2022 Apron 5H Noise levels at Representative Locations (L_{den})

Representative Location	*Reference No.*	*Noise Level, dB (L_{den})*		
		2022 Apron 5H	*Difference to 2018 Baseline*	*Difference to 2022 Baseline*
Ridgewood	GR01	57	+3	+2
The Baskins	GR02	49	+1	+1
Mayeston Hall	GR03	56	0	+1
St Margret's	GR04	50	+1	+1

Note – values rounded to nearest whole number. Differences based on unrounded values.

L_{den} noise levels at receptors close to the north of the airport site, for example Ridgewood (#01), are forecast to increase by around 3 dB(A) between the 2018 Baseline and 2022 Apron 5H scenarios. Receptors in other locations are forecast to increase by 0-1 dB(A).

Comparing the 2022 Apron 5H scenario to the 2022 Baseline, there are increases of 1-2 dB at all locations.

For the 2022 Apron 5H L_{den} contours the number of dwellings and the estimated population that they contain have been determined. This has been done based on the existing dwellings and population excluding consented developments, and also based on the existing dwellings and population allowing for consented developments. The results are given by contour in Table 14-38.

Table 14-38: Areas, number of dwellings and population in 2022 Apron 5H L_{den} contours

Scenario	*2022 Apron 5H*			
Contour L_{den} (dB)	*Excluding Consented Developments*		*Including Consented Developments*	
	Dwellings	*Population.*	*Dwellings*	*Population*
50	10,536	29,983	11,190	32,079
55	616	1,773	616	1,773
60	25	75	25	75
65	2	6	2	6
70	0	0	0	0

Comparing the 2022 Apron 5H scenario with the 2018 Baseline, the number of people exposed to at least a low level of ground noise (i.e. 50 dB L_{den} or above) increases from 26,361 to 29,983, and the number of people exposed to at least a high level of ground noise (i.e. 65 dB L_{den} or above) does not change from 6.

Comparing the 2022 Apron 5H scenario with the 2022 Baseline, the number of people exposed to at least a low level of ground noise (i.e. 50 dB L_{den} or above) is forecast to increase from 23,826 to 29,983, and the number of people exposed to at least a high level of ground noise (i.e. 65 dB L_{den} or above) is forecast to increase from 3 to 6.

When comparing scenarios, it is also important to consider the change in noise level in order to determine significant changes between the scenarios. Section 0, and specifically Table 14-4, set out the method for interpreting the absolute noise level and change in noise level into a magnitude of effect. The 2022 Apron 5H scenario is compared with the 2018 Baseline in Table 14-39, and with the 2022 Baseline in Table 14-40. These tables include all people in existing residential receptors who are within the study area and are exposed to at least 45 dB L_{den} in at least one of the scenarios. People who are exposed to negligible absolute noise levels in both scenarios or are outside the study area are assessed as not being subject to significant effects and so have not been included.

Table 14-39: Ground Noise (L_{den}) People by Magnitude of effect – 2022 Apron 5H vs 2018 Baseline

Magnitude of effect	*No. people with Beneficial Effect*	*No. people with Adverse Effect*
Imperceptible	13,773	16,748
Not Significant	35	11,772
Slight	3	7,479
Moderate	0	1,324
Significant	0	20
Very Significant	0	0
Profound	0	0

Table 14-40: Ground Noise (L_{den}) People by Magnitude of effect – 2022 Apron 5H vs 2022 Baseline

Magnitude of effect	*No. people with Beneficial Effect*	*No. people with Adverse Effect*
Imperceptible	0	36,734
Not Significant	0	12,701
Slight	0	1,455
Moderate	0	3
Significant	0	0
Very Significant	0	0
Profound	0	0

Going from the 2018 Baseline to the 2022 Apron 5H scenario, no people are assessed as having a significant beneficial effect, and 20 people are assessed as having a significant adverse effect. No people are assessed as having the highest effect levels, i.e. very significant and profound.

Going from the 2022 Baseline to the 2022 Apron 5H scenario, no people are assessed as having a significant effect, either beneficial or adverse.

In addition to the consideration of residential properties, other potential receptors of high sensitivity have been included in this assessment, specifically schools, residential healthcare facilities and places of worship.

There are no schools, residential healthcare facilities or places of worship above the L_{den} thresholds given in Table 14-4 for the 2022 Apron 5H scenario or any of the Baseline scenarios.

14.6.2.2 Opening Year 2022 Apron 5H L_{night} Metric

Noise contours have been produced for the primary assessment metric of L_{night} using the methodology described in Section 0. For the 2022 Apron 5H scenario these are based on forecast aircraft movements without Conditions 3(d) and 5 of the North Runway Permission. Due to the profound impact on the aviation industry worldwide of the Covid-19 pandemic activity is forecast to be less than 32 mppa by 2022, so the presence of Condition 3 of the Terminal 2 Permission (which limits Terminal capacity at Dublin Airport to 32 mppa) has no effect. It has been assumed that the Apron 5H application is successful and the proposed stands are operational.

Appendix 14C presents the resulting noise contours for each scenario. The noise contours representing a high impact, 55 dB L_{night}, do not extend much further than the airport site in the 2022 Apron 5H scenario or any of the Baseline scenarios.

The 2022 Apron 5H noise contours representing a low impact, 45 dB L_{night}, are a similar shape to the 2018 Baseline but are larger and shifted slightly to the north. They extend to the west nearly to the R122, to the north into Ridgewood, to the east to just past the M1 and to the south to Santry Demesne.

To provide further information on changes in the noise environment for specific communities, predictions have also been undertaken of the noise levels at a number of representative locations which are shown on Figure 14-2. The results of these predictions for the 2022 Apron 5H scenario in terms of the L_{night} metric are given in Table 14-41, where they are compared with the 2018 and 2022 Baseline scenarios.

Table 14-41: 2022 Apron 5H Noise levels at Representative Locations (L_{night})

Representative Location	*Reference No.*	*Baseline Noise Level, dB (L_{night})*		
		2022 Apron 5H	*Difference to 2018 Baseline*	*Difference to 2022 Baseline*
Ridgewood	GR01	48	+3	+4
The Baskins	GR02	41	+1	+2
Mayeston Hall	GR03	48	0	+2
St Margret's	GR04	42	+1	+2

Note – values rounded to nearest whole number. Differences based on unrounded values.

L_{night} noise levels at receptors close to the north of the airport site, for example Ridgewood (#01), are forecast to increase by around 3 dB(A) between the 2018 Baseline and 2022 Apron 5H scenarios. Receptors in other locations are forecast to increase by 0-1 dB(A).

Comparing the 2022 Apron 5H scenario to the 2022 Baseline, there are increases of 4 dB(A) at Ridgewood, and 2 dB(A) at other locations.

For the 2022 Apron 5H L_{night} contours the number of dwellings and the estimated population that they contain have been determined. This has been done based on the existing dwellings and population excluding consented developments, and also based on the existing dwellings and population allowing for consented developments. The results are given by contour in Table 14-42.

Table 14-42: Areas, number of dwellings and population in 2022 Apron 5H L_{night} contours

Scenario	*2022 Apron 5H*			
Contour L_{night} (dB)	*Excluding Consented Developments*		*Including Consented Developments*	
	Dwellings	*Population.*	*Dwellings*	*Population*
45	3,674	9,995	3,854	10,509
50	35	96	35	96
55	12	35	12	35
60	1	3	1	3
65	0	0	0	0

Comparing the 2022 Apron 5H scenario with the 2018 Baseline, the number of people exposed to at least a low level of ground noise (i.e. 45 dB L_{night} or above) increases from 3,424 to 9,995, and the number of people exposed to at least a high level of ground noise (i.e. 55 dB L_{night} or above) increases from 29 to 35.

Comparing the 2022 Apron 5H scenario with the 2022 Baseline, the number of people exposed to at least a low level of ground noise (i.e. 45 dB L_{night} or above) is forecast to increase from 631 to 9,995, and the number of people exposed to at least a high level of ground noise (i.e. 55 dB L_{night} or above) is forecast to increase from 6 to 35.

When comparing scenarios, it is also important to consider the change in noise level in order to determine significant changes between the scenarios. Section 0, and specifically Table 14-4, set out the method for interpreting the absolute noise level and change in noise level into a magnitude of effect. The 2022 Apron 5H scenario is compared with the 2018 Baseline in Table 14-43, and with the 2022 Baseline in Table 14-44. These tables include all people in existing residential receptors who are within the study area and are exposed to at least 40 dB L_{night} in at least one of the scenarios. People who are exposed to negligible absolute noise levels in both scenarios or are outside the study area are assessed as not being subject to significant effects and so have not been included.

Table 14-43: Ground Noise (L_{night}) People by Magnitude of effect – 2022 Apron 5H vs 2018 Baseline

Magnitude of effect	*No. people with Beneficial Effect*	*No. people with Adverse Effect*
Imperceptible	1,935	33,258
Not Significant	9	9,370
Slight	0	1,497
Moderate	3	28
Significant	0	3
Very Significant	0	0
Profound	0	0

Table 14-44: Ground Noise (L_{night}) People by Magnitude of effect – 2022 Apron 5H vs 2022 Baseline

Magnitude of effect	*No. people with Beneficial Effect*	*No. people with Adverse Effect*

Imperceptible	0	23,195
Not Significant	0	7,060
Slight	0	10,227
Moderate	0	5,397
Significant	0	34
Very Significant	0	0
Profound	0	0

Going from the 2018 Baseline to the 2022 Apron 5H scenario, no people are assessed as having a significant beneficial effect, and 3 people are assessed as having a significant adverse effect. No people are assessed as having the highest effect levels, i.e. very significant and profound.

Going from the 2022 Baseline to the 2022 Apron 5H scenario, no people are assessed as having a significant beneficial effect, and 34 people are assessed as having a significant adverse effect. No people are assessed as having the highest effect levels, i.e. very significant and profound.

In addition to the consideration of residential properties, other potential receptors of high sensitivity have been included in this assessment, specifically residential healthcare facilities and places of worship. Of these, only residential healthcare facilities are highly sensitive to noise at night. The numbers of these above the thresholds given in Table 14-4 for the 2022 Apron 5H scenario are given in Table 14-45, where they are compared with the 2018 and 2022 Baseline scenarios.

Table 14-45: Residential healthcare facilities in 2022 Apron 5H L_{night} contours

Scenario	*No. Residential Healthcare Facilities Above Threshold for Medium Absolute Effect*
2022 Apron 5H	1
2018 Baseline	1
2022 Baseline	0

There is one residential healthcare facility exposed to an L_{night} level above the threshold given in Table 14-4 (i.e. 45 dB L_{night} or above) in the 2018 Baseline, which is forecast to remain so in the 2022 Apron 5H scenario, although it would reduce to below the threshold in the 2022 Baseline scenario. The property is located in Santry Demesne.

14.6.2.3 Worst-case Year 2025 Apron 5H L_{den} Metric

Noise contours have been produced for the primary assessment metric of L_{den} using the methodology described in Section 0. For the 2025 Apron 5H scenario these are based on forecast aircraft movements without Conditions 3(d) and 5 of the North Runway Permission. It has been assumed that the Apron 5H application is successful and the proposed stands are operational.

Appendix 14C presents the resulting noise contours for each scenario. The noise contours representing a high impact, 65 dB L_{den}, do not extend much further than the airport site in the 2025 Apron 5H scenario or any of the Baseline scenarios.

The 2025 Apron 5H noise contours representing a low impact, 50 dB L_{den}, are a similar shape to the 2025 Baseline but extend around 100-200 m further in all directions.

To provide further information on changes in the noise environment for specific communities predictions have also been undertaken of the noise levels at a number of representative locations which are shown on Figure 14-2. The results of these predictions for the 2025 Apron 5H scenario in terms of the L_{den} metric are given in Table 14-46.

Table 14-46: 2025 Apron 5H Noise levels at Representative Locations (L_{den})

Representative Location	*Reference No.*	*Noise Level, dB (L_{den})*		
		2025 Apron 5H	*Difference to 2018 Baseline*	*Difference to 2025 Baseline*
Ridgewood	GR01	57	+4	+2
The Baskins	GR02	49	+1	+1
Mayeston Hall	GR03	56	0	+1
St Margret's	GR04	50	+1	+1

Note – values rounded to nearest whole number. Differences based on unrounded values.

L_{den} noise levels at receptors close to the north of the airport site, for example Ridgewood (#01), are forecast to increase by around 4 dB(A) between the 2018 Baseline and 2025 Apron 5H scenarios. Receptors to the south or west of the airport site, such as Mayeston Hall (#03), are forecast to increase by 0-1 dB(A).

Comparing the 2025 Apron 5H scenario to the 2025 Baseline, there are increases of 1-2 dB at all locations.

For the 2025 Apron 5H L_{den} contours the number of dwellings and the estimated population that they contain have been determined. This has been done based on the existing dwellings and population excluding consented developments, and also based on the existing dwellings and population allowing for consented developments. The results are given by contour in Table 14-47.

Table 14-47: Areas, number of dwellings and population in 2025 Apron 5H L_{den} contours

Scenario	*2025 Apron 5H*			
Contour L_{den} (dB)	*Excluding Consented Developments*		*Including Consented Developments*	
	Dwellings	*Population.*	*Dwellings*	*Population*
50	11,016	31,430	11,670	33,526
55	834	2,362	834	2,362
60	26	75	26	75
65	2	6	2	6
70	0	0	0	0

Comparing the 2025 Apron 5H scenario with the 2018 Baseline, the number of people exposed to at least a low level of ground noise (i.e. 50 dB L_{den} or above) increases from 26,361 to 31,430, and the number of people exposed to at least a high level of ground noise (i.e. 65 dB L_{den} or above) does not change from 6.

Comparing the 2025 Apron 5H scenario with the 2025 Baseline, the number of people exposed to at least a low level of ground noise (i.e. 50 dB L_{den} or above) is forecast to increase from 24,518 to 31,430, and the number of people exposed to at least a high level of ground noise (i.e. 65 dB L_{den} or above) is forecast to increase from 3 to 6.

When comparing scenarios, it is also important to consider the change in noise level in order to determine significant changes between the scenarios. Section 0, and specifically Table 14-4, set out the method for interpreting the absolute noise level and change in noise level into a magnitude of effect. The 2025 Apron 5H scenario is compared with the 2018 Baseline in Table 14-48, and with the 2025 Baseline in Table 14-49. These tables include all people in existing residential receptors who are within the study area and are exposed to at least 45 dB L_{den} in at least one of the scenarios. People who are exposed to negligible absolute noise levels in both scenarios or are outside the study area are assessed as not being subject to significant effects and so have not been included.

Table 14-48: Ground Noise (L_{den}) People by Magnitude of effect – 2025 Apron 5H vs 2018 Baseline

Magnitude of effect	*No. people with Beneficial Effect*	*No. people with Adverse Effect*
Imperceptible	7,155	22,349
Not Significant	10	7,093
Slight	3	12,768
Moderate	0	1,811
Significant	0	26
Very Significant	0	0
Profound	0	0

Table 14-49: Ground Noise (L_{den}) People by Magnitude of effect – 2025 Apron 5H vs 2025 Baseline

Magnitude of effect	*No. people with Beneficial Effect*	*No. people with Adverse Effect*
Imperceptible	0	35,931
Not Significant	0	13,270
Slight	0	1,890
Moderate	0	6
Significant	0	0
Very Significant	0	0
Profound	0	0

Going from the 2018 Baseline to the 2025 Apron 5H scenario, no people are assessed as having a significant beneficial effect, and 26 people are assessed as having a significant adverse effect. No people are assessed as having the highest effect levels, i.e. very significant and profound.

Going from the 2025 Baseline to the 2025 Apron 5H scenario, no people are assessed as having a significant effect, either beneficial or adverse.

In addition to the consideration of residential properties, other potential receptors of high sensitivity have been included in this assessment, specifically schools, residential healthcare facilities and places of worship.

There are no schools, residential healthcare facilities or places of worship above the L_{den} thresholds given in Table 14-4 for the 2025 Apron 5H scenario or any of the Baseline scenarios.

14.6.2.4 Worst-case Year 2025 Apron 5H L_{night} Metric

Noise contours have been produced for the primary assessment metric of L_{night} using the methodology described in Section 0. For the 2025 Apron 5H scenario these are based on forecast aircraft movements without Conditions 3(d) and 5 of the North Runway Permission. It has been assumed that the Apron 5H application is successful and the proposed stands are operational.

Appendix 14C presents the resulting noise contours for each scenario. The noise contours representing a high impact, 55 dB L_{night}, do not extend much further than the airport site in the 2025 Apron 5H scenario or any of the Baseline scenarios.

The 2025 Apron 5H noise contours representing a low impact, 45 dB L_{night}, are a similar shape to the 2018 Baseline but are larger and shifted slightly to the north. They extend to the west to the R122, to the north into Ridgewood, to the east to Glebe and to the south to the R104 in Santry Demesne.

To provide further information on changes in the noise environment for specific communities predictions have also been undertaken of the noise levels at a number of representative locations which are shown on Figure 14-2. The results of these predictions for the 2025 Apron 5H scenario in terms of the L_{night} metric are given in Table 14-50.

Table 14-50: 2025 Apron 5H Noise levels at Representative Locations (L_{night})

Representative Location	*Reference No.*	*Noise Level, dB (L_{night})*		
		2025 Apron 5H	*Difference to 2018 Baseline*	*Difference to 2025 Baseline*
Ridgewood	GR01	49	+3	+4
The Baskins	GR02	41	+1	+2
Mayeston Hall	GR03	48	0	+2
St Margret's	GR04	42	+1	+2

Note – values rounded to nearest whole number. Differences based on unrounded values.

L_{night} noise levels at receptors close to the north of the airport site, for example Ridgewood (#01), are forecast to increase by around 3 dB(A) between the 2018 Baseline and 2025 Apron 5H scenarios. Receptors in other location are forecast to increase by 0-1 dB(A).

Comparing the 2025 Apron 5H scenario to the 2025 Baseline, there are increases of 4 dB(A) at Ridgewood, and 2 dB(A) at other locations.

For the 2025 Apron 5H L_{night} contours the number of dwellings and the estimated population that they contain have been determined. This has been done based on the existing dwellings and population excluding consented developments, and also based on the existing dwellings and population allowing for consented developments. The results are given by contour in Table 14-51.

Table 14-51: Areas, number of dwellings and population in 2025 Apron 5H L_{night} contours

Scenario	*2025 Apron 5H*			
Contour L_{night} (dB)	*Excluding Consented Developments*		*Including Consented Developments*	
	Dwellings	*Population.*	*Dwellings*	*Population*
45	3,917	10,623	4,216	11,498
50	38	102	38	102
55	12	35	12	35

60	1	3	1	3
65	0	0	0	0

Comparing the 2025 Apron 5H scenario with the 2018 Baseline, the number of people exposed to at least a low level of ground noise (i.e. 45 dB L_{night} or above) increases from 3,424 to 10,623, and the number of people exposed to at least a high level of ground noise (i.e. 55 dB L_{night} or above) increases from 29 to 35.

Comparing the 2025 Apron 5H scenario with the 2025 Baseline, the number of people exposed to at least a low level of ground noise (i.e. 45 dB L_{night} or above) is forecast to increase from 578 to 10,623, and the number of people exposed to at least a high level of ground noise (i.e. 55 dB L_{night} or above) is forecast to increase from 6 to 35.

When comparing scenarios, it is also important to consider the change in noise level in order to determine significant changes between the scenarios. Section 0, and specifically Table 14-4, set out the method for interpreting the absolute noise level and change in noise level into a magnitude of effect. The 2025 Apron 5H scenario is compared with the 2018 Baseline in Table 14-52, and with the 2025 Baseline in Table 14-53. These tables include all people in existing residential receptors who are within the study area and are exposed to at least 40 dB L_{night} in at least one of the scenarios. People who are exposed to negligible absolute noise levels in both scenarios or are outside the study area are assessed as not being subject to significant effects and so have not been included.

Table 14-52: Ground Noise (L_{night}) People by Magnitude of effect – 2025 Apron 5H vs 2018 Baseline

Magnitude of effect	*No. people with Beneficial Effect*	*No. people with Adverse Effect*
Imperceptible	651	31,889
Not Significant	6	9,574
Slight	3	4,221
Moderate	0	31
Significant	0	3
Very Significant	0	0
Profound	0	0

Table 14-53: Ground Noise (L_{night}) People by Magnitude of effect – 2025 Apron 5H vs 2025 Baseline

Magnitude of effect	*No. people with Beneficial Effect*	*No. people with Adverse Effect*
Imperceptible	0	22,760
Not Significant	0	4,935
Slight	0	12,341
Moderate	0	6,235
Significant	0	34
Very Significant	0	0

Profound	0	0

Going from the 2018 Baseline to the 2025 Apron 5H scenario, no people are assessed as having a significant beneficial effect, and 3 people are assessed as having a significant adverse effect. No people are assessed as having the highest effect levels, i.e. very significant and profound.

Going from the 2025 Baseline to the 2025 Apron 5H scenario, no people are assessed as having a significant beneficial effect, and 34 people are assessed as having a significant adverse effect. No people are assessed as having the highest effect levels, i.e. very significant and profound.

In addition to the consideration of residential properties, other potential receptors of high sensitivity have been included in this assessment, specifically schools, residential healthcare facilities and places of worship. Of these, only residential healthcare facilities are highly sensitive to noise at night. The numbers of these above the thresholds given in Table 14-4 for the 2025 Apron 5H scenario are given in Table 14-54, where they are compared with the 2018 and 2025 Baseline scenarios.

Table 14-54: Residential healthcare facilities in 2025 Apron 5H L_{night} contours

Scenario	*No. Residential Healthcare Facilities Above Threshold for Medium Absolute Effect*
2025 Apron 5H	1
2018 Baseline	1
2025 Baseline	0

There is one residential healthcare facility exposed to an L_{night} level above the threshold given in Table 14-4 (i.e. 45 dB L_{night} or above) in the 2018 Baseline, which is forecast to remain so in the 2025 Apron 5H scenario, although it would reduce to below the threshold in the 2025 Baseline scenario. The property is located in Santry Demesne.

14.6.3 Cumulative Noise Effects

A potential consideration would be to assess the cumulative noise effect of the different noise sources, such as air noise assessed in Chapter 13 and ground noise assessed in this chapter. By convention, this type of cumulative assessment is not typically carried out, and was not for the Heathrow Cranford Agreement planning application (determined in February 2017) and the Stansted 43 million passengers application (determined in January 2020).

Instead each of the main sources associated with operations at the airport was assessed according to its own character, with specific methodologies applied. Air noise at a given receptor is characterised by a series of relatively loud individual noise events, between which there are periods of relative quiet. It can therefore be audible at large distances from the airport. Conversely ground noise at a given receptor is characterised by lower noise levels which have a longer duration and will vary less over time as it is often due to multiple activities occurring at the same time. It is typically only audible to those closer to the airport boundary.

For these reasons each of the noise sources are dealt with separately and it is not feasible to derive a cumulative noise impact for airport operations. Additionally, combining air and ground noise into a single assessment would have the potential to overlook potential significant effects that may arise for the quieter of the two sources.

14.7 Additional Mitigation Measures

14.7.1 Mitigation During Operation of Proposed Relevant Action

In addition to the mitigation measures already in place at Dublin Airport, as part of this application daa are proposing a number of measures in relation to the air noise effects. Of relevance to the ground noise effects is the proposal to enhance the sound insulation scheme such that dwellings will be eligible for a grant to pay for sound insulation improvement works based on their night time air noise level. No specific mitigation is proposed based on ground noise, however properties which benefit from this scheme based on their air noise level will also benefit from a reduction in the ground noise level.

14.8 Residual Effects and Conclusions

The commonly accepted metrics for assessing ground noise all relate to external noise levels. Therefore the assessment of effects presented in Section 14.6 do not allow for any benefit of the residential sound insulation schemes, as this reduces the internal noise level. However, the internal noise level is more representative of the effects, in particular for night noise which is the main focus of this application as most people would be expected to be indoors.

Therefore in order to assess the residual effects, the benefit of the residential sound insulation schemes has been allowed for by considering a residual effective noise level for properties with sound insulation, being 5 dB(A) lower than the modelled noise level.

Dwellings eligible for the existing schemes in a given scenario have been considered here as having a reduction of 5 dB for both their L_{den} and the L_{night} exposure, on the basis that the existing schemes offer to insulate the whole property.

Dwellings not eligible for the existing schemes, but eligible for the new scheme proposed as part of this application, have been considered here as having a reduction of 5 dB for their L_{night} exposure, and a reduction of 5 dB for the night component of their L_{den} exposure, on the basis that the new scheme is intended to cover insulation of bedrooms.

The assumed 5 dB(A) reduction is based on testing carried out in a sample of the properties treated under the existing scheme which found that a reduction of at least 5 dB(A) in the internal noise level has been achieved in almost all cases.

This residual effective noise level has then been used to determine residual effects, following the same methodology as the assessment of effects in Section 14.6.

Allowing for the benefit of the residential sound insulation schemes in general reduces the number of people assessed with significant adverse effects and increases the number of people assessed with significant beneficial effects.

The cumulative effect of the proposed Relevant Action and Apron 5H resulted in the highest impacts, so these scenarios have been presented in this section rather than the Relevant Action in isolation.

14.8.1 Likely Significant Environmental Effects

The residual effects, after the benefit of the residential sound insulation schemes has been allowed are summarised in Table 14-55 and Table 14-56. These tables include all people in existing residential receptors who are within the study area and are exposed to at least 45 dB L_{den} or 40 dB L_{night} in at least one of the scenarios.

Table 14-55: Summary of Residual Ground Noise Effects, 2022 Apron 5H Scenario

Baseline Scenario	*L_{den} Residual Effects*			*L_{night} Residual Effects*		
	Significant Beneficial	Significant Adverse	Not Significant	Significant Beneficial	Significant Adverse	Not Significant

2018 Baseline	0	16	50,997	3	0	45,978
2022 Baseline	0	0	50,747	3	12	45,770

Table 14-56: Summary of Residual Ground Noise Effects, 2025 Apron 5H Scenario

Baseline Scenario	*L_{den} Residual Effects*			*L_{night} Residual Effects*		
	Significant Beneficial	Significant Adverse	Not Significant	Significant Beneficial	Significant Adverse	Not Significant
2018 Baseline	0	22	51,053	3	0	46,245
2025 Baseline	0	0	50,952	3	12	46,158

Considering the year of opening of the North Runway, 2022, the residual effects of the Relevant Action scenario when compared to the 2018 Baseline are that a small number of people experience significant effects. Specifically the assessment finds a residual significant beneficial effect for 3 people in terms of the L_{night} metric and a significant adverse effect for 16 people in terms of the L_{den} metric.

If instead comparing with the 2022 Baseline, there are no residual significant effects in terms of the L_{den} metric and a residual significant beneficial effect for 3 people and significant adverse effect for 12 people in terms of the L_{night} metric.

Considering the likely worst-case future year, 2025, the residual effects of the Relevant Action scenario when compared to the 2018 Baseline are that a small number of people experience significant effects. Specifically the assessment finds a residual significant beneficial effect for 3 people in terms of the L_{night} metric and a significant adverse effect for 22 people in terms of the L_{den} metric.

If instead comparing with the 2025 Baseline, there are no residual significant effects in terms of the L_{den} metric and a residual significant beneficial effect for 3 people and significant adverse effect for 12 people in terms of the L_{night} metric.

Using a similar method to calculate the residual effects, the residual noise levels assessed as high or very high can be calculated. These are presented in Table 14-57.

Table 14-57: Summary of People Exposed to High Residual Noise Levels

Scenario	*No. People Exposed to High or Very High Residual L_{den} Noise Level*	*No. People Exposed to High or Very High Residual L_{night} Noise Level*
2018 Baseline	3	3
2022 Baseline	0	3
2025 Baseline	0	3
2022 Relevant Action	3	6
2025 Relevant Action	3	6
2022 Apron 5H	3	6
2025 Apron 5H	3	6

Considering the L_{den} results, the number of people exposed to a high residual noise level is 0 in the 2022 or 2025 Baseline scenarios, and 3 in all of the other scenarios.

Considering the L_{night} results, the number of people exposed to a high residual noise level is under 3 in the 2018, 2022 or 2025 Baseline scenarios, and 6 in the Relevant Action and Apron 5H scenarios.

14.9 Summary

The assessment in this chapter presents the likely significant effects from ground noise from aircraft as a result of the proposed Relevant Action.

This chapter has considered future forecast scenarios for the selected years of 2022 and 2025, and has compared the situation with the Relevant Action with two situations; that in 2018 (2018 Baseline), and that in the corresponding future year with the North Runway operational and the current conditions in place (2022 or 2025 Baseline).

Consideration has also been given to the cumulative effect of the Relevant Action and the separate Apron 5H application. This resulted in larger effects so results have been presented based on the cumulative situation.

Two primary assessment metrics have been considered, one relating to the overall situation (L_{den}) and one just the situation at night (L_{night}). For each of these metrics the number of people exposed to various noise levels have been determined for each assessment scenario. An assessment of significant effects has been carried out for the comparison with each of the situations described above.

Looking at the predicted number of people with significant residual effects, firstly considering the overall situation (L_{den} metric), in 2022 or 2025 with the Relevant Action and Apron 5H there are no forecast significant effects when compared with the corresponding 2022 or 2025 Baseline scenarios. Comparison with the 2018 Baseline leads to a forecast significant adverse effect for 16 people in 2022 and 22 people in 2025. Considering the night situation (L_{night} metric), in 2022 or 2025 with the Relevant Action and Apron 5H there is a forecast significant beneficial effect for 3 people and significant adverse effect for 12 people when compared with the corresponding 2022 or 2025 Baseline scenarios. However comparison with the 2018 Baseline leads to a forecast significant beneficial effect for 3 people and no forecast significant adverse effects.

Chapter 15: Biodiversity (Terrestrial)

15

15. Biodiversity: Terrestrial Ecology

15.1 Introduction

This chapter of the Environmental Impact Assessment Report (EIAR) provides baseline information in relation to biodiversity and assesses the potential impacts and effects of the proposed Relevant Action on terrestrial ecological features. It should be read in conjunction with Chapter 3: Description of the Project, which provides full details of the proposed Relevant Action.

Also relevant to this chapter is the Appropriate Assessment (AA) Screening Report prepared in relation to the proposed Relevant Action. This describes the screening exercise conducted, in accordance with the requirements of Article 6(3) of the Habitats Directive[18], to test for likely significant effects from the proposed Relevant Action on the Qualifying Interests (QI) and/or Special Conservation Interests (SCI) of Special Areas of Conservation (SAC) and/or Special Protection Areas (SPA), respectively. These two documents can be read in isolation and do not rely on one another. However, where appropriate, reference is made in this chapter to the analysis presented in the AA Screening Report.

15.2 Legislation and Planning Policy Context

15.2.1 Legislation

The following legislation is relevant to this chapter and has been considered during the assessment presented within it:

- the Habitats Directive;
- Council Directive 2009/147/EC on the conservation of wild birds (the 'Birds Directive');
- Directive 2000/60/EC of the European Parliament and of the Council of 23 October 2000 establishing a framework for Community action in the field of water policy (as amended) (hereafter referred to as the 'Water Framework Directive');
- Directive 2011/92/EU of the European Parliament and of the Council of 13 December 2011 on the assessment of the effects of certain public and private projects on the environment and Directive 2014/52/EU of the European Parliament and of the Council of 16 April 2014 amending Directive 2011/92/EU on the assessment of the effects of certain public and private projects on the environment (the 'EIA Directives');
- The Planning & Development Acts 2000 to 2020;
- The Wildlife Acts 1976 to 2018;
- Flora (Protection) Order 2015 S.I 356/2015 (the 'Flora Protection Order');
- Fisheries Acts 1959 to 2019;
- Inland Fisheries Acts 1959 to 2017; and,
- Local Government (Water Pollution Acts) 1977-2007.

15.2.2 National Planning Policy

The following national planning policy is also relevant to this chapter and has been considered throughout the assessment presented within it:

- A National Aviation Policy for Ireland (2015);
- Project Ireland 2040 – National Planning Framework (2018); and,
- National Biodiversity Action Plan 2017 – 2021.

[18] Council Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora, more commonly referred to as the 'Habitats Directive'.

15.2.3 Regional and Local Planning Policy

The following local planning policy is considered relevant to this assessment.

- Dublin Airport Noise Action Plan 2019-2023;
- Regional Spatial & Economic Strategy for the Eastern and Midland Region 2019-2031;
- Fingal County Development Plan 2017-2023;
- Dublin City Development Plan 2016-2022 Written Statement – Volume 1; and,
- Dublin Airport Local Area Plan (2020).

15.2.4 International Policy, Standards and Guidance

The following international policies, standards and guidance documents are considered relevant to this assessment.

- *Environmental Impact Assessment of Projects: Guidance on Screening* (EC, 2017);
- Draft Environmental Protection Agency (EPA) Guidelines on the Information to be Contained in Environmental Impact Assessment Reports (EPA, 2017);
- Guidelines *for Assessment of Ecological Impacts from National Road Schemes* (NRA, 2009);
- Chartered Institute of Ecology and Environmental Management (CIEEM) *Guidelines for Ecological Impact Assessment in the UK and Ireland* (CIEEM, 2018); and,
- Other guidance (e.g. for field surveys) referenced throughout this chapter, as relevant.

15.3 Assessment Methodology

15.3.1 Zone of Influence

The 'zone of influence' (ZoI) of a project is the area over which ecological features may be subject to significant effects as a result of the proposed project and any associated activities.

The ZoI will vary for different ecological features depending on their sensitivity to an environmental change. It is therefore appropriate to identify different ZoI for different features. The features affected could include designated sites, habitats, species, and the processes on which they depend.

It is also important to acknowledge, as per EPA draft guidance (EPA, 2017), "*that the absence of a designation or documented feature does not mean that no such feature exists within the site*". As such, ZoI should be identified for all features potentially occurring within or near to the proposed Relevant Action, in addition to any known to occur.

Given the nature of the proposed Relevant Action and the likely absence of sensitive ecological features, the ZoI adopted was 5 km from Dublin Airport.

15.3.2 Ecological Impact Assessment

The assessment of ecological impacts described in this chapter has been conducted in accordance with the guidelines published by CIEEM (2018). The CIEEM guidelines require that assessment is only carried out for any ecological features identified within the ZoI which are sufficiently 'important' (e.g. designated sites, or habitats or species which are rare, threatened or rapidly declining) and which could be significantly affected by the particular project. It is not necessary to carry out detailed assessment of features that are sufficiently widespread, unthreatened and resilient to project impacts and which will remain viable and sustainable. Likewise, only the impacts of a project which could result in significant effects on important ecological features need to be assessed.

15.3.3 Methodology for Determining Baseline Conditions and Sensitive Receptors

An ecological walkover survey of the site (Site as defined in EIAR Chapter 1: *Introduction*) was carried out on 11 March 2020 by AECOM Ecologists, L. Cappelli and S. McCollum. Habitats were classified according to *A Guide to Habitats in Ireland* (Fossitt, 2000) and were visually assessed to determine their potential to support protected species. Where safe access was possible, the surveyors searched for signs of any protected or notable species within the North Runway site.

In addition, a significant volume of other ecological surveys, assessments, and environmental reporting have been completed in relation to:

- Discharge of planning conditions for the consented North Runway, primarily relating to pre-construction surveys and mitigation;
- Historical and ongoing implementation of the Applicant's Wildlife Management Plan; and,
- Coastal waterbird surveys since 2004 carried out to inform the North Runway and proposed Relevant Action.
- Key ecological outputs since 2004 in relation to discharge of planning conditions for North Runway include:
- Ryle T and Cronin A RPS, (2016a) Bat Activity Survey and Proposed Mitigation Strategy daa North Runway;
- Ryle T RPS, (2016b) Pre-Construction Badger Survey daa North Runway; and,
- Ryle T RPS, (2016c) Pre-Construction Amphibian Survey daa North Runway.

15.3.4 Methodology for Determining Construction Effects

As the proposed Relevant Action will result in no changes to the design or construction of the North Runway, there will be no changes to the construction impacts. As a result, the proposed Relevant Action will not result in new construction related ecological effects.

15.3.5 Methodology for Determining Operational Effects

as a result of light or surface water pollution because:

- There is no additional lighting, or amendments to existing lighting as part of the proposed Relevant Action; and,
- There would be no amendments to surface water drainage relative to that already consented in the 2007 (and amended in 2020) planning permission for North Runway.

Furthermore, as any species occurring in proximity to North Runway will necessarily be habituated to the noise from aircraft, including during the hours of darkness, there will no additional impact from the proposed Relevant Action. This will be the case because of the proximity to Dublin Airport which is already used by aircraft, including at night.

Regarding bird collision, the existing licensed bird disturbance programme operating at Dublin Airport has a zero-tolerance approach to flocks of hazardous species[19] including gulls, waders, geese and swans. As a result, flocks of birds are not allowed to occur in proximity to the runway system and there will be no additional impacts from the proposed Relevant Action.

The potential for operational effects on European sites is considered in detail in the AA Screening Report. Other than the impacts highlighted in the preceding paragraphs, the only additional possible impact considered by the AA Screening Report is the potential for noise disturbance of SCI bird species (either within or outside of European site boundaries) of the SPAs over-flown by aircraft arriving at or departing from Dublin Airport. However, for the following reasons, it was concluded that there would be no disturbance effects:

[19] Which are in particular, birds weighing significantly in excess of 110 g, birds which flock, and birds which remain at the airfield despite the long-grass maintenance program.

- Birds are more readily disturbed when a noise stimulus is accompanied by a visual source. The majority of night-time flights will occur during the hours of darkness, meaning that there will be no visual stimulus associated with the noise generated by aircraft (as aircraft will not be visible, with the exception of lights);
- Commercial aircraft using Dublin Airport have not been identified in any of the Conservation Objectives Supporting Documents (published by NPWS) as being an existing pressure on the favourable conservation status of the SCI species of any of the designated sites. The assessments informing these documents have been made under existing conditions, which regularly includes more than 100 flights per night, relative to the 65/night restriction imposed by Planning Condition 5; and,
- In 228 hours of targeted field survey at Baldoyle Bay SPA and Rogerstown Estuary SPA, there was no recorded incidence of disturbance being caused to waterbirds by commercial aircraft using Dublin Airport. It can therefore be concluded that birds using these sites are unaffected, potentially through habituation, to aircraft over-flights. As the proposed Relevant Action will not result in any material change to the existing environment, it can therefore also be concluded that it will not cause any increase in disturbance of birds using these sites.

15.3.6 Significance Criteria

On the basis that there will be no changes to the design or construction of North Runway, and that the proposed Proposed Relevant Action will not result in any changes to the operation of North Runway which could result in significant impacts, it can be concluded that there will be no significant effects from the Proposed Relevant Action on ecological features.

15.3.7 Limitations and Assumptions

There are no significant limitations to the assessment of potential effects on ecological features presented in this chapter.

15.4 Baseline Conditions

The North Runway site was under construction during the ecological walkover survey carried out in March 2020. No evidence of any protected or notable species were identified during the survey. The dominant habitats present comprised artificial surfaces (Fossitt code: BL3) (i.e. airplane runway and roads), spoil and bare soil (Fossitt code: ED2), and recently seeded sections of amenity grassland (Fossitt code: GA2) which are all of no or negligible ecological value.

There are seven SPAs within 15 km of North Runway. Of these, only Rogerstown Estuary SPA, Baldoyle Bay SPA, Ireland’s Eye SPA, Lambay Island SPA and South Dublin Bay and River Tolka Estuary SPA are over-flown by aircraft using Dublin Airport. Relevant SCI species of these five sites are all waterbirds. A total of 228 hours of vantage point survey were carried out within Baldoyle Bay and Rogerstown Estuary between June 2016 and December 2018. During this period, despite an almost continuous stream of air traffic overhead, at no time was a reaction by any wetland bird(s) to passing aircraft recorded.

The Cuckoo Stream, which flows west to east through the application site, discharges into Baldoyle Bay Estuary (and thus the Baldoyle Bay SPA). The Cuckoo Stream is not known to have any important fisheries or invertebrate populations, due to its legacy of historically poor water quality (Q2-3 when last monitored in 2016, but always ≤Q3 since monitoring started in 1988). The most recent monitoring data available, from June 2019, shows that it is still failing to meet ‘good’ Water Framework Directive (WFD) status. The primary threat to water quality as a result of the operating Dublin Airport has, at least in the recent past, been identified as the application of de-icing chemicals following snow or frost events; further information can be found within EIAR *Chapter 12: Water (Drainage).*

15.5 Environmental Design and Management

A Wildlife Management Plan is implemented under licence at Dublin Airport. This prevents flocks of hazardous birds and/or other animals (e.g. Irish hare) from occurring in areas within which they could present a risk to aircraft.

15.6 Assessment of Effects and Significance

As stated in Section 15.3.2, according to industry-standard best practice guidelines published by CIEEM, an assessment of significance of effects is only required for ecological features which are considered to be important, and for which potentially significant impacts may arise as a result of a proposed action.

At the time of writing, North Runway was an active construction site. As a result, there are no semi-natural habitats present and any fauna species which may occur would be habituated to disturbance caused by intensive construction activities. Due to the implementation of the Wildlife Management Plan, flocks of birds and other fauna species which may be considered important are actively prevented from occurring in the vicinity of Dublin Airport.

Post-construction, any fauna species which occur in the vicinity of North Runway will necessarily be habituated to the presence of aircraft. The proposed Relevant Action will result in a negligible change in the potential magnitude of disturbance, resulting in only two extra hours of flights per day.

As there are no sensitive ecological features within the ZoI of the proposed Relevant Action which will be subject to significant impacts, no detailed assessment of effects is required.

15.7 Additional Mitigation Measures

As the proposed Relevant Action will have not any significant effects on ecological features, there is no requirement for mitigation to be implemented.

15.8 Residual Effects and Conclusions

There are no residual significant effects on ecological features from the proposed Relevant Action.

Chapter 16: Biodiversity (Aquatic)

16

16. Biodiversity (Aquatic)

16.1 Introduction

This chapter of the Environmental Impact Assessment Report (EIAR) contains the findings of an assessment of the likely significant effects on any aquatic biodiversity as a result of the proposed Relevant Action.

The proposed Relevant Action relates solely to proposals to amend condition 3 and replace condition 5 of the North Runway Permission and does not comprise or require the development of any physical or other infrastructure.

This assessment and EIAR chapter has been prepared by AECOM.

16.2 Legislation and Planning Policy

The following legislation is relevant to this chapter and has been considered during the assessment presented within it:

- The Habitats Directive (EU, 2002);
- The Birds Directive (EU, 2009);
- The Water Framework Directive (EU, 2000);
- The PAD (Government of Ireland, 2000-2019);
- The Wildlife Acts 1976 to 2018 (Government of Ireland, 1976-2018);
- The Flora Protection Order (Government of Ireland, 2015);
- Fisheries Acts 1959 to 2019 (Government of Ireland, 1959-2019);
- Inland Fisheries Acts 1959 to 2017 (Government of Ireland, 1959-2017); and,
- Local Government (Water Pollution Acts) 1977-2007.

16.2.1 National Planning Policy

The following national planning policy is also relevant to this chapter and has been considered throughout the assessment presented within it:

- A National Aviation Policy for Ireland (DTTS, 2015);
- Project Ireland 2040 – National Planning Framework (2018) (Government of Ireland, 2018); and
- National Biodiversity Action Plan 2017 – 2021 (DCHG, 2017).

16.2.2 Regional and Local Planning Policy

The following local planning policy is considered relevant to this assessment.

- Dublin Airport Noise Action Plan 2019-2023 (FCC, 2019);
- Regional Spatial & Economic Strategy for the Eastern and Midland Region 2019-2031 (Eastern and Midland Regional Assembly, 2019);
- Fingal County Development Plan 2017-2023;
- Dublin City Development Plan 2016-2022 Written Statement – Volume 1 (DCC, 2016); and
- Dublin Airport Local Area Plan (FCC, 2020).

16.2.3 International Policy, Standards and Guidance

The following international policies, standards and guidance documents are considered relevant to this assessment.

- EPA Draft Guidelines (EPA, 2017);

- Guidelines for Ecological Impact Assessment in the UK and Ireland' (CIEEM, 2018); and,
- Other guidance (e.g. for field surveys) referenced throughout this chapter, as relevant.

16.3 Baseline Conditions

The North Runway is currently under construction thus no semi-natural habitats are present which may be affected by the proposed Relevant Action (as the site has been dug up and/or is under hard-standing). Habitat in the surrounding area is largely limited to improved grassland and other agricultural land, dissected by species poor hedgerows and ditches.

There are seven Special Protection Areas (SPAs) within 15 km of North Runway. Of these, only Rogerstown Estuary SPA, Baldoyle Bay SPA, Ireland's Eye SPA, Lambay Island SPA and South Dublin Bay and River Tolka Estuary SPA are over-flown by aircraft using Dublin Airport. The Malahide Estuary SAC (site code 205) and Malahide Estuary SPA (site code 4025), are c. 4 km northeast of Dublin airport. Neither of these European sites is downstream of the application site (i.e. there is no hydrological connection between Dublin Airport and these sites). However, the Baldoyle Bay SPA (site code 4016), and Baldoyle Bay SAC (site code 199) which are located c. 6.5 km east of Dublin airport, are both downstream of the application site (i.e. there is a hydrological connection to them).

The Cuckoo Stream, which flows west to east through Dublin airport, discharges into Baldoyle Bay Estuary and thus the Baldoyle Bay SAC and SPA. The Cuckoo Stream is not known to have any important fisheries or invertebrate populations, due to its legacy of historically poor water quality (Q2-3 when last monitored in 2016, but always ≤Q3 since monitoring started in 1988). The most recent monitoring data available, from June 2019, shows that it is still failing to meet 'good' status under the Water Framework Directive (WFD) (further details can be found within EIAR *Chapter 12: Water*. The primary threat to water quality as a result of the operating Dublin Airport has, at least in the recent past, been identified as the application of de-icing chemicals following snow or frost events.

16.4 Assessment Methodology

16.4.1 Methodology for Determining Construction Effects

There will be **no change** to the extent of excavation or size of structures required due to there being no changes to the physical infrastructure of North Runway. As a result, the proposed Relevant Action will not result in any aquatic biodiversity effects during construction. Further assessment is therefore not required.

16.4.2 Methodology for Determining Operational Effects

The result of the permitted / constrained scenario coming into effect when North Runway becomes operational in 2022, is a loss of 1.1m passengers per year (-3.5%) and a cumulative loss over the 4-year period 2022-2025 of 4.3m passengers. The net effect of the proposed Relevant Action would be to facilitate an increase in the number of flights permitted to take off from, or land at, Dublin Airport at night, which would enable the lost 1.1million passengers to be regained annually in the post-COVID-19 recovery period.

The proposed Relevant Action will result in an operational change as a result of the amendment of condition 3(d) and replacement of condition 5. This will result in a small variation in the number of and times at which flights can depart and arrive into Dublin Airport at night time.

There are no changes to the drainage infrastructure of associated pollution control infrastructure on North Runway which drains to Sluice and Ward catchments as a result of the proposed Relevant Action.

It is assessed that the proposed Relevant Action will not result in any change to impacts on aquatic biodiversity assets when comparing the permitted / constrained scenario and the proposed / unconstrained scenario. As a result, the proposed Relevant Action will not result in any aquatic biodiversity effects during operation. Further assessment is therefore not required.

16.5 Summary

According to industry-standard best practice guidelines published by CIEEM, an assessment of significance of effects is only required for ecological features which are considered to be important, and for which potentially significant impacts may arise as a result of a proposed action.

As stated in *Section 16.4: Assessment Methodology,* there is no anticipated changes to Aquatic Biodiversity. The Proposed Relevant Action will not result in any effects beyond those already assessed and approved via the North Runway Permission. Further assessment is therefore not required.

Chapter 17: Landscape and Visual

17

17. Landscape and Visual

17.1 Introduction

This chapter of the Environmental Impact Assessment Report (EIAR) contains the findings of an assessment of the likely significant effects on Landscape and Visual impacts as a result of the proposed Relevant Action.

The proposed Relevant Action relates solely to proposals to amend conditions 3(d) and replace condition 5 of the North Runway Permission and does not comprise or require the development of any physical or other infrastructure, in and of itself.

This assessment and EIAR chapter has been prepared by AECOM.

17.2 Legislation and Planning Policy Context

The following policy and guidance is relevant to this chapter and has been considered during the assessment presented within it:

- Dublin Airport Local Area Plan, 2020, Fingal County Council
- Guidelines for Landscape and Visual Impact Assessment (GLVIA), Landscape Institute UK/ Institute of Environmental Management and Assessment (IEMA), 2013, 3rd Edition
- Photography and Photomontage in Landscape and Visual Impact Assessment, Landscape Institute Advice Note 01/2011
- National Inventory of Architectural Heritage (Gardens), Department of Housing, Local Government and Heritage (DAHG, 2020);
- Irish trails; http://www.irishtrails.ie/; and
- Ordnance Survey Ireland, 1:50,000 Discovery Mapping.
- The National Landscape Strategy (NLS) for Ireland 2015-2025
- The European Landscape Convention
- Fingal Development Plan 2017-2023.

17.2.1 Landscape and Visual Surrounding Area Summary Highly Sensitive Landscapes

Within the Fingal Development Plan 2017 - 2023 there are “Highly Sensitive Landscapes” identified within 4km of Dublin Airport, these are illustrated as per the figure taken from the Fingal Development Plan Viewer in Figure 17-1. Some of which have a very high or high landscape value and high or very high landscape sensitivity, these are of county or national importance and are designated as Highly Sensitive Landscapes (HSL).

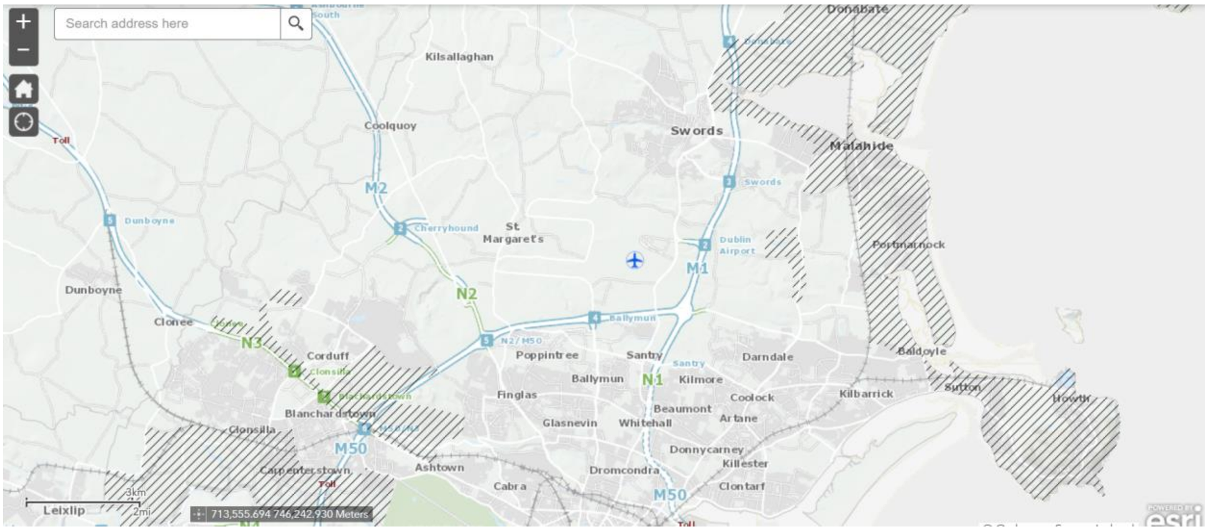


Figure 17-1 Highly sensitive landscapes within 4km of Dublin Airport (Fingal Development plan viewer, 2020)

17.2.2 Historic Landscape Characterisation

Fingal Development Plan 2017 – 2023 also identifies “Historic Landscape Characterisations” areas (HLC). A segment of Swords designated HLC Area runs through the northern part of Dublin Airport as seen on Figure 17-2.

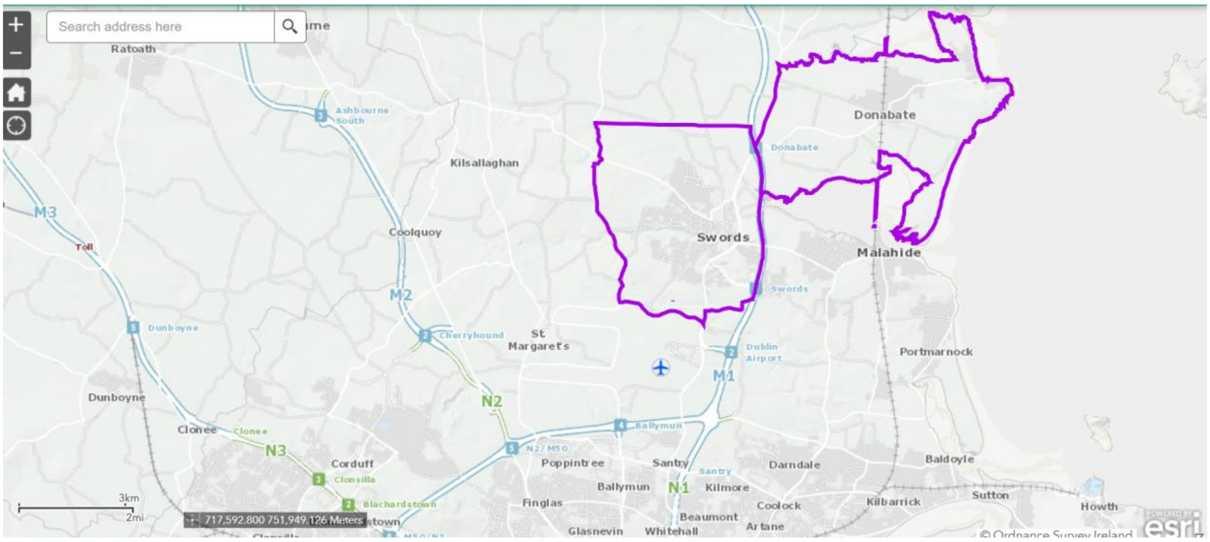


Figure 17-2 Historic Landscape Characterisation areas surrounding Dublin Airport (Fingal Development Plan Viewer, 2020)

Objective NH 42 within the Fingal Development Plan states: *“Ensure development reflects and reinforces the distinctiveness and sense of place of identified historic landscape character types”. It states further to retain “important features or characteristics, taking into account the results of the historic landscape characterisations carried out in the County”*.

17.2.3 Views and Prospects

The Fingal Development Plan states that *“The scenery and landscape of the County are of enormous amenity value to residents and tourists and constitute a valuable economic asset. The protection of this asset is therefore of primary importance in developing the potential of the County.”* and that *“Given the high rates of economic and population growth, the challenge the County faces is to manage the landscape so that any change is positive in its effects, such that the landscapes we value are protected”*.

Objective NH 40 within the Fingal Development Plan states: *“Protect views and prospects that contribute to the character of the landscape, particularly those identified in the Development Plan, from inappropriate development”*.

17.3 Assessment Methodology

17.3.1 Methodology for Determining Construction Effects

As the proposed Relevant Action will result in no changes to the design or construction of North Runway as per the approved North Runway Planning Permission, there will be **no changes** to the Landscape and Visual impacts than what has been approved within the North Runway Permission.

There will be **no change** to the extent of excavation or size of structures required due to there being no changes to the physical infrastructure of North Runway. As a result, the proposed Relevant Action will not result in any new landscape and visual effects during construction. Further assessment is therefore not required.

17.3.2 Methodology for Determining Operational Effects

As the proposed Relevant Action will result in no changes to the design or construction of the North Runway the only operational change will be as a result of the amendment of condition 3(d) and replacement of condition 5 resulting in a small variation in the times at which flights can depart and arrive into Dublin airport at night time.

The proposed Relevant Action will not result in a material change to Landscape and Visual amenity when comparing the permitted / constrained scenario and the proposed / unconstrained scenario. As a result, the proposed Relevant Action will not result in any new Landscape and Visual effects during operation beyond those already assessed and approved via the North Runway Permission. Further assessment is therefore not required.

17.4 Summary

As stated in S*ection 17.3: Assessment Methodology,* the proposed Relevant Action will result in a very small change when compared against the permitted / constrained scenario. The effect to the Landscape and Visual receptors is deemed **negligible** and will not change the assessment that has been approved as part of the North Runway Permission. On this basis, no further assessment is required as it is anticipated that there will be **no significant effects.**

Chapter 18: Land and Soils

18

18. Land and Soils

18.1 Introduction

This chapter of the Environmental Impact Assessment Report (EIAR) contains the findings of an assessment of the likely significant effects on Land and Soil impacts as a result of the proposed Relevant Action.

The proposed Relevant Action relates solely to proposals to amend condition 3(d) and replace condition 5 of the North Runway Permission and does not comprise or require the development of any physical or other infrastructure.

This assessment and EIAR chapter has been prepared by AECOM.

18.2 Planning Policy and Guidance

The following policy and guidance is relevant to this chapter and has been considered during the assessment presented within it. General legislation, policy and guidance has also been considered but is not listed as this has been covered in the introductory chapters:

- Institute of Geologists of Ireland (IGI), Guidelines for the Preparation of Soils, Geology and Hydrogeology Chapters of Environmental Impact Statements (2013)
- EPA, Towards Setting Guideline Values for the Protection of Groundwater in Ireland (2003)
- Regional and Spatial Economic Strategy (RSES) for the Eastern and Midland Region, 2019

18.3 Land and Soils Surrounding Area Summary

Data and background information relating to Land and Soils of the airport were derived from the online GSI 'Spatial Resources Viewer'.

18.3.1 Bedrock Geology

The majority of the airport is underlain by the Tober Colleen Formation, a dark grey, calcareous shale and limestone conglomerate of Carboniferous age.

The remainder is underlain by the Malahide Formation, an argillaceous limestone / shale, and by Waulsortian Limestone, a massive unbedded lime / mudstone. A small portion of the airport is underlain by the Lucan Formation, also known as the Calp Formation, a dark limestone and shale. All of the above formations are of Carboniferous age.

The Tober Colleen Formation is generally considered a 'Poor Aquifer', bedrock which is generally classified as unproductive except for local zones. The other bedrock units constitute a 'Locally Important Aquifer', which is moderately productive only in local zones.

18.3.2 Overburden Geology

Quaternary deposits overlying bedrock comprise glacial till derived from limestones (boulder clay) while the soils have been mapped as made ground. There is no gravel aquifer underlying the airport.

Soils immediately surrounding the airport are mapped on the EPA website as the Elton series, fine loamy drift with limestone, which has moderate drainage.

18.3.3 Topography and Landslides

The airport is relatively flat, with an elevation of 80 m above Ordnance Datum (OD) to the west close to runway 10/28 and declining to 60 m OD in the south-east, with a gradient of 0.005.

18.3.4 Groundwater Usage

The airport's water supply is solely provided by mains services with a reservoir on site having a 14,500m^3 capacity.

18.3.5 Depth to Groundwater and Flow Direction

Depth to groundwater measurements are not reported in the licensed monitoring wells on site, however, given that the shallow monitoring wells are generally between 4.2 m and 6 m below ground level (bgl) it is assessed that the depth to groundwater in the overburden (glacial till and made ground) is approximately 3 m bgl.

18.3.6 Groundwater Bodies

Across the airport the bedrock aquifer is divided into three different groundwater bodies:

- The Swords Groundwater Body, IE_EA_G_011[20], which was classified as having 'Good' status under the Water Framework Directive (WFD) for the period 2010-2015 and 'Not at Risk'. This groundwater body broadly coincides with the Malahide and Tober Collen formations beneath the northern half of runway 16/34, and northwards through runway 11/29 and the North Runway. The area of the groundwater body as a whole is estimated at 199 km^2, with the airport located in the south-east of the groundwater body. Groundwater flow is expected to be primarily through shallow bedrock where weathering and fracturing is greatest. However, the presence of warm springs indicates that some deep circulation of groundwater can occur.
- The Industrial Facility (P0480-02) Groundwater Body, IE_EA_G_086[21]. This is a small groundwater body which is classified as having 'Poor' status for the period 2013-2018 and as being 'At Risk'. This groundwater body is approximately 3.25 km^2 in area, extending from the hangars northwards to the Naul Road (L2040); south across the short-term car parks, office developments and onto the junction between the R132 and Corballis Road South near the Red Long-Term Car Park; and eastwards to the M1 motorway.
- The Dublin Groundwater Body, IE_EA_G_008[22]. This groundwater body is classified as having 'Good' status for the period 2010-2015 and as being 'Not At Risk'. This groundwater body coincides with the Tober Colleen Formation beneath the piers, terminals, cargo area, and most of the airfield as well as the Calp Formation beneath the Eastlands area. The airport straddles the northern boundary of this groundwater body. This is a large groundwater body with an estimated area of 837 km^2, extending from Dunshaughlin, Kilcock and Naas in the west, eastwards across Dublin city to the coast. Groundwater flow paths are expected to be short (~1 km) from recharge to discharge points, with groundwater discharge occurring to rivers where they are in hydraulic continuity with the aquifer, to springs and to the coast. Groundwater flow is expected to be primarily through shallow bedrock where weathering and fracturing is greatest.

18.3.7 Land Use

Available historic maps from 1837-1842 and 1888-1913 indicate that the site was primarily occupied by agricultural land during this period with a number of single dwellings within the airport boundary, which included:

- Corballis House;
- Collinstown House; and
- A ruined castle,

An airfield was first developed at Collinstown in 1917, during World War 1, with the commercial airport developed in the late 1930s.

As shown on the Corine 2018 land cover map (https://land.copernicus.eu/pan-european/corine-land-cover/clc2018), the majority of land surrounding North Runway and the airport is classified as a combination of industrial / commercial (artificial surfaces) and agricultural (arable or pasture). The airport itself is classified as artificial surface throughout for industrial / commercial / transport use, with this classification extending eastwards across the office and hotel developments and incorporating the long-term car parks west of the M1 motorway.

[20] https://secure.dccae.gov.ie/GSI_DOWNLOAD/Groundwater/Reports/GWB/SwordsGWB.pdf
[21] https://www.catchments.ie/data/#/waterbody/IE_EA_G_086?_k=oqhzta
[22] https://secure.dccae.gov.ie/GSI_DOWNLOAD/Groundwater/Reports/GWB/DublinGWB.pdf

The airport buildings, comprising the terminals, hangars, piers and support facilities for catering, cargo and fuel, are set out in a horseshoe configuration with airfield development to the west (aprons, taxiways and runways) and ground transportation infrastructure located centrally to the east.

Within the airfield, ground cover is predominantly concrete with some grassed areas adjacent to the taxiways, runways and around the airfield perimeter.

18.4 Assessment Methodology

18.4.1 Methodology for Determining Construction Effects

As the proposed Relevant Action will result in no changes to the design or construction of North Runway as per the approved North Runway Planning Permission, there will be **no changes** to the Land and Soil impacts than what has been approved within the North Runway Planning Permission.

There will be **no change** to the extent of excavation or size of structures required due to there being no changes to the physical infrastructure of North Runway. As a result, the proposed Relevant Action will not result in any new Land and Soil effects during construction. Further assessment is therefore not required.

18.4.2 Methodology for Determining Operational Effects

The result of the permitted / constrained scenario coming into effect when North Runway becomes operational in 2022, is a loss of 1.1m passengers per year (-3.5%) and a cumulative loss over the 4-year period 2022-2025 of 4.3m passengers. The net effect of the proposed Relevant Action would be to facilitate an increase in the number of flights permitted to take off from, or land at, Dublin Airport at night, which would enable the lost 1.1million passengers to be regained annually in the post-COVID-19 recovery period.

The proposed Relevant Action will result in an operational change as a result of the amendment of condition 3(d) and replacement of condition 5. This will result in a small variation in the number of and times at which flights can depart and arrive into Dublin Airport at night time.

It is assessed that the proposed Relevant Action will not result in any change to impacts on land and soils when comparing the permitted / constrained scenario and the proposed / unconstrained scenario. As a result, the proposed Relevant Action will not result in any new land and soils effects during operation. Further assessment is therefore not required.

18.5 Summary

The proposed Relevant Action will not result in any effects upon land and soils assets when compared with the permitted / constrained scenario. On this basis, no further assessment is required within this EIAR.

Chapter 19:
Material Assets

19

19. Material Assets

19.1 Introduction

This chapter of the Environmental Impact Assessment Report (EIAR) contains the findings of an assessment of the likely significant effects on material assets as a result of the proposed Relevant Action.

The proposed Relevant Action relates solely to proposals to amend condition 3(d) and replace condition 5 of the North Runway Permission and does not comprise or require the development of any physical or other infrastructure.

The result of the permitted / constrained scenario coming into effect when North Runway becomes operational in 2022, is a loss of 1.1m passengers per year (-3.5%) and a cumulative loss over the 4-year period 2022-2025 of 4.3m passengers. The net effect of the proposed Relevant Action would be to facilitate an increase in the number of flights permitted to take off from, or land at, Dublin Airport at night, which would enable the lost 1.1million passengers to be regained annually in the post-COVID-19 recovery period. There is therefore no increase in passenger numbers or traffic overall or any amendment of permitted annual passenger capacity of the Terminals at Dublin Airport. Condition no. 3 of the Terminal 2 Planning Permission (Fingal County Council Reg. Ref. No. F04A/1755; ABP Ref. No. PL06F.220670) and condition no. 2 of the Terminal 1 Extension Planning Permission (Fingal County Council Reg. Ref. No. F06A/1843; ABP Ref. No. PL06F.223469) provide that the combined capacity of Terminal 1 and Terminal 2 together shall not exceed 32 million passengers per annum.

This assessment and EIAR chapter has been prepared by AECOM.

19.2 Legislation and Policy

The following legislation and policy is relevant to this chapter and has been considered during the assessment presented within it. General legislation, policy and guidance has also been considered but is not listed as this has been covered in the introductory chapters:

- Waste Framework Directive 201/851
- EC (Waste Directive) Regulations 2011
- East Midlands Regional Waste Management Plan 2015 - 2021

19.3 Material Assets Summary

As per the draft EPA advice note for preparing environmental impact statements (EPA, 2015), natural origin and human origin material assets that should be considered within a EIAR are as follows:

Material Assets of Natural Origin Include:

- Assimilative capacity of air and water;
- Non-renewable resources (e.g. minerals, soils, oil, gas, etc.);
- Renewable resources (hydraulic head, wind exposure, wave exposure etc.); and
- Deep water berthage.

Material Assets of Human Origin Include:

- Cities, towns, villages and settlements;
- Transportation infrastructure (roads, railways, canals, airports etc);
- Major utilities (water supplies, sewage, power systems, telecommunication systems etc);
- Ownership and access;
- Agronomy;
- Commercial and Industrial Development;
- Property; and

- Tourism & Recreational Infrastructure.

The summaries below include the material assets that are deemed to be of relevance to the proposed Relevant Action.

19.3.1 Waste

Dublin Airport is located within the Eastern and Midlands Waste Region and is managed by Dublin City Council, the Waste Enforcement Regional Lead Authority (WERLA). In terms of waste management, the WERLA are responsible for implementing the Eastern-Midlands Region Waste Management Plan 2015-2021 (the Plan), as well as setting priorities and common objectives for waste enforcement within the region.

The three key objectives of the Plan are as follows:

- Prevent waste: a reduction of one per cent per annum in the amount of household waste generated over the period of the plan;
- More recycling: increase the recycle rate of domestic and commercial waste from 40 to 50 per cent by 2020; and
- Further reduce landfill: eliminate all unprocessed waste going to landfill from 2016.

Waste management in Dublin is largely governed by the requirements set out in the Plan. The Plan addresses all areas of waste management, from waste prevention and minimisation, to its collection treatment, recovery and final disposal. WERLA has set a target of 70% for the reuse, recycling and material recovery of man-made construction and demolition waste (excluding soil and stone) by December 2020.

As passenger numbers rise at Dublin Airport it is expected that the quantity of waste generated will also rise. Dublin Airport has a target of “Zero Waste to Landfill” which was first achieved in 2016 and is a key part of the Airport’s waste management strategy (Dublin Airport, 2019). A current target in respect of waste is to achieve 50% of waste recycled by 2020. Recycling rates have improved from 11% in 2013 to 42% in 2019 (Dublin Airport, 2019).

19.3.2 Built services assets

19.3.2.1 Electricity

In terms of electricity, the on-site power supply and distribution network was significantly upgraded as part of the development of Terminal 2 in 2011. A daa owned and operated substation at Dardistown with dual supply 100kVA power lines to the airport was completed. This enables the daa to provide power to the airport directly. In 2018, daa in partnership with ESB installed 268 solar panels on top of the airport's reservoir system which will provide more than half of the reservoir's annual energy requirements. The solar panels are connected directly to the airport's reservoir system.

19.3.2.2 Gas

With regard to gas, the on-site gas mains within Dublin Airport were upgraded to a 315 mm 4-bar ring main installed as part of the development of Terminal 2 in 2011. This is fed from a new Above Ground Installation (AGI) adjacent to the Dardistown substation with local AGIs around the site. In addition, Bord Gais Networks (BGN) installed a new 19-bar distribution line and AGI on the Santry Road.

19.3.2.3 Water

Dublin Airport straddles the Blanchardstown High Level Water Supply Area (Ballycoolin Reservoir Source – via elevated storage) and the Airport Water Supply Area (Ballycoolin Source via the 24” (600mm) diameter Forrest Little Main). A 36” (900mm) diameter trunk main supplies the area and delivers roughly 660 L/s.

Distribution pipework from the reservoir supplies cold water to the existing terminal, hangers, workshops, Aer Lingus offices and fire hydrants on the fire ring main across the airport (daa, 2008).

19.3.2.4 Surface Water

Several river catchments and subsequent sub-catchments drain land at Dublin Airport. These include:

- The Forrest Little, Wad Stream and Kealy’s Stream sub-catchments which are tributaries of the Sluice River which discharges to into the sea at Portmarnock; and
- The Cuckoo Stream and Mayne Stream sub-catchments, both tributaries of the Mayne River which discharges into the Baldoyle estuary.

19.3.2.5 Existing Foul Water Drainage

The foul drainage catchment is a mixture of industrial, commercial and hotel accommodation areas. Typical discharges are from toilets, sinks and hand wash basins within the airport buildings and from the hotel facilities (daa, 2008).

The daa capital investment programme (CIP) 2020+ states: *"The foul sewer infrastructure at Dublin Airport comprises a network of small sewer pipes from the two terminals and all campus buildings, a 450mm collector sewer and a 900mm outfall sewer. This outfall sewer in turn enters the Local Authority Owned Swords Road branch sewer, which then joins the Dublin City Council North Fringe sewer. While the main collector and outfall sewers convey under gravity, there are 5 No. ejector stations and 17 No. pumps installed to complete the system"* (daa, 2019).

For all foul discharges at existing terminal facilities, traders are required to be licensed and for all other foul discharges, daa holds a discharge license.

19.3.3 Existing Telecommunications Network

The on-site communications at Dublin Airport were significantly upgraded as part of the Terminal 2 upgrades in 2011. The DAC Masterplan states: "*the airport and its environs are served by a dual-path, divergent connectivity to Dublin's T50 broadband ring. This is a multi-duct system surrounding the City providing an uninterrupted physical link with two major transatlantic fibre termination points, with access to 27 international carriers, including direct fibre connectivity from Eircom, Colt, Digiweb, BT, Viatel and EU Networks" (Fingal County Council, 2016)*.

This network is referred to as the Campus Area Network (CAN) and is a high capacity (band width) fibre optic system with nodes at which connections are made to individual buildings and/or users.

The existing communications network for South Apron and all terminal buildings, is well serviced by the existing telecommunication duct network.

19.4 Assessment Methodology

19.4.1 Methodology for Determining Construction Effects

As the proposed Relevant Action will result in no changes to the design or construction of North Runway, there will be no changes to any Material Assets.

There will be no change to the extent of excavation or size of structures required due to there being no changes to the physical infrastructure of North Runway. As a result, the proposed Relevant Action will not have any new requirements for further material assets or result in any material asset effects, therefore further assessment of construction effects is not required.

19.4.2 Methodology for Determining Operational Effects

The proposed Relevant Action will result in an operational change as a result of the amendment of condition 3(d) and replacement of condition 5. This will result in a variation in the number of flights and times at which flights can depart and arrive into Dublin Airport at night.

As described in *Chapter 2: Characteristics of the project,* the proposed Relevant Action does not seek any other amendment of conditions of the North Runway Permission governing the general operation of the runway system. This includes condition no. 3 of the Terminal 2 Planning Permission and condition no. 2 of the Terminal 1 Extension Planning Permission which state that the combined capacity of Terminal 1 and Terminal 2 together shall not exceed 32 million passengers per annum (mppa).

Therefore the result of the permitted / constrained scenario coming into effect when North Runway becomes operational in 2022, is a loss of air traffic movements and associated loss of 1.1m passengers per year (-3.5%) and a cumulative loss over the 4-year period 2022-2025 of 4.3m passengers. The net effect of the proposed Relevant Action would be to facilitate an increase in the number of flights permitted to take off from, or land at, Dublin Airport at night, which would enable the lost 1.1million passengers to be regained annually in the post-COVID-19 recovery period but remain within condition no. 3 of the Terminal 2 Planning Permission and condition no. 2 of the Terminal 1 Extension Planning Permission which state that the combined capacity of Terminal 1 and Terminal 2 together shall not exceed 32 million passengers per annum (mppa).

The proposed Relevant Action will facilitate an increase in the number of flights at Dublin Airport during the night time, however this will not facilitate an increase beyond condition no. 3 of the Terminal 2 Planning Permission and condition no. 2 of the Terminal 1 Extension Planning Permission which state that the combined capacity of Terminal 1 and Terminal 2 together shall not exceed 32 million passengers per annum (mppa). It is therefore assessed that the proposed Relevant Action may cause some small differentiation to the time that certain material assets are consumed during operation at night time but will not result in a net increase in consumption of any material assets when comparing the permitted / constrained scenario and the proposed / unconstrained scenario either at 2022, or at 2025. As a result, it is assessed that the proposed Relevant Action will result in **negligible** effects to material assets during operation and so further assessment is therefore not required.

19.5 Summary

The proposed Relevant Action will result in a small variation in the consumption of material assets during operation when compared against the permitted / constrained scenario. However, it is important to note that condition no. 3 of the Terminal 2 Planning Permission and condition no. 2 of the Terminal 1 Extension Planning Permission which state that the combined capacity of Terminal 1 and Terminal 2 together shall not exceed 32 million passengers per annum (mppa) is in place for both the permitted / constrained and proposed / unconstrained scenarios and so no material changes are likely to occur. As a result, the effect to the Material Assets is deemed **negligible.**

Chapter 20: Cultural Heritage

20

20. Cultural Heritage

20.1 Introduction

This chapter of the Environmental Impact Assessment Report (EIAR) reports the findings of an assessment of the likely significant effects on Cultural Heritage as a result of the proposed Relevant Action.

The proposed Relevant Action relates solely to proposals to amend condition 3(d) and replace condition 5 respectively of the North Runway Permission and does not comprise or require the development of any physical or other infrastructure.

This assessment and EIAR chapter has been prepared by AECOM.

20.2 Legislation, Policy and Guidance

The following legislation, policy and guidance is relevant to this chapter and has been considered during the assessment presented within it. General legislation, policy and guidance has also been considered but is not listed as this has been covered in the introductory chapters:

- National Monuments Acts 1930
- Demesnes, Estates and their Settings, An Action of the County Cork Heritage Plan 2005/2010. Cork County Council, Cork
- Department of Arts, Heritage, and the Gaeltacht, 1999, Frameworks and Principles for the Protection of the Archaeological Heritage. The Stationary Office, Dublin
- Department of Arts, Heritage and the Gaeltacht, 2011, Architectural Heritage Protection, Guidelines for Planning Authorities. The Stationary Office, Dublin
- Fingal Heritage Plan, 2018 – 2023, Fingal County Council, 2018
- Institute of Archaeologists of Ireland ("IAI") (2006a) Code of Conduct for Archaeological Assessment Excavation
- IAI (2006b) Code of Conduct for the Treatment of Archaeological Objects in the context of an archaeological excavation. Institute of Archaeologists of Ireland
- IAI (2007) Environmental Sampling: Guidelines for Archaeologists. Institute of Archaeologists of Ireland

20.3 Cultural Heritage Surrounding Area Summary

Designated and non-designated heritage assets are present within the Dublin Airport boundary and in the close surrounding area. The specific locations and distances of these assets from the North Runway have not been detailed further because no construction or operational impacts are anticipated as part of the proposed Relevant Action.

20.4 Assessment Methodology

20.4.1 Methodology for Determining Construction Effects

As the proposed Relevant Action will result in no changes to the design or construction of North Runway, there will be **no changes** to the cultural heritage baseline of the North Runway.

There will be no change to the extent of excavation or size of structures required due to there being no changes to the physical infrastructure of North Runway. As a result, the proposed Relevant Action will not result in any new Cultural Heritage effects and further assessment is therefore not required.

20.4.2 Methodology for Determining Operational Effects

The result of the permitted / constrained scenario coming into effect when North Runway becomes operational in 2022, is a loss of 1.1m passengers per year (-3.5%) and a cumulative loss over the 4-year period 2022-2025 of 4.3m passengers. The net effect of the proposed Relevant Action would be to facilitate an increase in the number of flights permitted to take off from, or land at, Dublin Airport at night, which would enable the lost 1.1million passengers to be regained annually in the post-COVID-19 recovery period.

The proposed Relevant Action will result in an operational change as a result of the amendment of condition 3(d) and replacement of condition 5. This will result in a small variation in the number of and times at which flights can depart and arrive into Dublin Airport at night time.

It is assessed that the proposed Relevant Action will not result in any change to impacts on cultural heritage assets when comparing the permitted / constrained scenario and the proposed / unconstrained scenario. As a result, the proposed Relevant Action will not result in any new Cultural Heritage effects during operation. Further assessment is therefore not required.

20.5 Summary

The proposed Relevant Action will not result in any effects upon cultural heritage assets when compared with the permitted / constrained scenario. On this basis, no further assessment is required within this EIAR.

Chapter 21: Interaction and Cumulative Effects

21

21. Interaction and Cumulative Effects

21.1 Introduction

The EIA Directive (EC, 2011) states an Environmental Impact Assessment Report (EIAR) should contain:

'*A description of the likely significant effects of the project on the environment resulting from…the cumulation of effects with other existing and/or approved projects, taking into account any existing environmental problems relating to areas of particular environmental importance likely to be affected or the use of natural resources*.'

The Directive makes clear that the description of the likely significant effects should cover their cumulative effects. The Environmental Protection Agency's draft 'Guidelines on the information to be contained in Environmental Impact Assessment Reports (EPA, 2017) (hereafter referred to as 'the EPA Draft Guidelines') explains that cumulative effects are '*the addition of many minor or significant effects, including the effects of other projects, to create larger, more significant effects*'.

This chapter assesses the cumulative and in-combination effects associated with the proposed Relevant Action. These two types of environmental effects are defined in the EIA Directive as:

- In-combination Effects - Interrelationships that occur between the individual environmental effects of the proposed Relevant Action and the way that these effects have the potential to combine together to cause cumulative effects with one another at certain sensitive locations and lead to significant effects; and
- Cumulative Effects - The potential for effects of the proposed Relevant Action to combine with effects from other projects in the vicinity and lead to significant effects.

The in-combination and cumulative effects have been assessed using a combination of professional judgment and the finding of assessments carried out in relation to other projects in the vicinity of the proposed Relevant Action.

21.2 Legislative Context

The EIA Directive was transposed into domestic law on the 1st September 2018 in the form of the European Union (Planning and Development) (Environmental Impact Assessment) Regulations 2018 (hereafter referred to as 'the EIA Regulations') (EU, 2018).

21.3 Assessment Methodology

21.3.1 In-combination Effects

The assessment of in-combination effects of different types of impact, or impact interaction, from the proposed Relevant Action on particular receptors considers each of the environmental topics addressed within the EIAR and reported as part of this Environmental Impact Assessment Report (EIAR). The in-combination effect is focussed on the operational phase after the proposed Relevant Action is in place, as the proposed Relevant Action relates to the operating conditions of the runway system at night only.

This assessment only considers the residual effects and therefore takes into account any specific design or environmental management mitigation measures identified within each technical assessment (Chapters 7-20).

As In-combination effects are defined as a combination of impacts, only those receptors identified in multiple assessments can be considered. Population and health inherently assesses the in-combination effects by drawing on the assessment provided in *Chapter 13: Air Noise and Vibration*, *Chapter 14: Ground Noise and Vibration* and *Chapter 10: Air Quality*.

This assessment considers the residual effects for each topic and takes into consideration the significance of each individual identified effect and the duration over which these effects would be experienced in-combination.

The main potential impacts are outlined below:

- Changes in aircraft noise patterns;

- Changes in emissions of pollutants to air; and
- Changes in Risk of Hazard from Bird Strike.

21.3.2 Cumulative Effects

The Site is defined as being located at Dublin Airport, Co. Dublin, in the townlands of Collinstown, Toberbunny, Commons, Cloghran, Corballis, Coultry, Portmellick, Harristown, Shanganhill, Sandyhill, Huntstown, Pickardstown, Dunbro, Millhead, Kingstown, Barberstown, Forrest Great, Forrest Little and Rock on a site of c. 580 ha. North Runway is currently under construction within the northern extent of the Airport.

Cumulative effects consider the impacts of other undeveloped permitted projects and reasonably foreseeable development within the vicinity and context of the project. This will include other projects planned by daa, and any known permitted or planned projects by third parties. The following section details the process followed to identify those schemes with the potential to result in significant cumulative effects when considered in combination with the proposed Relevant Action.

The cumulative effects assessment presents a summary of the combined effects of the proposed Relevant Action with relevant schemes identified below for each of the environmental topics covered within the technical chapters (7-20) of this EIAR. These effects have been interpreted and classified using professional judgement, developing upon the assessment methodology outlined in technical chapters (7-20).

The first stage of the assessment is to establish criteria to identify a list of schemes in the vicinity of the application site.

Due to the fact that there are no works proposed as part of the proposed Relevant Action and that the Relevant Action will only result in the amendment and replacement of operating restrictions at night time, it is assessed that schemes outside that of the airport boundary will not result in any potential cumulative effects and so have been scoped out of this assessment. This is due to the fact that the proposed Relevant Action relates to night time operations only, and does not seek to alter the existing layout, location, flight paths, design, or infrastructure of the airport, and does not involve any construction.

The proposed Relevant Action does not seek any amendment of conditions of the North Runway Permission governing the general operation of the runway system (i.e., conditions which are not specific to night-time use, namely conditions no. 3 (a), 3(b), 3(c) and 4 of the North Runway Planning Permission) or any amendment of permitted annual passenger capacity of the Terminals at Dublin Airport. Condition no. 3 of the Terminal 2 Planning Permission (Fingal County Council Reg. Ref. No. F04A/1755; ABP Ref. No. PL06F.220670) and condition no. 2 of the Terminal 1 Extension Planning Permission (Fingal County Council Reg. Ref. No. F06A/1843; ABP Ref. No. PL06F.223469) provide that the combined capacity of Terminal 1 and Terminal 2 together shall not exceed 32 million passengers per annum.

The Fingal County Council planning porta (FCC, 2020) alongside a list of other airport projects provided by daa has been used to generate a list of schemes that have potential to form cumulative effects when combined with the Proposed Relevant Action.

A long list of schemes included in the cumulative effects assessment has been identified and filtered to short list ‘other developments’ for purposes of the assessment of cumulative effects together with the proposed Relevant Action. Each technical assessment within the EIAR has considered which of these schemes may result in cumulative effects together with the proposed Relevant Action from the perspective of the relevant technical assessment.

In addition to the above, and due to the proposed Relevant Action relating to night time operations only, and no construction or changes to infrastructure, the following criteria was used to determine which schemes to consider further within the cumulative assessment. If an identified scheme was categorised as one of the following, it was not considered as part of the list of schemes:

- Those outside of the airport boundary;
- Applications submitted before 1st November 2015 (5 years);
- Works to trees;
- Change of land use;
- Small scale schemes (e.g. less than five new dwellings/buildings);

- Changes of building use;
- Extensions to existing buildings;
- Cosmetic alterations to existing property/buildings;
- Roof mounted solar PV panels;
- Ground mounted solar PV panels with less than 50kW output;
- Renewal of planning permission for retention of existing operational use; and Variation to planning permissions, including reserved matters applications (where original application would be excluded).

Table 21-1 provides details of the identified schemes and justifies why each scheme is, or is not considered within this assessment of cumulative effects. Where an identified scheme did not have sufficient environmental information, it was not considered within this assessment. Sufficient detail relates to the availability of environmental reports or assessments; to enable a cumulative assessment to be made, potential environmental impacts of a scheme are required to understand the potential for any cumulative effects. Environmental assessments are usually contained as part of the planning application and are made available through the Fingal County Council planning portal, where a scheme is not yet present on the portal or does not contain environmental assessments, then those schemes are not considered to be reasonably foreseeable and have therefore not been considered further in the assessment.

Table 21-1 List of schemes identified through local planning portal and direct contact with daa

Scheme ID	Scheme Name	Application reference	Scheme description	Considered in the assessment	Justification
1	Substation F	F20A/0295	Replacement substation on the North Apron - single-storey free standing c.5m tall substation (approximately 18m x 21m), within which will be enclosed; a medium voltage ring main unit room; a medium voltage switch gear distribution room; a communications room; a transformer room; a generator change over panel room; a generator room; a main distribution room; and an entrance lobby.	No	Considered to be of a scale that will not result in any potential cumulative effects.
2	South Apron Widening	FS5/024/20	Enhancement of taxiway system to ease airfield congestion - The construction of new and rehabilitated taxiway pavement along with all associated ancillary development including surface water drainage and attenuation, road markings and signage, and Aircraft Ground Lighting.	No	No construction as part of the proposed Relevant Action and so no potential for cumulative effects.
3	Green Car Park/ Red Express North	F20A/0331	Application for temporary continuance of use of passenger car park for a period of 7 years	No	Renewal of planning permission for retention of existing operational use.
4	Terminal Forecourts /Tolling	F20A/0455	Insertion of traffic barriers on Dublin Airport private roads and associated works including lane realignment. Provision of Free Waiting Zone	No	Considered to be of a scale that will not result in any potential cumulative effects.

Scheme ID	Scheme Name	Application reference	Scheme description	Considered in the assessment	Justification
5	Pre-screening compound	TBC	Logistics and security compound. Taking over NR compound.	No	Not currently available on Fingal Planning Portal. Insufficient information to carry out assessment.
6	Demolition of vacant properties	TBC	Demolition of vacant buildings at various locations	No	Not currently available on Fingal Planning Portal. Insufficient information to carry out assessment.
7	North Apron Extension (12 Replacement Stands)	F20A/0550	Aircraft Stands in the North Apron to replace stands lost to North Runway (APC)	Yes	Potential cumulative Effects for: Noise and Vibration Population and Human Health Traffic and Transportation Landscape and Visual Biodiversity, Flora and Fauna: Terrestrial Ecology Water (Drainage)
8	Vehicle Maintenance Base/Logistics Building	F20A/0058	Construction of a vehicle maintenance building comprising of 2 no. units with mezzanine levels, 2 no. storage areas (tanks and bunds)	Yes	Potential for cumulative Biodiversity, Flora and Fauna: Terrestrial Ecology effects. Noise and Vibration.
9	Terminal 1 Façade and Offices	F20A/0553	Upgrade the façade of T1, renovate L4 & 5 and change of use of part of a car park to office use The development will consist of the installation of a new facade and thermal envelope to all elevations of the upper two storeys of the original Terminal 1 building (i.e. 'Levels 40 & 50'), with enhanced and consolidated daa office space to be provided across both levels, and associated development at roof level and Level 10 (i.e. Arrivals Level).	No	Considered to be of a scale that will not result in any potential cumulative effects.
10	Bus Shelter	F20A/0394	New bus shelter and taxi shelter extension	No	Considered to be of a scale that will not result in any potential cumulative effects.
11	Flight Catering Building	TBC	Demolition of side flanks, change of use to existing flight catering building to office and provision of substation	No	Not currently available on Fingal Planning Portal. Insufficient information to carry out assessment.
12	Pre-Boarding Zone	TBC	Permanent use of Pre-Boarding Zone building, associated canopy and covered pedestrian walkway and omit Condition 2 attached to the	No	Not currently available on Fingal Planning Portal. Insufficient information to carry out assessment.

Scheme ID	Scheme Name	Application reference	Scheme description	Considered in the assessment	Justification
			permitted development Reg. Ref. F16A/0483		
13	Runway 10 Line Up	TBC	Additional line up point for the 10/28 Runway	No	Not currently available on Fingal Planning Portal. Insufficient information to carry out assessment.
14	Infrastructure Application	TBC	Application for airport infrastructure to increase capacity at Dublin Airport and all associated infrastructure. Full details of the Principal elements of this project are not yet available but will likely consist of new aprons and Pier extensions.	No	The environmental assessments have not yet been finalised and currently insufficient information available to undertake a cumulative assessment.
15	North Runway Physical Amendments	F19A/0023 PL06F.305298	Physical amendments to permitted north parallel runway and taxiways.	No	The proposed Relevant Action will result in no changes to the design or construction of the North Runway Permission.
16	Dispatch Hut and Tug Shelter	TBC	Single-storey free-standing General Aviation Tug Shelter on the West Apron	No	Not currently available on Fingal Planning Portal. Insufficient information to carry out assessment.
17	Cargo Relocations	TBC	Development of new cargo facilities and relocation of tennants.	No	Not currently available on Fingal Planning Portal. Insufficient information to carry out assessment.
18	Pedestrian Walkway	F18A/0552	Covered 80m pedestrian walkway at Pier 4 (total floor area 160sqm)	No	Considered to be of a scale that will not result in any potential cumulative effects.
19	Airside Operational Buildings/Animal Welfare Facility	F19A/0426	Animal Welfare Facility (376 sqm), Airside Operations Facilities (Parking, storage tanks, foul waste disposal) & Substation	Yes	Potential cumulative Effects for: Biodiversity, Flora and Fauna: Terrestrial Ecology Soils, Geology and Hydrology Air Quality Water (Drainage) Noise and Vibration
20	Thermal Storage Tank	F19A/0084	Thermal Storage Tank (250m³) for the storage of hot water. It will be used to store excess heat and improve energy efficiency of the existing Combined Heat and Power Plant serving T2.	No	Considered to be of a scale that will not result in any potential cumulative effects.
21	Hold Baggage Screening	F18A/0638 F19A/0168	Demolition of existing Carousel Building and extension of the existing Terminal 1 baggage hall in	No	Considered to be of a scale that will not result in any potential cumulative effects.

Scheme ID	Scheme Name	Application reference	Scheme description	Considered in the assessment	Justification
			two locations to facilitate the mandatory upgrade of the airport security screening system for passenger baggage.		
22	P1/P2 Immigration Hall	F19A/0049	Extension to the existing Terminal 1 Pier 1 and Pier 2 Immigration Hall at Dublin Airport.	No	Considered to be of a scale that will not result in any potential cumulative effects.
23	Covid Medical Centre	n/a	1. Change of use of the current prefabricated unit known as the 'Dublin Airport Central Marketing Suite', located next to the T2 Multi-storey Car Park 2. Erection of a temporary unit to be used for COVID-19 testing on the Dublin Airport campus (exact location details TBC later this week) 3. Erection of a temporary unit to be used for COVID-19 testing on the Cork Airport campus (exact location details TBC later this week)	No	Not currently available on Fingal Planning Portal. Insufficient information to carry out assessment.
24	Gate Post 9	FS5/018/19	Construction of a Security Gatepost (Security Gatepost 9A) and the demolition of existing Gate 9, all in the townland of Huntstown, Dublin Airport, Co. Dublin.	No	Considered to be of a scale that will not result in any potential cumulative effects.
25	Critical Taxiway	FS5/017/19	New Taxiway and rehabilitation of existing taxiway	No	Considered to be of a scale that will not result in any potential cumulative effects.
26	Gate Post 1B	FS5/045/18	Erection of a new security gatepost, and all associated infrastructure including access to Castlemoate Road and modifications to the CPSRA boundary fence and the construction of a temporary access to serve planned rehabilitation/ upgrade works to the North Apron.	No	Considered to be of a scale that will not result in any potential cumulative effects.
27	Link 7	CLASS32/001/19	Notification in respect of proposed development in North Apron.	No	Considered to be of a scale that will not result in any potential cumulative effects.
28	Sub station T	F18A/0747	A replacement substation to serve the airfield with power.	No	Considered to be of a scale that will not result in any potential cumulative effects.

Scheme ID	Scheme Name	Application reference	Scheme description	Considered in the assessment	Justification
29	P1 P2 Immigration Hall Alteration to Permission F19A/0049	F20A/0262	Permission to alter previous approval F19A/0049 relating specifically to an approved porch extension. The proposal obtained permission to change the materials and foot print of the porch and included for advertising	No	Considered to be of a scale that will not result in any potential cumulative effects.
30	Solar Farm	TBC	Development of a Large PV Solar Farm	No	Not currently available on Fingal Planning Portal. Insufficient information to carry out assessment.
31	Dublin Airport Central	F16A/0155 ABP: 247299	Demolition and part demolition of buildings to provide for 4 no. office blocks and other works at the former Aer Lingus Head Office Building and modifications to F14A/0436 for new access road.	Yes	Potential cumulative Effects for: Traffic and Transportation Air Quality Climate and Carbon Noise and Vibration Landscape and Visual Biodiversity, Flora and Fauna: Terrestrial Ecology Water (Drainage) Soils, Geology and Hydrogeology Material Assets Cultural Heritage
32	T2 Kitchen Refurbishment	FS5/019/20	Refurbishment of kitchen facility involving installation of ventilation panels	No	Considered to be of a scale that will not result in any potential cumulative effects.
33	Border Control Post	n.a	S.181 (2)(a)	No	Not currently available on Fingal Planning Portal. Insufficient information to carry out assessment.

21.4 Limitations and Assumptions

A limitation that exists for the cumulative effects assessment is that not all of the cumulative schemes identified could be assessed as some of the schemes do not have sufficient environmental information available. It is only possible to consider current schemes and those that will take place in the reasonably foreseeable future. Furthermore, the assessment can only be based on the data that is readily available. The reason for excluding the schemes on this basis is because the potential environmental impacts of a scheme are required to understand the potential for any cumulative effects.

It is also assumed that due to the nature of the proposed Relevant Action, cumulative schemes outside that of the airport boundary are not necessary to consider within the scope of the cumulative effects assessment. The basis for excluding schemes beyond the airport boundary from the cumulative effects assessment is because these schemes are considered to be of a distance where cumulative effects with the proposed Relevant Action would not arise. The nature of the impacts identified with the proposed Relevant Action are such that they relate very specifically to Dublin Airport and the operation of the runway system, and are not anticipated to interact with other developments beyond the airport boundary to form significant cumulative effects.

21.5 In-combination Effects

The following section reports the likelihood of receptors experiencing significant in-combination environmental effects as a result of the proposed Relevant Action. The receptors included within this assessment are reported within the technical chapters (7-20) of this EIAR.

The following receptor groups have been identified as likely to experience in-combination effects as a result of the proposed Relevant Action:

- Residential property, Schools and Community Facilities

Table 21-2 shows the likely residual effects on the receptors and provides a description of the likely in-combination effects experienced. It should be noted that the effects listed below only consider the operational phase as the proposed Relevant Action will not have a construction phase.

Table 21-2 In-combination effects assessment

Receptor	Description of combined effect	Likely significance
Residential property, Schools and Community Facilities	During operation, Residential property, Schools and Community Facilities surrounding the airport are likely to experience a combination of adverse noise and vibration, air quality and hazard and risk effects.	The combination of these effects are likely to all be experienced at the same time, with the magnitude of in-combination effects occurring as assessed in the individual assessments. It is therefore assessed that the in-combination effects are unlikely to combine and result in any significant effects due to the proposed Relevant Action relating to night time operations only.

21.6 Assessment of Cumulative Effects

This section presents a summary of the assessment of cumulative environmental effects with those schemes identified in Table 21-1 within Section 21.4 of this chapter.

21.6.1 Population and Human Health

Applications: F19A/0426 and F20A/0550

Chapter 7: Population and Human Health considers the assessments carried out in Chapter 13: Air Noise and Vibration, Chapter 14: Ground Noise and Vibration and Chapter 10: Air Quality. The population assessment determines that there is a moderate adverse effect on Amenity and Local Communities, although no mitigation is provided within the Population and Human Health chapter itself, mitigation is provided within the Noise and Vibration Chapters. It is assessed that the proposed Relevant Action will not cause any new cumulative effects in combination with applications **F19A/0426 and F20A/0550.**

The Human Health assessment provided in Chapter 7 assesses that due to the number of people being adversely affected within Chapter 13. Air Noise and Vibration, the impact of the proposed Relevant Action on air quality, noise and neighbourhood amenity as a determinant of human health and well-being is assessed to be negative (-).

21.6.2 Traffic and Transportation

Applications: F16A/0155 and F20A/0550

The proposed Relevant Action entails no change to the extent of excavation or size of structures required to the physical infrastructure of North Runway. There is no change to the permitted 32mppa capacity of the terminals as part of the proposed Relevant Action. As a result, the proposed Relevant Action combined with applications

F19A/0426 and F20A/0550 will not result in any significant cumulative effects for traffic and transportation throughout construction or operation.

21.6.3 Air Quality

Applications: F19A/0426 and F16A/0155

The Air Quality assessment provided in Chapter 10, concluded that annual mean concentrations of all the pollutants considered are below the relevant limit values for all of the assessed receptor locations. It is assessed that the concentration changes resulting from the combined proposed Relevant Action and the schemes highlighted above will not breach these limits as the residual effects of the applications above are assessed as **not significant**.

The proposed Relevant Action does not have a construction phase, this combined with the small scale and temporary nature of the identified schemes construction phases enables the conclusion to be drawn that the cumulative effect of the schemes considered above would not result in any cumulative effects.

21.6.4 Climate and Carbon

Applications: F16A/0155

As described in chapter 11, GHG emissions resulting from the operational phase of the proposed Relevant Action are inevitable. However, the size and scale of the schemes assessed as having potential cumulative effects are not considered to be large enough to change the assessment carried out for the proposed Relevant Action. The effects of the proposed Relevant Action GHG assessment is not considered to be of significance, therefore it is assessed that there will be no cumulative effects on GHG emissions or any other Climate and Carbon parameter.

21.6.5 Noise and Vibration

Applications: F19A/0426, F16A/0155, F20A/0455 and F20A/0550

The proposed Relevant Action will not result in any changes to the design or construction of North Runway. As a result, the proposed Relevant Action will not result in any construction related environmental effects to noise and vibration. With the exception of application F16A/0155 and F20A/0550, the noise and vibration impacts from the schemes identified as having potential cumulative effects are temporary in nature as they arise from the construction phase of the developments. Through the implementation of suitable mitigation measures outlined in these developments respective CEMPs, significant cumulative effects will be avoided.

Application F20A/0550 is assessed within *Chapter 14: Ground Noise and Vibration* and is referred to as the 'Apron 5H scenario'. The Apron 5H scenario is an assessment of the scenario where both the proposed Relevant Action has been taken and the planning application for Apron 5H granted. It is, in effect, a scenario in which the cumulative effects of the two are assessed.

The assessment concluded that the residual effect when comparing the number of people exposed to high or very high residual L_{den} Noise Levels (defined within Chapters 13 and 14) and the number of people exposed to high or very high residual L_{night} Noise Levels did not change between the proposed Relevant Action scenario and the Apron 5H scenario; which was assessed as being 3 people exposed to high or very high residual L_{den} Noise Levels and 6 people exposed to high or very high residual L_{night} Noise Levels in 2022 and 2025 respectively. It is therefore assessed that no significant cumulative effects will arise.

As part of application F16A/0155, four areas of operational noise are highlighted in their environmental impact statement (daa, 2020), these are as follows: Building Services Noise, Car Parking on the Site, Delivery Activity and Additional Vehicular Traffic on Public Roads. All of these sources of noise do not require mitigation, except for 'building services noise' which with the implementation of mitigation measures does not produce any significant adverse residual effects on the local ambient noise environment during the construction or operational phases of application F16A/0155. Through the implementation of the mitigation measures described in the EIAR for application F16A/0155, and the assessment of the Apron 5H scenario in this EIAR, it is concluded that no significant cumulative effects will arise. Further details on the assessment of the Apron 5H Scenario is provided in *Chapter 14: Ground Noise and Vibration.*

21.6.6 Landscape and Visual

Applications: F16A/0155 and F20A/0550

The proposed Relevant Action entails no change to the extent of excavation or size of structures required to the physical infrastructure of North Runway. There is no change to the permitted 32mppa capacity of the terminals as part of the proposed Relevant Action. The proposed Relevant Action relates to night time operations only. As a result, the proposed Relevant Action will not result in any cumulative landscape and visual effects with applications: F16A/0155 and F20A/0550.

21.6.7 Biodiversity, Flora and Fauna: Terrestrial Ecology

Applications: F20A/0455, F19A/0426, F16A/0155 and F20A/0550

As stated in Chapter 14 of this EIAR, there are no sensitive ecological features within the airport which will be subject to significant impacts. The proposed Relevant Action entails no change to the extent of excavation or size of structures required to the physical infrastructure of North Runway. There is no change to the permitted 32mppa capacity of the terminals as part of the proposed Relevant Action. The proposed Relevant Action relates to night time operations only. As well as this, implementation of the Wildlife Management Plan by Dublin Airport, actively prevents flocks of birds and other fauna species which may be considered important from occurring in the vicinity of Dublin Airport. It is assessed that the active bird management operations at the airport will ensure that likely significant effects are avoided through mitigation, therefore it can be concluded that no cumulative effects will arise.

21.6.8 Water (Drainage)

Applications F19A/0426, F16A/0155 and F20A/0550

As stated in Chapter 12, there will be no change to the extent of excavation or size of structures required due to there being no changes to the physical infrastructure of North Runway. As a result, the proposed Relevant Action will not result in any construction effects already approved via the North Runway Permission. It is therefore assessed that no significant cumulative effects will arise.

21.6.9 Land and Soils

Applications F19A/0426 and F16A/0155

The proposed Relevant Action entails no change to the extent of excavation or size of structures required to the physical infrastructure of North Runway. There is no to the permitted 32mppa capacity of the terminals as part of the proposed Relevant Action. As a result, there will be no changes to the land and soils baseline of the North Runway and so it is assessed that no cumulative effects will occur as a result.

21.6.10 Material Assets

Applications: F16A/0155

The proposed Relevant Action entails no change to the extent of excavation or size of structures required to the physical infrastructure of North Runway. There is no change to the permitted 32mppa capacity of the terminals as part of the proposed Relevant Action. As a result, there will be no requirements for any further material assets and so it is assessed that no cumulative effects will occur as a result.

21.6.11 Cultural Heritage

Applications: F16A/0155

The proposed Relevant Action entails no change to the extent of excavation or size of structures required to the physical infrastructure of North Runway. There is no change to the permitted 32mppa capacity of the terminals as part of the proposed Relevant Action. As a result, there will be no changes to the cultural heritage baseline of the North Runway and so it is assessed that no cumulative effects will occur as a result.

21.7 Summary

It is considered that the proposed Relevant Action will not result in any cumulative effects or in-combination effect interactions, this is mainly due to the nature of the proposed Relevant Action itself, which concerns operation at night time only and does not make any changes to the design or construction of North Runway or the runway system at the airport. Any effects that have been identified are likely to remain not significant due to the mitigation already present within this EIAR and any mitigation present in the the schemes identified as relevant for the purposes of the cumulative assessment.

22. References

ABP. (2006). (F04A/1755 & PL06F.217429)

Airport Direction D-O Wildlife/Habitat, Dublin Airport Aerodrome Manual, Part E – Operating procedures of the Aerodrome, its equipment and safety measures, February 2016.

ANC/IOA/CIEH. (2017). ProPG: Planning & Noise –New Residential Development, Association of Noise Consultants, Institute of Acoustics and Chartered Institute of Environmental Health.

AQC. (2020). Dublin Airport North Runway: Relevant Action Application - Technical Report.

Atmosfair, (2020); Calculate Flight Emissions [online]. Available at: https://www.atmosfair.de/en/offset/flight/

Babisch, W., (2011). Cardiovascular effects of noise. Noise Health. 13. 201-204.

Babisch, W., (2014). Updated exposure-response relationship between road traffic noise and coronary heart diseases: A metaanalysis. Noise and Health, 16(68), 1-9

Bambrick. H., Dear. K., Woodruff. R., Hanigan. I., and McMichael. AJ., (2008) The impacts of climate change on three health outcomes: temperature-related mortality and hospitalisations, salmonellosis and other bacterial gastroenteritis, and population at risk from dengue. Garnaut Climate Change Review.

Barton, H. and Tsourou, C, (2000), Healthy Urban Planning. World Health Organisation.

Basner, M., & McGuire, S., (2018). WHO Environmental Noise Guidelines for the European Region: A Systematic Review on Environmental Noise and Effects on Sleep. Int J Environ Res Public Health. 14.

Basner, M., Babisch, W., Davis, A., Brink, M., Clark, C., Janssen, S., and Stansfeld, S., (2014). Auditory and non-auditory effects of noise on health. Lancet, 383(9925), 1325-1332

Baudin, C., Lefevre, M., Champelovier, P., Lambert, J., Laumon, B., & Evrard, A. S. (2018). Aircraft Noise and Psychological Ill-Health: The Results of a Cross-Sectional Study in France. International Journal of Environmental Research and Public Health, 15(8)

Bell, M. L., Zanobetti, A. & Dominici, F., (2013). Evidence on vulnerability and susceptibility to health risks associated with short-term exposure to particulate matter: a systematic review and meta-analysis. Am J Epidemiol, 178, 865-76.

Berglund, B., Lindvall, T., & Schwela, D, H. (1999). Guidelines For Community Noise, World Health Organisaion.

Beutel, M. E., Junger, C., Klein, E. M., Wild, P., Lackner, K., Blettner, M., and Munzel, T., (2016). Noise Annoyance Is Associated with Depression and Anxiety in the General Population- The Contribution of Aircraft Noise. PloS One, 11(5).

Bonsaksen, T., Thorrisen, M. M., et al., (2019). Who reported having a high-strain job, low-strain job, active job and passive job? The WIRUS Screening study. PLoS ONE, 14.

Braubach, M., Jacobs, D. E. & Ormandy, D. (eds.), (2011). Environmental burden of disease associated with inadequate housing. A method guide to the quantification of health effects of selected housing risks in the WHO European Region, Copenhagen, Denmark: World Health Organization Europe.

Breugelmans, O., Houthuijs, D., van Kamp, I., Stellato, R., van Wiechen, C. and Doornbos, G., (2007). Longitudinal effects of a sudden change in aircraft noise exposure on annoyance and sleep disturbance around Amsterdam Airport. Paper presented at the International Congress on Acoustics, Madrid.

Brink, M., Wirth, K. E., & Schierz, C., (2008). Annoyance responses to stable and changing aircraft noise exposure. The Journal of Acoustic Society of America. 124. 2930.

British Standards Institution. (2011). PAS 2050:2011 Specification for the assessment of the life cycle greenhouse gas emissions of goods and services.

Brown, A. L., and van Kamp, I., (2009). Response to a change in transport noise exposure: competing explanations of change effects. Journal of the Acoustical Society of America, 125, 905-914.

BSI. (2003). BS 7445:2003 Description and measurement of environmental noise, British Standards Institution.

BSI. (2014). BS 8233:2014 Sound insulation and noise reduction for buildings – Code of practice, British Standards Institute.

Canivet, C., Choi, B., et al., (2013). Can high psychological job demands, low decision latitude, and high job strain predict disability pensions? A 12-year follow-up of middle-aged Swedish workers. Int Arch Occup Environ Health. 86. 307-319.

Carbon Brief. (2019). Why Ireland is nowhere near meetings its climate change goals.

CCC. (2005). Demesnes, Estates and their Settings, An Action of the County Cork Heritage Plan 2005/2010. Cork County Council.

Central Statistics Office (Ireland), (2016), Census 2016.

Central Statistics Office (Ireland), (2019), Labour Force Survey (2019, Q2).

Central Statistics Office, (2019); Irish Health Survey 2015.

Central Statistics Office, (2019); Irish Life Tables: Period Life Expectancy by Sex, Age, Region and Year.

CIEEM. (2018). Guidelines for Ecological Impact Assessment in the UK and Ireland, Chartered Institute of Ecology and Environmental Management.

Civil Aviation Authority. (2020). CAP1616a: Airspace Change: Environmental requirements technical annex.

Clark, C., Pike, C., McManus, S., Harris, J., Bebbington, P., Brugha, T., and Stansfeld, S. A., (2012). The contribution of work and non-work stressors to common mental disorders in the 2007 Adult Psychiatric Morbidity Survey. Psychological Medicine, 42(4), 829-842.

Codema. (2018). Dublin City Baseline Report.

Codema. (n.d.). A Strategy Towards Climate Change Action Plans for The Dublin Local Authorities.

Daa (2008) Dublin Airport Multi Storey Car Park and Hotel, Environmental Impact Statement by Arup Consulting Engineers

Daa (2019) Dublin Airport Sets New Passenger Record. Available from: https://www.dublinairport.com/latest-news/detail/dublin-airport-sets-new-passenger-record-2 [Accessed 4 March 2019]

Daa (2019), Capital Investment Programme 2020+, Submission to CAR

Daa, Environmental Impact Statement, DAC Project IE0311582-22-RP-0002, Issue: B. Available at: http://documents.fingalcoco.ie/NorthgatePublicDocs/00522551.pdf (Accessed: November 2020

Daa. (2019). Dublin Airport Air Quality Monitoring Annual Report. Dublin Airport Authority.

DAHG. (1999). Frameworks and Principles for the Protection of the Archaeological Heritage. The Stationary Office, Dublin, Department of Arts, Heritage and the Gaeltacht.

DAHG. (2011). Architectural Heritage Protection, Guidelines for Planning Authorities. The Stationary Office, Dublin, Department of Arts, Heritage and the Gaeltacht.

DCC. (2009). Dublin Regional Air Quality Management Plan 2009-2012, Dublin City Council.

DCC. (2010). Dublin City Sustainable Energy Action plan 2010 – 2020, Dublin City Council.

DCC. (2016). Dublin City Development Plan, 2016-2022. Dublin City Council.

DCC. (2019). Climate Change Action Plan 2019-2024, Dublin City Council.

DCCAE. (2013). National Policy Position on Climate Action and Low Carbon Development, Department of Communications, Climate Action and Environment.

DCCAE. (2019). Climate Action Plan 2019: To Tackle Climate Breakdown, Department of Communications, Climate Action and Environment.

DCHG. (2017). National Biodiversity Action Plan 2017 – 2021. Department of Culture, Heritage and the Gaeltacht.

DCHG. (2020) National Inventory of Architectural Heritage (Gardens), Department of Culture, Heritage and the Gaeltacht.

Dear, K., Ranmuthugala, G., and Kjellström, T., et al. (2005). Effects of temperature and ozone on daily mortality during the August 2003 heat wave in France. Arch Environ Occup Health; 60: 205–12.

Defra. (2010). Noise Policy Statement for England, Department for Environment, Food and Rural Affairs.

Defra. (2014). Energy recovery for residual waste: A carbon based modelling approach, Department for Environment, Food and Rural Affairs.

Defra. (2018). 2020 Government greenhouse gas conversion factors for company reporting - Methodology Paper for Conversion factors Final Report, Department for Environment, Food and Rural Affairs.

Defra. (2018) Local Air Quality Management Technical Guidance (TG16), Department for Environment, Food and Rural Affairs.

Defra. (2019). Background Mapping data for local authorities, Department for Environment, Food and Rural Affairs.

Defra. (2019). National Planning Policy Guidance, Planning Practice Guidance, Noise, Department for Environment, Food and Rural Affairs.

Department for Transport, Tourism and Sport, (2019); People, Place and Policy: Growing Tourism to 2025.

Department for Transport. (2017). Consultation Response on UK Airspace Policy: A framework for balanced decisions on the design and use of airspace.

Department of Health, (2019); Healthy Ireland Framework 2019 – 2025.

Department of Health, (2019); Open Beds Report – June 2019.

Department of Housing, Planning and Local Government, (2018), National Development Plan 2018 – 2027

Department of Housing, Planning and Local Government, (2018), Project Ireland 2040: National Planning Framework

Department of Transport, Tourism and Sport (2015) National Aviation Policy for Ireland

Department of Transport, Tourism and Sport (2015) People, Place and Policy: Growing Tourism to 2025

Department of Transport, Tourism and Sport (2018) Review of Future Capacity Needs at Ireland's State Airports, Final Report for the Department of Transport, Tourism and Sport

DHPLG. (2018). River Basin Management Plan 2018-2021, Department of Housing Planning and Local Government.

Directive 2011/92/EU of the European Parliament and of the Council of 13th December 2011 on the assessment of the effects of certain public and private projects on the environment (as amended by Directive 2014/52/EU)

DTTS. (2015). National Aviation Policy, Department of Transport, Tourism and Sport.

Dublin Airport (2019), Sustainability Report 2019, Taking Action for a Greener Airport. Available at: https://www.dublinairport.com/docs/default-source/sustainability-reports/91098-dublin-airport-sustainability-report-fa.pdf?sfvrsn=cd27df4e_4 (Accessed: December 2020)

Dublin Airport Drainage Masterplan (2020);

Dublin Drainage. (2005a). Greater Dublin Strategic Drainage Study Final Strategy Report.

Dublin Drainage. (2005b). Greater Dublin Strategic Drainage Study – Regional Drainage Policies – Volume 2 – New Development.

Eastern and Midland Regional Assembly. (2019). Regional Spatial & Economic Strategy for the Eastern and Midland Region 2019-2031.

EC. (2015). EU Emissions Trading System (EU ETS), European Commission.

EC. (2017). Environmental Impact Assessment of Projects – Guidance on Scoping (Directive 2011/92/EU as amended by 2014/52/EU, European Commission.

Egan, M., Tannahill, C., Petticrew, M., et al., (2008). Psychosocial risk factors in home and community settings and their associations with population health and health inequalities: a systematic meta-review. BMC Public Health, 8, 239.

EMEP/ EEA. (2019). Aviation Emissions Calculator (accompaniment to the EMEP/ EEA air pollutant emission inventory guidebook, 2019, chapter 1.A.3.a Aviation)

EMWR. (2015). Eastern Midlands Region Waste Management Plan, 2015-2021, Eastern Midlands Waste Regio

Environmental Protection Agency, (2002); Advice Notes on Current Practice in the Preparation of Environmental Impact Statements.

Environmental Protection Agency, (2017); Draft Guidelines on the Information to be Contained in Environmental Impact Assessment Reports.

Environmental Protection Agency, (2017b); Draft Advice Notes for Preparing Environmental Impact Statements

EPA. (2002). EPA Guidelines on the information to be contained in Environmental Impact Statements. Environmental Protection Agency, Co. Wexford, Ireland.

EPA. (2003). EPA Advice Notes on Current Practice in the Preparation of Environmental Impact Statements. Environmental Protection Agency, Co. Wexford, Ireland.

EPA. (2003). Towards Setting Guideline Values for the Protection of Groundwater in Ireland', Environmental Protection Agency, Co. Wexford, Ireland.

EPA. (2011). Air Quality Standards Regulations 2011, Environmental Protection Agency, Co. Wexford, Ireland.

EPA. (2019). Air Quality in Ireland 2019, Environmental Protection Agency, Co. Wexford, Ireland.

EPA. (2019). Guidance on Retention Requirements for Firewater Run-off, Environmental Protection Agency, Co. Wexford, Ireland.

EPA. (20198). Air Quality in Ireland 2018, Environmental Protection Agency, Co. Wexford, Ireland.

EPA. (2020). Air Quality Bulletin 2020, Environmental Protection Agency, Co. Wexford, Ireland.

EPA. (2020a). Irelands Greenhouse Gas Emissions Projections, Environmental Protection Agency, Co. Wexford, Ireland.

EPA. (2020b). Ireland's Greenhouse Gas Emissions Projections (2019 – 2040), Environmental Protection Agency, Co. Wexford, Ireland.

EPA. (2020c). National Inventory Report, Environmental Protection Agency, Co. Wexford, Ireland.

ERM. (2003). Public Safety Zones Report Appendix B Public Safety Zones: Criteria and Policy, Risk Assessment and Expert Opinions, prepared by ERM on behalf of the Department of Transport and the Department of Environment, Heritage and Local Government, Environmental Resource Management Ireland Ltd.

EU. (1999). Council Directive 1999/30/EC, of 22 April 1999, relating to limit values for sulphur dioxide, nitrogen dioxide and oxides of nitrogen, particulate matter and lead in ambient air, European Union.

EU. (2000). Directive 2000/60/EC of the European Parliament and of the Council of 23 October 2000 establishing a framework for Community action in the field of water policy (as amended), European Union.

EU. (2000). Directive 2000/69/EC of the European Parliament and of the Council of 16 November 2000 relating to limit values for benzene and carbon monoxide in ambient air, European Union.

EU. (2002). Council Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora, European Union.

EU. (2002). Directive 2002/3/EC of the European Parliament and of the Council of 12 February 2002 relating to ozone in ambient air, European Union.

EU. (2002). Directive 2002/49/EC Directive of the European Parliament and of the Council of 25th June 2002 relating to the assessment and management of environmental noise, European Union.

EU. (2007). Directive 2007/60/EC of the European Parliament and of the Council of 23 October 2007 on the assessment and management of flood risks, European Union.

EU. (2008). Directive 2008/50/EC of the European Parliament and of the Council, of May 2008, on ambient air quality and cleaner air for Europe, European Union.

EU. (2008). Regulation (EC) No 216/2008 of the European Parliament and of the Council of 20 February 2008 on common rules in the field of civil aviation and establishing a European Aviation Safety Agency, and repealing Council Directive 91/670/EEC, Regulation (EC) No 1592/2002 and Directive 2004/36/EC, European Union.

EU. (2009). Directive 2009/147/EC of the European Parliament and of the Council of 30 November 2009 on the conservation of wild birds, European Union.

EU. (2012). Directive 2012/18/EU of the European Parliament and the Council of 4 July 2012 on the control of major-accident hazards involving dangerous substances, amending and subsequently repealing Council Directive 96/82/EC, European Union.

EU. (2014). Commission Regulation (EU) No 139/2014 of 12 February 2014 laying down requirements and administrative procedures related to aerodromes pursuant to Regulation (EC) No 216/2008 of the European Parliament and of the Council Text with EEA relevance, European Union.

EU. (2014). Directive 2014/52/EU of the European Parliament and of the Council of 16 April 2014 amending Directive 2011/92/EU on the assessment of the effects of certain public and private projects on the environment, European Union.

EU. (2014). Regulation (EU) No 598/2014 of the European Parliament and of the Council of 16 April 2014 on the establishment of rules and procedures with regard to the introduction of noise-related operating restrictions at Union airports within a Balanced Approach and repealing Directive 2002/30/EC, European

EU. (2018). Directive (EU) 2018/851 of the European Parliament and of the Council of 30 May 2018 amending Directive 2008/98/EC on waste, European Union.

EU. (2018). The European Union (Planning and Development) (Environmental Impact Assessment) Regulations 2018.

EU. (2018a). Directive 2018/850 of the European Parliament and of the Council of 30 May 2018 amending Directive 1999/31/EC on the landfill of waste (Text with EEA relevance), European Union.

EU. (2018b); Directive (2018/410 of the European Parliament and of the Council of 14 March 2018 amending Directive 2003/87/EC to enhance cost-effective emission reductions and low-carbon investments, and Decision (EU) 2015/1814 (Text with EEA relevance).

EU. (2020). Directive 2020/367 of 4 March 2020 amending Annex III to Directive 2002/49/EC of the European Parliament and of the Council as regards the establishment of assessment methods for harmful effects of environmental noise (Text with EEA relevance), European Union.

Evans, A.W., Foot, P.B., Mason, S.M., Parker, I.G., & Slater, K. (1987). Third Party Risks Near Airports and Public Safety Zone Policy: A Report to the Department by Consultants, Department of the Environment, Transport and the Regions.

FCC. (2005). Fingal Development Plan 2005 – 2011, Fingal County Council.

FCC. (2017). Fingal Development Plan 2017-2023, Fingal County Council.

FCC. (2018). Dublin Airport Noise Action Plan 2019-2023, Fingal County Council.

FCC. (2019). Fingal County Council Climate Change Action Plan 2019-2024, Fingal County Council.

FCC. (2019). Fingal Heritage Plan, 2018 – 2023, Fingal County Council.

FCC. (2020). Dublin Airport Local Area Plan (2020), Fingal County Council.

Fingal County Council (2016) Dublin Airport Central Masterplan. Available online at: https://www.fingal.ie/sites/default/files/2019-03/Airport%20Masterplan%20March%202016r.pdf

Fingal County Council (FCC) Noise Action Plan for Dublin Airport 2019-2023

Fingal County Council Planning Portal, Available: https://planning.agileapplications.ie/fingal/search-applications/ (Accessed: November 2020)

Fingal County Council, (2017); Fingal Development Plan 2017 – 2023.

Fingal County Council, (2019); Draft Dublin Airport Local Area Plan.

Fossitt, J. (2000). A Guide to Habitats in Ireland. The Heritage Council.

GFL. (2003). Externes Risiko für den Flughafen Frankfurt Main, report prepared for Frankfurt Airport by Gesellschaft für Luftverkehrsforschung mbH.

Government if Ireland. (1930-2004). National Monuments Acts (1930 – 2004).

Government of Ireland, (2018), National Planning Framework: Project Ireland 2040.

Government of Ireland. (1959-2017). Inland Fisheries Acts 1959 to 2017.

Government of Ireland. (1959-2019). Fisheries Acts 1959 to 2019.

Government of Ireland. (1976-2018). The Wildlife Acts 1976 to 2018.

Government of Ireland. (1977-2007). Local Government (Water Pollution Acts) 1977-2007.

Government of Ireland. (1992). The Environmental Protection Act 1992 (as amended).

Government of Ireland. (2000-2020). Planning and Development Acts 2000 to 2020.

Government of Ireland. (2001-2020). Planning and Development Regulations 2001 to 2020.

Government of Ireland. (2002). National Spatial Strategy for Ireland 2002 – 2020.

Government of Ireland. (2003). Protection of the Environment Act (as amended).

Government of Ireland. (2010). S.I. No. 122 of 2010- European Communities (Assessment and Management of Flood Risks) Regulations, 2010.

Government of Ireland. (2011). S.I. No. 126/2011 - European Communities (Waste Directive) Regulations 2011.

Government of Ireland. (2011). S.I. No. 180/2011 - Air Quality Standards Regulations 2011.

Government of Ireland. (2012). S.I. No. 326 of 2012 – Air Pollution Act.

Government of Ireland. (2015). Climate Action and Low Carbon Development Act 2015.

Government of Ireland. (2015). S.I. No. 356/2015 - Flora (Protection) Order, 2015.

Government of Ireland. (2018). Project Ireland 2040: National Planning Framework.

Government of Ireland. (2018a). Project Ireland 2040: National Planning Framework.

Government of Ireland. (2018b). National Development Plan 2018-2027.

Government of Ireland. (2019). Climate Action Plan 2019.

Government of Ireland. (2019). The Aircraft Noise (Dublin Airport) Regulation Act 2019.

Government of Ireland. (2020). A Waste Action Plan for a Circular Economy. Ireland's National Waste Policy. 2020-2025.

Government of Ireland: Prepared by Department of Health, (2018); Health in Ireland: Key Trends 2018.

Greater Dublin Regional Code of Practice for Drainage Works Version 6.0

Gruebner, O., Rapp, M. A., Adli, M., Kluge, U., Galea, S., and Heinz, A., (2017). Cities and Mental Health. Dtsch Arztebl Int, 114(8), 121-127.

Guidelines on the information to be contained in Environmental Impact Assessment Reports, Environmental Protection Agency (2017)

Haase, T., and Pratschke, J. (2017); The 2016 Pobal HP Deprivation Index for Small Areas (SA).

Health and Safety Commission. (1991). Major hazard aspects of the transport of dangerous substances, Heathrow Airport Limited. (2018). Heathrow Airport 2017 Emissions Inventory.

Herbig, B., Dragano, N. & Angerer, P., (2013). Health in the long-term unemployed. Dtsch Arztebl Int, 110, 413-9.

Historic England. (2014). Aviation Noise Metric – Research on the Potential Noise Impacts on the Historic Environment by Proposals for Airport Expansion in England.

HSA. (2010). Policy & Approach of the Health & Safety Authority to COMAH Risk-based Land-use Planning, Health and Safety Authority.

IAI. (2006a). Code of Conduct for Archaeological Assessment Excavation, Institute of Archaeologists of Ireland;

IAI. (2006b). Code of Conduct for the Treatment of Archaeological Objects in the context of an archaeological excavation, Institute of Archaeologists of Ireland.

IAI. (2007). Environmental Sampling: Guidelines for Archaeologists, Institute of Archaeologists of Ireland

ICAO (2010). Doc 9829 Guidance on the Balanced Approach to Aircraft Noise Management, International Civil Aviation Organisation.

ICAO. (2011). Airport Air Quality Manual, International Civil Aviation Organization.

ICAO. (2014). Annex 16 to the Convention on International Civil Aviation, Environmental Protection, Volume 1 Aircraft Noise, 7th Edition, International Civil Aviation Organisation.

ICAO. (2016). Carbon Offsetting and Reduction Scheme for International Aviation, International Civil Aviation Organization

Ideno, Y., Hayashi, K., Abe, Y., et al., (2017). Blood pressure-lowering effect of Shinrin-yoku (Forest bathing): a systematic review and meta-analysis. BMC Complement Altern Med, 17, 409.

IEMA. (2017). Environmental Impact Assessment Guide to: Assessing Greenhouse Gas Emissions and Evaluating their Significance. Institute of Environmental Management and Assessment.

IEMA. (2020). Environmental Impact Assessment Guide to: Climate Change Resilience and Adaptation. Institute of Environmental Management and Assessment.

IGI. (2013). Guidelines for the Preparation of Soils, Geology and Hydrogeology Chapters of Environmental Impact Statements, Institute of Geologists Ireland.

ILI. (2015). The National Landscape Strategy (NLS) for Ireland 2015-2025, Irish Landscape Institute.

Institute of Public Health in Ireland, (2005), Health Impacts of Transport: a review.

Institute of Public Health in Ireland, (2006), Health Impacts of the Built Environment: a review.

Institute of Public Health in Ireland, (2009). Health Impact Assessment Guidance.

Intergovernmental Panel on Climate Change (IPCC), (1999); Aviation and the Global Atmosphere: A Special Report of IPCC Working Groups I and III.

InterVISTAS. (2019). Dublin Airport Economic Impact of Operating Restriction.

IPCC. (2018); Global warming of 1.5°C. An IPCC special report on the impacts of global warming of 1.5°C above pre-industrial levels and related global greenhouse gas emission pathways, in the context of strengthening the global response to the threat of climate change, sustainable development, and efforts to eradicate poverty, Intergovernmental Panel on Climate Change

ISO. (1996). ISO 9613-2:1996 Acoustics – Attenuation of sound during propagation outdoors – Part 2: General method of calculation, International Organization for Standardization.

Kempen, E. V., Casas, M., Pershagen, G., and Foraster, M., (2018). WHO Environmental Noise Guidelines for the European Region: A Systematic Review on Environmental Noise and Cardiovascular and Metabolic Effects: A Summary. International Journal of Environmental Research and Public Health, 15(2)

Keum, N., Greenwood, D. C., Lee, D. H., et al., (2015). Adult weight gain and adiposity-related cancers: a dose-response meta-analysis of prospective observational studies. J Natl Cancer Inst, 107.

Kim, T. J. & von dem Knesebeck, O., (2015). Is an insecure job better for health than having no job at all? A systematic review of studies investigating the health-related risks of both job insecurity and unemployment. BMC Public Health, 15, 985.

Knowlton. K., Lynn. B., and Goldberg. R.A., et al., (2007) Projecting heat-related mortality impacts under a changing climate in the New York City region. Am J Public Health; 97:2028-34.

Kredlow, M. A., Capozzoli, M. C., Hearon, B. A., et al., (2015). The effects of physical activity on sleep: a meta-analytic review. J Behav Med, 38, 427-49.

Landscape Institute. (2011). Photography and Photomontage in Landscape and Visual Impact Assessment, Landscape Institute Advice Note 01/2011.

Landscape Institute. (2013). Guidelines for Landscape and Visual Impact Assessment (GLVIA), 3rd Edition, 2013, Landscape Institute (UK) & IEMA.

Lee, D., Fahey, D., Forster, P. et al., (2009); Aviation and Global Climate Change in the 21st Century. Atmospheric Environment 35: 3520-3537.

Liu, Y., Yan, S., Poh, K., et al., (2016). Impact of air quality guidelines on COPD sufferers. Int J Chron Obstruct Pulmon Dis. 11. 839-872.

London Healthy Urban Development Unit, (2019); HUDU Planning for Health: Rapid Health Impact Assessment Tool (Fourth Edition, October 2019).

Loomis, D., Grosse, Y., et al., (2013). IARC evaluation of the carcinogenicity of outdoor air pollution. Lancet Oncol. 14. 1262–1263.

Lustenberger, T., Inaba, K., Talving, P., et al., (2010). Bicyclists injured by automobiles: relationship of age to injury type and severity--a national trauma databank analysis. J.Trauma, 69, 1120-1125.

McCormack, G. R., Rock, M., Toohey, A. M., et al., (2010). Characteristics of urban parks associated with park use and physical activity: a review of qualitative research. Health Place, 16, 712-26.

McMichael, A.J., and Lindgren, E., (2011). Climate change: present and future risks to health, and necessary responses. Journal of Internal Medicine. 270. (5).

Mendez-Figueroa, H., Dahlke, J. D., Vrees, R. A., et al. (2013). Trauma in pregnancy: an updated systematic review. Am.J.Obstet.Gynecol., 209, 1-10.

Miller, W. D., Pollack, C. E. & Williams, D. R., (2011). Healthy homes and communities: putting the pieces together. Am J Prev Med, 40, S48-57.

Moorcroft and Barrowcliff. (2017). Land-Use Planning & Development Control: Planning For Air Quality, Institute of Air Quality Management / Environmental Protection United Kingdom.

Mott MacDonald, (2020). Dublin Airport Operating Restrictions: Quantification of Impacts on Future Growth September 2020 Update – 2022-2025 Period

Mott McDonald. (2020). Quantification of Impacts on Future Growth, Update 2022 - 2025 Period.

Mouchel Parkman. (2004). Dublin Airport Northern Parallel Runway Environmental Impact Statement, Part 2.

Mueller, N., Rojas-Rueda, D., Cole-Hunter, T., et al., (2015). Health impact assessment of active transportation: A systematic review. Prev Med, 76, 103-14.

Müller, U., Schreckenberg, D., Möehler, U., and Liepert, M., (2018). Maximum level as an additional criterion for the assessment of railway noise at night: derivation of a wake-up protection criterion for standards and regulations. Paper presented at the Euronoise, Crete.

Munzel, T., and Daiber, A., (2018). Environmental Stressors and Their Impact on Health and Disease with Focus on Oxidative Stress. Antioxid Redox Signal, 28(9), 735-740

Munzel, T., Sorensen, M., Schmidt, F., Schmidt, E., Steven, S.,Kroller-Schon, S., and Daiber, A., (2018). The Adverse Effects of Environmental Noise Exposure on Oxidative Stress and Cardiovascular Risk. Antioxid Redox Signal, 28(9), 873-908

National Institute for Health & Clinical Excellence, (2010). Preventing unintentional road injuries among the under-15s. National Institute for Health and Clinical Excellence. NICE public health guidance, 31.

NRA. (2009). Guidelines for assessment of ecological impacts of national roads schemes, revision 2, National Roads Authority.

NRA. (2011). Guidelines for the Treatment of Air Quality During the Planning and Construction of National Road Schemes, National Roads Authority.

NTA. (2016a). Transport Strategy for the Greater Dublin Area (2016 – 2035). National Transport Authority.

NTA. (2016b); NTA Passenger Transport Surveys at Dublin, Cork and Shannon Airports 2016, National Transport Authority.

Orellano, P., Quaranta, N., Reynoso, J., et al., (2017). Effect of outdoor air pollution on asthma exacerbations in children and adults: Systematic review and multilevel metaanalysis. PLoS One, 12.

P.G.Cowell, P.B. Foot, R.J.Gerrard, D.Kent, S.M.Mason & A.Rivoire. (2000). A Methodology for Calculating Individual Risk Due to Aircraft Accidents near Airports, NATS R&D Report.

Public Health England, (2017). Spatial Planning for Health An evidence resource for planning and designing healthier places.

RPS. (2016). Flood Risk Assessment.

Ryle T. (2016b). Pre-Construction Badger Survey daa North Runway, RPS

Ryle T. (2016c) Pre-Construction Amphibian Survey daa North Runway, RPS.

Ryle, T., and Cronin A. (2016a). Bat Activity Survey and Proposed Mitigation Strategy daa North Runway, RPS

Sausen, R., Isaken, I., Grewe, V. et al., (2005); Aviation Radiative Forcing in 2000: An Update on IPCC (1999). Meteorologische Zeitschrift 14(4): 555-561.

SB, EUROPEAN UNION (PLANNING AND DEVELOPMENT) (ENVIRONMENTAL IMPACT ASSESSMENT) REGULATIONS 2018.

Schreckenberg, D., Griefahn, B., and Meis, M., (2010). The associations between noise sensitivity, reported physical and mental health, perceived environmental quality, and noise annoyance. Noise & health, 12(46), 7-16

The Great Circle Mapper, (2020); Air Distance & Flight Time Calculation [online]. Available at: https://www.greatcirclemapper.net/

Thomson, H., Jepson, R., Hurley, F., et al. (2008). Assessing the unintended health impacts of road transport policies and interventions: translating research evidence for use in policy and practice. BMC.Public Health, 8, 339.

UK Civil Aviation Authority (2017). Survey of noise attitudes 2014: Aircraft, CAP 1506.

UK Department for Transport. (2013). Aviation Policy Framework.

UK Department for Transport. (2017). UK Airspace Policy: A framework for balanced decisions on the design and use of airspace 2017 consultation.

UK Department for Transport. (2018) Aviation 2050: The Future of UK Aviation.

UK Department of Education (2015). BB93: acoustic design of schools – performance standards.

UK Department of Health. (2013). Specialist Services, Health Technical Memorandum 08-01: Acoustics.

UK HSE. (1989). Quantified risk assessment: Its input to decision making, UK Health and Safety Executive, HMSO, 1989

UK HSE. (1992). The tolerability of risk from nuclear power stations, UK Health and Safety Executive.

UK HSE. (2001). Reducing risks, protecting people, HSE's decision-making process, UK Health & Safety Executive.

UK Ministry of Housing, Communities and Local Government. (2018). National Planning Policy Framework

UNECE. (200). The Aarhus Convention: An Implementation Guide, United Nations Economic Commission for Europe.

UNFCC. (2015). Paris Agreement, United Nations Framework Convention on Climate Change

van der Noordt, M., H, I. J., Droomers, M., et al., (2014). Health effects of employment: a systematic review of prospective studies. Occup Environ Med, 71, 730-6.

Vienneau, D., Schindler, C., Perez, L., Probst-Hensch, N., and Roosli,M., (2015). The relationship between transportation noise exposure and ischemic heart disease: a meta-analysis. Environmental Research, 138, 372-380

WBCSD and WRI. (2012). The Greenhouse Gas Protocol, A Corporate Accounting and Reporting Standard, World Business Council for Sustainable Development and World Resources Institute.

White, K., Arntzen, M., Walker, F., Waiyaki, F. M., Meeter, M., and Bronkhorst, A. W., (2017). Nosie annoyance caused by continuous descent approaches compared to regular descent procedures. Applied Acoustics, 125, 194-198.

WHO, (2009). Protecting health from climate change: connecting science, policy and people. Geneva, World Health Organization.

WHO. (2009). Night Noise Guidelines for Europe, World Health Organisation.

WHO. (2018). Environmental Noise Guidelines for the European Region, World Health Organisation.

World Health Organisation, (2006); Constitution of the World Health Organisation.

World Health Organisation, (2020), Constitution. [Online]. Available from: https://www.who.int/about/who-we-are/constitution

aecom.com