Gatwick Airport Northern Runway Project

Environmental Statement
Chapter 18: Health and Wellbeing

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18 Health and Wellbeing

18.1. Introduction

18.1.1 This chapter of the Environmental Statement (ES) presents the findings of the Environmental Impact Assessment (EIA) concerning the potential effects of the proposal to make best use of Gatwick's existing runways and infrastructure (referred to within this report as 'the Project') on human health.

18.1.2 The chapter draws from and builds upon **ES Chapter 5**: Project Description (Doc Ref 5.1) and the other relevant technical chapters within the ES (most notably: **ES Chapter 8: Landscape, Townscape and Visual Resources** (Doc Ref. 5.1); **ES Chapter 10: Geology and Ground Conditions** (Doc Ref. 5.1); **ES Chapter 11: Water Environment** (Doc Ref. 5.1); **ES Chapter 12: Traffic and Transport** (Doc Ref. 5.1); **ES Chapter 13: Air Quality** (Doc Ref. 5.1**); ES Chapter 14: Noise and Vibration** (Doc Ref. 5.1); **ES Chapter 17: Socio-economic Effects** (Doc Ref. 5.1); and **ES Chapter 19: Agricultural Land Use and Recreation** (Doc Ref. 5.1.)) which provide the basis of the assessment of the effects on health and wellbeing. For the sake of brevity, this chapter does not repeat text or replicate data from the inter-related technical disciplines. The health assessment extends rather than repeats analysis, so takes as its input the residual effect conclusions of these other ES chapters.

18.1.3 For the purposes of this chapter, health is defined as '*a state of complete physical, mental and social wellbeing and not merely the absence of disease or infirmity*' (WHO, 1948); and mental health is defined as a '*state in which every individual realises his or her own potential, can cope with the normal stresses of life, can work productively and fruitfully, and is able to make a contribution to her or his community'* (WHO, 2022a). In this chapter the terms health and wellbeing are used interchangeably, and parity is given to considering both physical and mental health outcomes.

18.1.4 Following principles of public health, human health in EIA takes a population health approach (Pyper, et al., 2022a; IPH, 2021; Cave, et al., 2020), Population health means '*the health outcomes of a group of individuals, including the distribution of such outcomes within the group*' (Kindig & Stoddart, 2003). The conclusions of this chapter therefore relate to the health outcomes to defined populations, not the health outcomes of individuals.

18.1.5 Health and wellbeing are influenced by a range of factors, termed the 'wider determinants of health'. Determinants of health considered in EIA span bio-physical, social, behavioural, economic and institutional factors (WHO, 2022b). Key determinants of health covered within the scope of this assessment are:

- Bio-physical environment changes in air quality, noise, water quality, ground contamination and lighting.
- Social environment changes in transport, including effects on health-related behaviours such as physical activity.
- Economic environment changes in employment and skills opportunities, as well as indirect economic benefits.
- Institutional environment changes in healthcare service capacity, including onsite provision and supporting routine NHS strategic planning functions.

18.1.6 In assessing whether or not the changes due to the Project would give rise to likely and significant population health effects (beneficial or adverse), this ES chapter sets out:

- The legislation and policy that describes the national requirements and standards relevant to applying public health in a development consent order (DCO) (Doc Ref. 2.1) context, as well as regional and local considerations.
- The existing and future population health baseline conditions established from desk studies and consultation with health stakeholders.
- The EIA methods described in guidance and agreed with health stakeholders for assessing population health effects, including the potential for health inequalities to vulnerable groups.
- The evidence-based conclusions as to the likely significant direct, indirect and cumulative population health effects during relevant assessment years for construction and operation.
- Monitoring and mitigation measures that could prevent, minimise, reduce or offset potential adverse effects or enhance potential beneficial effects.
- Assumptions and limitations encountered in compiling the information (see **ES Appendix 18.4.1 Methods Statement for Health and Wellbeing** (Doc Ref. 5.3), section 4).

18.1.7 This chapter is accompanied by:

- **ES Appendix 18.2.1: Summary of Planning Policy: Health and Wellbeing** (Doc Ref. 5.3);
- **ES Appendix 18.3.1: Summary of Stakeholder Consultation** (Doc Ref. 5.3);
- **ES Appendix 18.3.2: Summary of Other Consultation Responses for Health and Wellbeing** (Doc Ref. 5.3);
- **ES Appendix 18.4.1: Methods Statement for Health and Wellbeing** (Doc Ref. 5.3);
- **ES Appendix 18.5.1: Health Baseline Trends, Priorities and Vulnerable Groups** (Doc Ref. 5.3);
- **ES Appendix 18.5.2: Health Baseline Data Tables** (Doc Ref. 5.3); and
- **ES Appendix 18.8.1: Quantitative Health Assessment Results** (Doc Ref. 5.3).

18.1.8 The Health and Wellbeing chapter in the Preliminary Environmental Information Report (PEIR) identified Next Steps and these have been addressed in this chapter as follows:

- further testing the conclusions of the health and wellbeing assessment relating to changes in air quality by applying quantitative assessment methods using relevant risk ratios;
- further assessment relating to the health and wellbeing effects of construction noise and ground noise, drawing from the outputs of noise modelling;
- exploring existing and future occupational healthcare provision at the airport;
- quantitatively forecasting changes to Airport transfers to hospital using existing statistics on passenger throughput and response rate; and
- further developing the cumulative effects assessment for the full range of health and wellbeing determinants.

18.2. Legislation and Policy

Legislation

18.2.1 The Infrastructure Planning (Environmental Impact Assessment) Regulations 2017 (as amended) (the EIA Regulations) set out, at Regulation 5(2) and Schedule 4, the topics to be assessed within the EIA process, including:

'(2) The EIA must identify, describe and assess in an appropriate manner, in light of each individual case, the direct and indirect significant effects of the Project on the following factors –

(a) population and human health;…' (Regulation 5(2)) *(HM Government, 2017)*

18.2.2 The Health and Safety at Work etc Act 1974 (HM Government, 1974a) places duties on employers to ensure, '*so far as is reasonably practicable*': the health, safety and welfare at work of all their employees; and that persons not in their employment are not exposed to risks to their health or safety as a result of the activities undertaken.

18.2.3 The Environmental Protection Act 1990 (as amended), Part IIA covers contaminated land and Part III manages the control of emissions (including dust, noise and light) that may be prejudicial to health or a nuisance (HM Government, 1990).

18.2.4 The Environment Act 1995 sets provisions for protecting certain environmental conditions of relevance to health in the UK (HM Government, 1995). Part II covers contaminated land and Part IV covers air quality.

18.2.5 The Air Quality Standards Regulations 2010 (amended in 2016) set out statutory health protection standards on ambient air quality (HM Government, 2016).

18.2.6 The Civil Aviation Act 2012 (HM Governement, 2012a) gives the Civil Aviation Authority a role in promoting better public information about the environmental effects of civil aviation in the UK, their impact on human health and safety, and measures taken to mitigate adverse impacts.

18.2.7 Control of Pollution Act 1974 (HM Government, 1974b) makes provisions in relation to waste disposal, water pollution, noise, atmospheric pollution and public health. It describes licencing of certain activities to avoid danger to public health or serious detriment to the amenity of the locality affected. It also covers control of, and consent for, noise on construction sites (sections 60 and 61), including defining 'best practicable means' (section 72).

18.2.8 The Environment Act 2021 (HM Government, 2021) established The Office for Environmental Protection (OEP) as a public body in England and Norther Ireland. The OEP sets targets and takes enforcement action to prevent, or mitigate, serious damage to the natural environment or to human health. This includes reducing adverse impacts on public health. The OEP objective (OEP, 2022) is for environmental law (including EIA legalisation) and its implementation to be well designed and delivered, so that positive outcomes for the environment and people's health and wellbeing are achieved.

18.2.9 The Department for Environment Food and Rural Affairs (Defra) Environmental Improvement Plan 2023 (Defra, 2023) amends the national $PM_{2.5}$ standards. The Environmental Improvement Plan includes a long-term target for reducing population exposure to $PM_{2.5}$ concentrations to meet an annual mean of 10µg/m^3, as recommended by the World Health Organization's (WHO) 2005 guideline. As set out in **ES Chapter 13**: **Air Quality** (Doc Ref. 5.1), this assessment considers current legislated limits in the Air Quality Standards Regulations.

18.2.10 The Public Health (Control of Disease) Act 1984 (HM Government, 1984) (as amended), relates to disease control and establishing of port health authorities. Port health authorities carry out a range of health controls at the UK borders. These include checks on imported food, inspecting

aircraft for food safety and infectious disease control, as well as general public and environmental health checks (HM Government, 2012b).

18.2.11 Public Health (Aircraft) Regulations 1979 (as amended) (HM Government, 1979), reflect the International Health Regulations 2005 requirement (adopted by the WHO) that port health is notified of any cases or symptoms of infectious disease aboard an aircraft before it arrives in port.

Planning Policy Context

National Policy Statements

18.2.12 The Airports National Policy Statement (NPS) (Department for Transport, 2018), although primarily provided in relation to a new runway at Heathrow Airport, remains a relevant consideration for other applications for airport infrastructure in London and the South East of England.

18.2.13 The NPS for National Networks (Department for Transport, 2014) sets out the need for development of road, rail and strategic rail freight interchange projects on the national networks and the policy against which decisions on major road and rail projects will be made[1]. This has been taken into account in relation to the highways improvements proposed as part of the Project.

18.2.14 Table 18.2.1 provides a summary of the relevant requirements of these NPSs and how these are addressed within the ES.

18.2.15 Additional national policy is set out in **ES Appendix 18.2.1 Summary of Local Planning Policy– Health and Wellbeing** (Doc Ref. 5.3), including in relation to:

- National Planning Policy Framework (2021)
- Aviation Policy Framework (2013)
- Aviation Strategy (Green Paper): Aviation 2050 – The Future of UK Aviation Policy (2019)
- Flightpath to the Future (FttF) (Department for Transport, 2022a)
- Jet Zero Strategy: Delivering net zero aviation by 2050 (Department for Transport, 2022b)
- Transport decarbonisation plan (Department for Transport, 2021)
- Beyond the horizon – The future of UK aviation: Making best use of existing runways (HM Government, 2018)
- Airports National Policy Statement: new runway capacity and infrastructure at airports in the South East of England (Department for Transport, 2018)
- Noise Policy Statement for England (NPSE) (Department for Environment, Food & Rural Affairs, 2010)
- Air Quality Strategy for England, Scotland, Wales and Northern Ireland (DEFRA, 2011).

[1] The Department for Transport published a revised draft National Policy Statement for National Networks ("NPSNN") for consultation on 14 March 2023. The draft NPSNN confirms in paragraph 1.16 that the existing NPSNN remains the relevant government policy and has full force and effect in relation to any applicable applications for development consent accepted for examination before designation of the updated NPSNN. The draft NPSNN further notes in paragraph 1.17 that the emerging draft NPSNN is capable of being an important and relevant consideration in the Secretary of State's decision making process. As such, the Applicant will continue to monitor the progress of the NPSNN review process and incorporate any updates to the Project's application documentation where considered appropriate in due course.

Table 18.2.1: Summary of NPS Information Relevant to this Chapter

Summary of NPS requirement	How and where considered in the ES
Airports NPS	
A project level Health Impact Assessment (HIA) is required (paragraph 1.37)	As set out by government guidance for HIA in spatial planning (Public Health England, 2020), if a project is subject to EIA, then the applicant should integrate the HIA within the EIA and "*follow health in EIA process*". This is confirmed in IEMA 2022 guidance (Pyper, et al., 2022b). The assessment included within this chapter applies recognised HIA guidance and combines this with the regulatory requirements defined for EIA to investigate, inform, assess and effectively communicate how and where health issues and opportunities are addressed.
The application should include and propose health mitigation, which seeks to maximise the health benefits of the scheme and mitigate any negative health impacts (paragraph 1.37)	The approach draws from and builds upon mitigation outlined by the inter-related technical disciplines to not only reduce any potentially adverse impacts, but also enhance health and wellbeing opportunities where possible. Mitigation and enhancement measures seek to support the delivery of local health objectives. Mitigation measures included as part of the Project are set out in Section 18.7.
Where the proposed project has likely significant environmental impacts that would have an effect on human beings, any environmental statement should identify and set out the assessment of any likely significant health impacts (paragraph 4.72).	This has been addressed through the provision of this health and wellbeing ES chapter.
The applicant should identify measures to avoid, reduce or compensate for adverse health impacts as appropriate. These impacts may affect people simultaneously, so the applicant, the Examining Authority and the Secretary of State (in determining an application for development consent) should consider the cumulative impact on health (Paragraph 4.73).	The approach draws from and builds upon the inter-related technical disciplines to consider likely environmental and socio-economic changes and activities with the potential to significantly influence population health, including through interactions and cumulative effects. Mitigation measures are set out in Section 18.7.
National Networks NPS	
Where the proposed project has likely significant environmental impacts that would have an effect on human beings, any environmental statement should identify and set out the assessment of any likely significant adverse health impacts (paragraph 4.81)	This has been addressed through the provision of this Health and Wellbeing chapter.

Summary of NPS requirement	How and where considered in the ES
The applicant should identify measures to avoid, reduce or compensate for adverse health impacts as appropriate. These impacts may affect people simultaneously, so the applicant, and the Secretary of State (in determining an application for development consent) should consider the cumulative impact on health (paragraph 4.82).	The approach draws from and builds upon the inter-related technical disciplines to consider all likely environmental and socio-economic changes and activities with the potential to significantly influence population health, including cumulative effects. Mitigation measures are set out in Section 18.7.

Regional Policy

The London Plan 2021

18.2.16 This is the spatial development strategy for Greater London:

"To improve Londoners' health and reduce health inequalities, those involved in planning and development must: *…ensure that the wider determinants of health are addressed in an integrated and co-ordinated way, taking a systematic approach to improving the mental and physical health of all Londoners and reducing health inequalities …"*

"The Mayor supports the role of the airports serving London in enhancing the city's spatial growth… The environmental and health impacts of aviation must be fully acknowledged and aviation-related development proposals should include mitigation measures that fully meet their external and environmental costs, particularly in respect of noise, air quality and climate change. Any airport expansion scheme must be appropriately assessed …". [policy T8] *(Mayor of London, 2021)*.

Local Planning Policy

18.2.17 Gatwick Airport is located in the county of West Sussex and immediately adjacent to the bordering county of Surrey to the north. The airport lies within the administrative area of Crawley Borough Council and adjacent to the boundaries of Mole Valley District Council to the northwest, Reigate and Banstead Borough Council to the north east and Horsham District Council to the southwest. The administrative area of Tandridge District Council is located approximately 1.9 km to the east of Gatwick Airport, while Mid Sussex District Council lies approximately 2 km to the southeast.

18.2.18 The relevant local planning policies specific to health and wellbeing based on the extent of the study area for this assessment and taken into account for this assessment are summarised in Table 18.2.2. Further details are provided in **ES Appendix 18.2.1 Summary of Local Planning Policy–Health and Wellbeing** (Doc Ref. 5.3).

Table 18.2.2: Local Planning Policy

Administrative Area	Plan	Policy
Adopted Policy		
Crawley Borough Council	Crawley 2030: Crawley Borough Local Plan 2015-2030 (2015)	Policy ENV10: Pollution Management and Land Contamination
		Policy ENV11: Development & Noise
		Policy GAT1: Development of the Airport with a Single Runway
Reigate and Banstead Borough Council	Reigate and Banstead Local Plan Development Management Plan 2018-2027 (2019)	Policy DES9: Pollution and Contaminated Land
	Reigate and Banstead Local Plan: Core Strategy 2014	Policy CS5: Valued People & Economic Development
Horsham District Council	Horsham District Planning Framework 2015 (excluding South Downs National Park)	Policy 24: Environmental Protection
Mid Sussex District Council	Mid Sussex District Plan 2014-2031 (2018)	Policy DP24: Leisure, Cultural & Recreational Activities
		Policy DP25: Community Facilities & Local Services
		Policy DP29: Noise, Air and Light Pollution
Tandridge District Council	Tandridge District Core Strategy (2008)	No local policies directly applicable to health and wellbeing
	Tandridge Local Plan Part 2: Detailed Policies 2014-2029 (2014)	DP5: Highway Safety & Design
		DP7: General Policy for New Development
		DP22: Minimising Contamination, Hazards & Pollution
West Sussex County Council	West Sussex Transport Plan 2022-36 (2022)	Public health and wellbeing identified as a key issue
Surrey County Council	Surrey Local Transport Plan 2022-32 (LTP4) (2022)	Safer and improved walking and cycling routes
		Redesigned neighbourhoods for better access to facilities and services
		Support for those with accessibility needs
		Improved health and wellbeing through cleaner air, closer communities, quality of life and safer routes

Administrative Area	Plan	Policy
Mole Valley District Council	The Mole Valley Local Development Framework: Core Strategy (2009)	Policy CS5: Gypsies, Travellers and Travelling Showpeople
		Policy CS17: Infrastructure, Services and Community Facilities
		Policy CS19: Sustainable Construction, Renewable Energy and Energy Conservation
Emerging Policy		
Crawley Borough Council	Draft Crawley Borough Local Plan 2021-2037 (2021)	Policy SD2: Enabling Healthy Lifestyles and Wellbeing
		Policy GAT1: Development of the Airport with a Single Runway
		Policy EP3: Pollution Management and Land Contamination
		Policy EP4: Development and Noise
		Policy EP5: Air Quality
Tandridge District Council	Our Local Plan 2033 (Regulation 22 Submission) (2019)	Policy TLP17: Health and Wellbeing
		Policy TLP46: Pollution and Air Quality
Horsham District Council	Draft Horsham District Local Plan 2019-2036 (2020)	Policy 25 - Strategic Policy: Environmental Protection
		Policy 32 - Local Greenspace
		Strategic Policy 45: Inclusive Communities, Health and Wellbeing
Mole Valley District Council	Future Mole Valley 2018-2033: Consultation Draft Local Plan (2020)	EN5: Inclusive Environment
		EN13: Promoting Environmental Quality
		INF1: Promoting Sustainable Transport and Parking

18.3. Consultation and Engagement

18.3.1 In September 2019 Gatwick Airport Limited (GAL) submitted a Scoping Report to the Planning Inspectorate which described the scope and methodology for the technical studies being undertaken to provide an assessment of any likely significant effects and, where necessary, to determine suitable mitigation measures for the construction and operational periods of the Project. It also described those topics or sub-topics, which are proposed to be scoped out of the EIA process and provided justification as to why the Project would not have the potential to give rise to significant environmental effects in these areas. The **Scoping Report** is provided in ES Appendix 6.2.1 (Doc Ref. 5.3).

18.3.2 Following consultation with the statutory bodies, the Planning Inspectorate (on behalf of the Secretary of State) provided a Scoping Opinion on 11 October 2019. The **Scoping Opinion** is provided in ES Appendix 6.2.2 (Doc Ref. 5.3).

18.3.3 Key issues raised during the scoping process specific to health and wellbeing are listed in **ES Appendix 18.3.1: Summary of Stakeholder Scoping Responses – Health and Wellbeing** (Doc Ref. 5.3) and summarised in Table 18.3.1, together with details of how these have been addressed within the ES. Further details of individual consultee scoping responses are provided in Appendix 18.3.1.

Table 18.3.1: Summary of Scoping Responses

Reference	Details	How/where addressed in the ES
Planning Inspectorate: 11 October 2019		
4.11.1	The **Scoping Report** (ES Appendix 6.2.1 (Doc Ref. 5.3)) states that the majority of the operational workforce would originate from within the region, with no material change in demography or associated health care requirements. However, the Inspectorate does not agree that population impacts (ie change in local demography) should be scoped out during construction or operation, on which basis the Inspectorate also does not agree that health effects arising from population change should be scoped out.	Changes in local healthcare capacity associated with population changes are discussed in Section 18.8. Population impacts in relation to change in local demography are discussed in **ES Chapter 17: Socio-economic Effects** (Doc Ref. 5.1).
4.11.2	The Inspectorate agrees that, as any electricity supply infrastructure for the Project would be compliant by design, and within guideline exposure levels set to protect public health, electric and magnetic field (EMF) risk is unlikely to result in significant effects and can be scoped out of the ES. However, the Inspectorate welcomes the commitment that EMF concerns should be addressed if raised during consultation.	A 'Risk Perception' section, which addresses health effects from EMF, has been provided in Section 18.8 to address any potential key areas of concern.
4.11.3	The Inspectorate agrees that the effects of climate change can be scoped out of the health assessment as they will be addressed within the Climate Change and Carbon chapter of the ES, but would expect to see adequate cross-referencing and signposting to the matter within the health chapter of the ES.	Effects of climate change are addressed in **ES Chapter 15: Climate Change** (Doc Ref. 5.1) and **ES Chapter 16: Greenhouse Gases** (Doc Ref. 5.1) with cross references made in other chapters, where required.

Reference	Details	How/where addressed in the ES
4.11.4	The Inspectorate is content that any effects from major accidents can be scoped out of the health and wellbeing assessment, as they will be considered as part of the assessment of Major Accidents and Disasters. The Inspectorate is also content that the risk of transmission of communicable diseases can be scoped out, as it is managed through International Health Regulations. However, the Inspectorate advises that the ES provides an explanation of how the risk is to be controlled. A statement was made in the Scoping Report that impacts of changes to Public Safety Zones will be addressed in the section on Major Accidents and Disasters. However, there was no reference to assessing such changes in the Major Accidents and Disasters section of the Scoping Report. As such, the Inspectorate does not agree that risks from changes to Public Safety Zones can be scoped out of the ES.	It is noted that the Inspectorate is content that any effects from major accidents can be scoped out of the health and wellbeing assessment on the basis that this is covered in **ES Appendix 5.3.4 Major Accidents and Disasters** (Doc Ref. 5.3). Regarding risk of transmission of communicable diseases, further explanation of the management of this issue, through International Health Regulations, is provided in Section 18.8. Effects in relation to Public Safety Zones[2] are considered in the Major Accidents and Disasters assessment and reflect the outcome of the Civil Aviation Authority's consultation on standardising Public Safety Zones.
4.11.5	The Inspectorate agrees that the commitments to ensuring control of pests should be sufficient to ensure significant effects on public health are unlikely and can be scoped out. However, the Inspectorate advises that the ES contains a summary of this matter and an explanation of the measures to be provided in the Code of Construction Practice.	**ES Appendix 5.3.2 Code of Construction Practice** (Doc Ref. 5.3), sets out the measures that GAL and its contractors would be required to implement for all construction activities associated with the Project. These measures have been identified during the design of the Project and as part of the EIA process. They include strategies, control measures and monitoring procedures for managing the potential environmental impacts during the construction period and limiting disturbance from construction activities as far as reasonably practicable, including pest control (Section 4.6).
4.11.6	Despite the implementation of the lighting strategy, the scale and location of any	Potential health effects from permanent lighting associated with design and temporary

[2] Public Safety Zones are defined as "areas of land at the ends of the runways at the busiest airports, within which development is restricted in order to control the number of people on the ground at risk of death or injury in the event of an aircraft accident on take-off or landing" [paraphrased] (Department for Transport, 2021)

Reference	Details	How/where addressed in the ES
	requisite lighting had not yet been determined during scoping. The Inspectorate does not consider it possible to rule out any likely significant effects on health from the impact of light pollution without this information and therefore, does not agree that this can be scoped out.	construction lighting required to provide a safe and appropriate working environment are addressed in Section 18.8.
4.11.7	The Inspectorate agrees that operational effects on staff wellbeing can be scoped out of the ES as this will be managed in accordance with existing procedures and would be regulated by the Health and Safety at Work Act. However, the Inspectorate advises that the ES contains a summary of existing procedures to provide assurances that there would be no likely significant effect.	Occupational health is covered within Section 18.8. As set out in that section, GAL has a strong Health and Safety culture with a clear Environmental, Health and Safety Policy (GAL, 2021).
4.11.8	The Inspectorate advises that the health and wellbeing assessment methodology is discussed and agreed with relevant consultation bodies, prior to the commencement of the assessment.	A health forum (the health topic working group) has been set up with relevant consultation bodies whereby the proposed methodology was discussed, including representatives from the UK Health Security Agency (UKHSA), the Department of Health and Social Care Office of Health Improvement and Disparities (OHID), West Sussex County Council, East Sussex County Council, Mid Sussex District Council, Surrey County Council, Kent County Council, Crawley Borough Council, Reigate and Banstead Borough Council, Horsham District Council, Mid Sussex District Council, Mole Valley District Council, Tandridge District Council, NHS Sussex, NHS Sussex ICB, Surrey Heartlands ICB and Applied Resilience (in the capacity of emergency management on behalf of Reigate and Banstead Borough Council). The assessment methods have been presented in detail to the group and consensus sought on their use. There is general agreement on the qualitative and quantitative methods of the health assessment, albeit stakeholders reserve their final agreement until they have reviewed the completed ES.
4.11.9	The Inspectorate acknowledges that the study area will vary depending on the issue being	The study areas are tailored to the individual health determinants investigated. Health

Reference	Details	How/where addressed in the ES
	explored (eg air quality or surface transport), but states that the study areas should be sufficiently broad to account for the transient nature of noise, of effects on air and water quality, and vehicle movements. The Applicant is advised to make efforts to agree study areas for these different issues with relevant consultation bodies. It should be clear in the text of the ES, which study area is being applied and a clear cross reference to the relevant sections of other chapters should be made, where relevant.	determinants such as air quality, noise and socio-economics include a broad study area to consider the distribution and magnitude of change upon public health. The study area methodology is discussed in more detail in Section 18.4.
4.11.10	The ES should consider not only the effects of safety and community connectivity, but also any likely significant health effects on non-motorised users (for example through losses or changes to public rights of way, open space and the existing road network) and on community severance.	The health and wellbeing assessment (Section 18.8) relating to changes in transport nature and flow rate analyses impacts on severance, pedestrian and cyclist amenity, and accidents and safety. In addition, a section on health and wellbeing effects from changes to lifestyle factors is included which addresses the impacts associated with loss or changes to public rights of way and open space.
4.11.11	For the avoidance of doubt, the Inspectorate considers that impacts on water quality, flood risk and ground conditions should be assessed in the health and wellbeing chapter.	An assessment of the population health implications of water quality, flood risk and ground conditions is included within Section 18.8.
4.11.12	The Scoping Report has not identified potential sensitive receptors. These should be identified in the ES, with consideration given to vulnerable groups who might be disproportionately affected by the Project.	Further detail on the potential sensitive receptors and vulnerable groups relevant to health and wellbeing is provided in Section 18.4.
4.11.13	The ES should assess the impact on local primary health care, acute services and emergency responders from additional passenger movements, where these are likely to result in significant effects.	Health and wellbeing effects from changes to local healthcare capacity are addressed in Section 18.8. Other emergency responders are discussed in the Major Accidents and Disasters assessment.

18.3.4 The PEIR was issued to inform the statutory consultation carried out on the Project in autumn 2021. It presented the preliminary findings of the EIA process for the Project at that time. The consultation responses specific to the health and wellbeing assessment and the way in which they have been taken into account in this ES chapter are set out in **ES Appendix 18.3.2 Summary of Other Consultation Responses – Health and Wellbeing** (Doc Ref. 5.3) and summarised in Table 18.3.2. Further detail about the consultation process for the Project and way

the consultation responses have been taken into account is provided in the separate **Consultation Report** (Doc Ref. 6.1).

Table 18.3.2: Summary of Consultation in Response to the PEIR

Key Themes	How taken into account in the ES
UK Health Security Agency and Office of Health Improvement and Disparities	
The methods are welcomed and more detail is requested.	Further detail on methods provided in Section 18.4 and **ES Appendix 18.4.1 Methods Statement for Health and Wellbeing** (Doc Ref. 5.3).
Request the inclusion of incidence rates for quantitative analysis.	Incidence rates are included in the noise and air quality quantitative health analysis results, see Section 18.8 and **ES Appendix 18.8.1 Quantitative Health Assessment Results** (Doc Ref. 5.3).
Welcome approach to mental health and request communicating risk to the public.	The summary at the end of this chapter and the **EIA Non-Technical Summary** (Doc Ref. 5.4), which includes a section on health and wellbeing, support public communication.
Request to further consider vulnerable groups.	The health assessment defines and discusses relevant vulnerable sub-populations, see Sections 18.4 and 18.8, as well as Appendices 18.5.1 and 18.5.2.
Welcomes assessment of opportunities and requests targeted mitigation for disadvantaged groups.	Where appropriate and proportionate, targeted mitigation is discussed in Section 18.8.
Notes further analysis of healthcare service implications in the ES.	Section 18.8 discusses routine service planning and Port health. Port health covers a range of health controls at the UK borders.
Queried need to assess unaccompanied children arriving at Gatwick.	This issue was considered and discussed with health stakeholders but scoped out. Unaccompanied children arriving at Gatwick is a complex issue that is not just a function of passenger numbers but reflects migration, asylum seeking and border control polices internationally. As the drivers do not relate to the Project change, significant population level effects are unlikely.
Local Authorities	
Request baseline mental health and physical activity baseline indicators.	Indicators are included in Section 18.8 and **ES Appendix 18.5.2 Health and Wellbeing Baseline Data Tables** (Doc Ref. 5.3).
Request for vulnerable groups to be more clearly discussed.	The health assessment defines and discusses relevant vulnerable sub-populations, see Sections 18.4 and 18.8, as well as **ES Appendix 18.5.1 Health Baseline Trends, Priorities and Vulnerable Groups** (Doc Ref. 5.3) and **ES**

Key Themes	How taken into account in the ES
	Appendix 18.5.2: Health and Wellbeing Baseline Data Tables (Doc Ref. 5.3).
Request an Equality Impact Assessment (EqIA).	The ES health assessment considers inequalities. An equality impact assessment relates to the public sector equality duty under the Equality Act 2010. This is not a duty of the applicant.
Request for the assessment of combined and cumulative effects.	Combined and cumulative effects are assessed in Sections 18.10 and 18.11.
Request for quantitative air quality health impacts by assessment year.	Quantitative analysis reported by assessment year in Section 18.8 and **ES Appendix 18.8.1 Quantitative Health Assessment Results** (Doc Ref. 5.3).
Request for discussion of ultra-fine particulates (UFP).	Discussion of UFPs included in Section 18.8.
Concern about the non-threshold nature of some air pollutants.	Non-threshold health effects are discussed in Section 18.8.
Concern that noise benefits not realised by local communities.	Noise effects are discussed in Section 18.8, with further discussion on this issue in **ES Chapter 14**: **Noise and Vibration** (Doc Ref. 5.1).
Request for the Noise Insulation Scheme to provide further benefits.	Noise effects are discussed in Section 18.8, with further discussion on this issue in **ES Chapter 14: Noise and Vibration** (Doc Ref. 5.1).
Request for night-time noise other than from flights to be considered.	Air and surface noise assessed and reported in Section 18.8, with further discussion of this issue in **ES Chapter 14: Noise and Vibration** (Doc Ref. 5.1).
Request clarification of mitigation to avoid significant effects on local healthcare.	Healthcare effects are assessed in Section 18.8, including proportionate mitigation.
Request for consultation with healthcare providers.	There has been constructive engagement with West Sussex Integrated Care Board (ICB).
Request for detail on open spaces reprovision.	Section 18.8 sets out and assesses changes in open space, with further detail set out in **ES Chapter 19: Agricultural Land Use and Recreation** (Doc Ref. 5.1).
Concern about lighting impacts on the A23 along Riverside Garden Park.	Lighting impacts assessed in Section 18.8.
Notes importance of the physical activity opportunity being assessed.	The health assessment in Section 18.8 has regard to the importance of physical activity.
Request road accident risk to be considered.	Road safety is discussed in Section 18.8, with further detail set out in **ES Chapter 12: Traffic and Transport** (Doc Ref. 5.1).

18.3.5 In June 2022 an additional consultation was undertaken to update stakeholders and the local community on the ongoing work and refinement to the Project proposals, which included a targeted, statutory consultation on the design changes to the proposed highway improvement changes. As these changes to the Project could lead to new or materially different potentially

significant environmental effects compared to those reported in the PEIR, an updated Preliminary Environmental Information (PEI) was issued as part of this additional consultation. The consultation responses specific to the health and wellbeing assessment and the way in which they have been taken into account in this ES chapter are set out **ES Appendix 14.3.2: Summary of PEIR and Updated PEIR Responses – Noise and Vibration** (Doc Ref. 5.3) and summarised in Table 18.3.3. Further detail about the consultation process for the Project and way the consultation responses have been taken into account is provided in the separate **Consultation Report** (Doc Ref. 6.1).

Table 18.3.3: Summary of Consultation in Response to the Updated PEI

Key Themes	How taken into account in the ES
UK Health Security Agency and Office of Health Improvement and Disparities	
No Additional Comments Submitted	N/A
Local Authorities	
Concern that Riverside Gardens could be significantly harmed by the proposed works, including the quality of life of particularly affected residents. Request for targeted mitigation and compensation.	The effects of population health due to land take, disruption and disturbance in Riverside Garden Park is discussed in Section 18.8, informed by **ES Chapter 8: Landscape, Townscape and Visual Resources** (Doc Ref. 5.1), **ES Chapter 14: Noise and Vibration** (Doc Ref. 5.1) and **ES Chapter19: Agricultural Land Use and Recreation** (Doc Ref. 5.1).
Parish Councils	
Concern that there would also be a significant impact on the quality of life for residents due to noise.	The effects of noise on population health are discussed in Section 18.8, informed by **ES Chapter 14: Noise and Vibration** (Doc Ref. 5.1).
West Sussex Clinical Commissioning Group (now Integrated Care Board)	
Request to explore collaboration opportunities in relation to healthcare service planning work undertaken in Crawley, as well as discussion of environmental impacts of the Project on population health and wellbeing.	There has been constructive engagement with West Sussex ICB on this issue to progress the suggested collaboration. This is discussed in Section 18.8 in the section on changes to local healthcare capacity.

18.3.6 Outside of the above-described public consultations, GAL also continued to engage with key stakeholders and during such engagement, key issues raised specific to health and wellbeing are listed in Table 18.3.4, together with details of how these issues have been taken into account within the ES. Further details on matters discussed with the Health Topic Working Group are provided in **ES Appendix 18.3.2: Summary of Other Consultation Responses – Health and Wellbeing** (Doc Ref. 5.3) (Table 1.4.1). Engagement with the Health Topic Working Group is

anticipated to continue post-submission of the ES, for example, to discuss mitigation measures and residual effect conclusions.

Table 18.3.4: Summary of Consultation and Engagement

Consultee	Date	Details	How/where taken into account in the ES
Local Authority Economics and Employment Topic Working Group			
Representatives from: Crawley Borough Council; Tandridge District Council; Reigate and Banstead Borough Council; Mole Valley District Council; West Sussex County Council; Surrey County Council; Horsham District Council; Mid Sussex District Council; and East Sussex County Council.	28 August 2019	A presentation on discussion of the proposed scope and methodology of the health and wellbeing chapter.	Session outputs informed and refined the content of the health and wellbeing chapter and helped finalise the purpose of the proposed Health Forum and its participants.
Health Forum Meeting			
Representatives from West Sussex County Council and Surrey County Council Public Health Teams.	18 September 2019	Introduced the Project, proposed scope and methodology of the health chapter to the Health Forum made up of key health stakeholders. Discussion focused on the DCO process, health and wellbeing assessment scope/approach, local public health circumstance, priorities and need to inform potential mitigation or enhancement measures.	Session outputs informed and refined the content of the health and wellbeing chapter, mitigation and support initiatives.
Health Topic Working Group meeting 1 (an expanded health stakeholder group replacing the health forum)			
Representatives from: Crawley Borough Council; Surrey County Council; East Sussex County Council; Surrey Heartlands ICB; Mole Valley District Council; Reigate and Banstead Borough Council; West Sussex County Council;	20 June 2022	Introduction to the assessment team; summary of the Project and PEIR findings; summary of PEIR consultation comments and GAL responses; and next steps in the assessment.	Consensus building on the scope of Section 18.8 and stakeholder feedback set out in Section 18.3.

Consultee	Date	Details	How/where taken into account in the ES
Tandridge District Council; Applied Resilience (in the capacity of emergency management on behalf of Reigate & Banstead Borough Council).			
Health Topic Working Group meeting 2			
Representatives from: Mole Valley District Council; Crawley Borough Council; Surrey County Council; East Sussex County Council; UKHSA; West Sussex County Council; NHS Sussex; Surrey Heartlands ICB; Reigate and Banstead Borough Council; OHID; NHS Sussex ICB.	27 July 2022	Presentation on the qualitative methods framework set out in IEMA 2022 guidance and used by the assessment to determine significant effects consistently and transparently across wider determinants of health.	**ES Appendix 18.4.1: Methods Statement for Health and Wellbeing** (Doc Ref. 5.3).
Health Topic Working Group meeting 3			
Representatives from: Crawley Borough Council; Kent County Council; Tandridge District Council; Mole Valley District Council; UKHSA; West Sussex County Council; Surrey County Council; Reigate and Banstead Borough Council; Horsham District Council; East Sussex County Council; OHID; Surrey Heartlands ICB.	4 October 2022	Presentation on the quantitative methods used to pragmatically estimate the scale of change in selected health outcomes relevant to air quality and noise. Discussion of the formulae, parameters and data sources, the presentation of results, and how the quantitative results inform the overarching qualitative methodology.	**ES Appendix 18.4.1: Methods Statement for Health and Wellbeing** (Doc Ref. 5.3).
Health Topic Working Group meeting 4			
Representatives from: Surrey County Council; Crawley Borough Council; Horsham District Council; East Sussex County Council; Tandridge District Council.	8 November 2022	A consensus building exercise was undertaken. The session focused on agreeing the ES health assessment scope and methods. There was broad agreement from participants across the 33 issues discussed. It	**ES Appendix 18.3.1: Summary of Stakeholder Scoping Responses – Health and Wellbeing** (Doc Ref. 5.3) sets out the

Consultee	Date	Details	How/where taken into account in the ES
		was noted that further agreement would be sought following stakeholder review of the ES. The issues discussed reflected the concerns and clarifications requested by stakeholders to date and how each was being responded to by the assessment. Those stakeholders not in attendance were given the opportunity to responded by email or further discussion on each point. No comments or statements of disagreement were received.	points discussed, and level of consensus reached.
Health Topic Working Group meeting 5			
Representatives from: Surrey Heartlands ICB; West Sussex County Council; Surrey County Council; Tandridge District Council; Crawley Borough Council; Mid Sussex District Council; Reigate and Banstead Borough Council; East Sussex County Council; Applied Resilience (on behalf of Reigate & Banstead Borough Council).	19 January 2023	The draft findings of the ES health assessment were introduced and discussed with stakeholders. Participants reported this to be a useful session. There was discussion around issues such as public rights of way diversions and scaling of statutory Port health activities, including keeping non-native mosquito monitoring locations and frequency under review. Follow-up queries on the management of uncertainty within the assessment were received.	Section 18.8 assessment findings.

18.4. Assessment Methodology

18.4.1 Further detail on vulnerable groups and on quantitative methods are set out in **ES Appendix 18.4.1: Methods Statement for Health and Wellbeing** (Doc Ref. 5.3).

Relevant Guidance

18.4.2 The EIA Regulations reinforce the consideration of health within the planning and assessment process but do not provide definitive guidance on the approach, process or methodology to follow.

18.4.3 Taking this into consideration, it is considered appropriate for the health and wellbeing chapter to apply recognised health in EIA and Health Impact Assessment (HIA) guidance to investigate, inform, assess and effectively communicate how and where population health issues and opportunities are addressed.

18.4.4 The following guidance has been taken into account in undertaking the assessment:

- Institute of Environmental Management and Assessment (IEMA) 2022 guidance on health in EIA series, effective scoping (Pyper, et al., 2022b) and determining significance (Pyper, et al., 2022a).
- Institute of Public Health (IPH) Guidance, standalone Health Impact Assessment and health in environmental assessment, 2021 (Institute of Public Health, 2021).
- International Association for Impact Assessment (IAIA) and European Public Health Association, reference paper on addressing Human Health in EIA (Cave, et al., 2020).
- International Association for Impact Assessment, Health Impact Assessment international best practice principles, 2021 (Winkler, et al., 2021).
- Public Health England, Health Impact Assessment in spatial planning 2020 (Public Health England, 2020).
- Public Health England, advice on the content of Environmental Statements accompanying an application under the Nationally Significant Infrastructure Planning (NSIP) Regime, 2021 (PHE, 2021).

Scope of the Assessment

18.4.5 The scope of this ES chapter has been developed in consultation with relevant statutory and non-statutory consultees as set out in Table 18.3.1 and Table 18.3.4 and also informed by the consultation on the PEIR in 2021 and updated PEI relating to the highway improvement changes in 2022 (see **ES Appendix 18.3.1: Summary of Stakeholder Responses for Health and Wellbeing** (Doc Ref. 5.3)). The assessment scope focuses on a range of bio-physical, social, economic and institutional environment determinants with the potential to influence population health, either adversely or beneficially.

18.4.6 Taking into account the scoping and consultation process, Table 18.4.1 summarises the issues considered as part of this assessment.

Table 18.4.1: Issues Considered within the Assessment

Activity	Potential Effects
Construction Period (including Demolition): Health and Wellbeing	
Construction and demolition activities within existing airport boundary,	Environmental (changes in air quality, the water environment, ground conditions, noise and light exposure from construction activities and road traffic).
	Transport (severance, pedestrian/cyclist amenity, risk of accident and injury).

Activity	Potential Effects
including construction of upgraded highway junctions and associated changes in surface transport	Lifestyle (access to open space, barriers to physical activity, etc).
	Socio-economic (employment opportunities and associated income generation).
	Impacts on local healthcare capacity from the introduction of a large workforce.
	Health risks from pests.
Operational Period: Health and Wellbeing	
Use of the airport, including upgraded highway junctions	Environmental (changes in air quality, the water environment, ground conditions, noise and light exposure from operational activities, eg aircraft/support operations/road traffic).
	Transport (severance, pedestrian/cyclist amenity, risk of accident and injury).
	Lifestyle (access to open space, barriers to physical activity, etc).
	Socio-economic (employment opportunities and associated income generation).
	Impacts on local healthcare capacity from changes to the operational workforce and increase in passenger throughput (on ambulance and NHS emergency department services).
	Extended operational hazards (specifically, the risk of transmission of communicable diseases). Changes to Public Safety Zones are considered in the Major Accidents and Disasters assessment.

18.4.7 Effects which are not considered likely to be significant have been scoped out of the assessment. A summary of the effects scoped out is presented in Table 18.4.2. In this regard the full list of possible determinants of health listed in the IEMA 2022 guidance (Pyper, et al., 2022b) has been taken into account but is not reported exhaustively. This is in line with proportionate reporting and the consensus built around the health assessment scope established through the Scoping Opinion and consultation with health stakeholders.

Table 18.4.2: Issues Scoped Out of the Assessment

Issue	Justification
Health and wellbeing effects from exposure to electric and magnetic fields	All overhead power lines, underground cables or substations operating at ≤132 kV are compliant with guideline exposure levels set to protect public health by design. All electricity supply infrastructure for the Project will comply with this guideline exposure limit. These commitments address actual risks. Population health effects associated with understanding of risk, including electric and magnetic fields, are set out in section 18.8.
Health and wellbeing effects associated with climate change	Climate change is addressed within **ES Chapter 15: Climate Change** (Doc Ref. 5.1) and **ES Chapter 16: Greenhouse Gases** (Doc Ref. 5.1).

Study Area

18.4.8 The health assessment has regard to the zones of influence defined by other EIA chapters. Those zones of influence inform the health chapter's consideration of effect magnitude, including the extent of health effect precursors, such as noise contours or air quality concentrations.

- **ES Chapter 12: Traffic and Transport** (Doc Ref. 5.1) - traffic and transport study areas: Gatwick Airport area; Study Area links for assessment 1 & 2; and Area of Detailed Modelling.
- **ES Chapter 13: Air Quality** (Doc Ref. 5.1) - air quality study area includes both the 11 km by 10 km study area and the Affected Road Network (ARN) study area (including receptors within 200m from the ARN).
- **ES Chapter 14: Noise and Vibration** (Doc Ref. 5.1) - noise study area of all receptors where threshold changes are anticipated to occur (more than 20 km from the airport and beyond this for overflights).
- **ES Chapter 17: Socio-economic Effects** (Doc Ref. 5.1) - socio-economic study areas: Project Boundary, Local Study Area (LSA), Functional Market Area (FEMA), Labour Market Area (LMA) and Six Authorities Area.
- **ES Chapter 19: Agricultural Land Use and Recreation** (Doc Ref. 5.1) - recreation study area, which encompasses local travel patterns by rights of way/recreational users and land used by the community that have the potential to be lost.

18.4.9 Consistent with IEMA 2022 guidance (Pyper, et al., 2022b), the health chapter uses study areas to determine the sensitivity of the populations in the areas, not set a limit on the extent of all health effects. This reflects that health study areas do not necessarily define the boundaries of all potential health effects, particularly mental health effects. The health study areas represent the locations that would drive any likely significant population health effect, ie where the great majority of the impact is anticipated to occur. Any effects beyond the study areas would not change the conclusions reached in relation to the likely significant population health effects of the Project.

18.4.10 The following study area related terms are used in the health assessment:

- The ‘site-specific’ population relates to the most localised effects close to sources (see below for definitions of representative geographic ward areas).
- The ‘local’ population relates to the wider community effects (see below for definitions of areas that differ between bio-physical and economic determinants).
- The ‘regional’ population is defined using the area of the South East.
- The ‘national’ population is defined with reference to England.
- The ‘international’ population is defined with reference to global effects relevant to international travel and transboundary effects.

18.4.11 The assessment of a given determinant of health includes one or more of these terms to geographically describe the populations assessed. For example, the assessment may reference both site-specific and local populations, with a single significance conclusion that is relevant to both. This is a proportionate approach and avoids duplication in reaching separate conclusions for every geography. If it is not explicit within the assessment, then it is implicit that larger geographies include effects to smaller geographies, eg regional effects include local effects.

18.4.12 The site-specific population is defined using a proportionate baseline ward level data selection. This reflects a geographic distribution and the areas with poorer health outcomes as measured by

under 75-year-old mortality from causes considered preventable[3]. These wards provide a realistic worst-case basis for determining population sensitivity for site-specific effects, even if exact geographies and impact extents vary. For example, localised population effects away from the Airport, along flight paths or surface access routes are informed by the health baseline in the context of the study areas of: **ES Chapter 12: Traffic and Transport** (Doc Ref. 5.1); **ES Chapter 13: Air Quality** (Doc Ref. 5.1); and **ES Chapter 14: Noise and Vibration** (Doc Ref. 5.1).

18.4.13 For all determinants of health, the vulnerable group population has high sensitivity. This conclusion is based on site-specific baseline data for the wards listed below. Additional baseline data would be unlikely to change this conclusion. The wards are collectively referred to in the health assessment as the 'nine ward area'. Baseline indicators for the nine ward area are discussed in Section 18.8 and **ES Appendix 18.5.2: Health and Wellbeing Baseline Data Tables** (Doc Ref. 5.3).

- Langley Green & Tushmore (E05012919), the Airport site, with a 134.2 standardised mortality ratio (SMR), which is worse when compared to 100.00 for England.
- Charlwood (E05007317), northwest of the Airport, with a 104.4 SMR.
- Horley West & Sidlow (E05012878), north of the Airport, with an 80.3 SMR.
- Horley Central & South (E05012876), northeast of the Airport, with a 104.2 SMR.
- Pound Hill North & Forge Wood (E05012922), east of the Airport, with a 71.1 SMR.
- Three Bridges (E05012925), southeast of the Airport, with a 92.8 SMR.
- Northgate & West Green (E05012921), south of the Airport, with a 119.3 SMR.
- Ifield (E05012918), southwest of the Airport, with a 110.1 SMR.
- Colgate & Rusper (E05011815), west of the Airport, with a 67.7 SMR.

18.4.14 The local population is defined in two ways, recognising that there are differing wider community impacts between bio-physical and socio-economic health determinants.

- Bio-physical health determinants (such as changes to air quality and noise exposure) are likely to have a more local impact in the wider community as potential changes in hazard are limited by physical dispersion characteristics. As a result, the local study area focuses on the local authority districts of: Crawley, Reigate and Banstead, Tandridge, Mid Sussex, Horsham and Mole Valley. The assessment refers to this as the 'health local study area' (HLSA).
- Socio-economic health determinants are not limited by physical dispersion characteristics, though may be influenced by factors such as travel times, which whilst still relating to local effects, cover a broader area. This study area remains consistent with the largest study area defined in **ES Chapter 17: Socio-economic Effects** (Doc Ref. 5.1), and comprises the County areas of East Sussex, West Sussex, Surrey, Kent, Brighton and Hove and the London Borough of Croydon ('Six Authorities Area').

Temporal Scope

18.4.15 The temporal scope of the health chapter assessment uses the following summary terms:

- 'Very short term' relates to effects measured in hours, days or weeks;

[3] Office for Health Improvement and Disparities, Local Health mapping tool, Deaths from causes considered preventable, under 75 years, Indirectly standardised ratio, 2016 to 2020 (Standardised mortality ratio. Online. Local Health - Office for Health Improvement and Disparities - Indicators: maps, data and charts).

- 'Short term' relates to effects measured in months;
- 'Medium term' relates to effects measured in years; and
- 'Long term' relates to effects measured in decades (eg the long-term effects on health from increased flights or long-term employment).

Assessment Scenarios

18.4.16 The assessment describes the change in population health effects between the base case of do-minimum (DM) and Project scenarios in the following main assessment years, capturing the worst-case health and wellbeing effects:

- initial construction period (2024-2029);
- first full year of opening (2029);
- interim assessment year (2032);
- design year (2038); and
- long term forecast year (2047).

18.4.17 **ES Chapter 12: Traffic and Transport** (Doc Ref. 5.1); **ES Chapter 13: Air Quality** (Doc Ref. 5.1); **ES Chapter 14: Noise and Vibration** (Doc Ref. 5.1) refer to a Central Case and Slow Fleet Transition Case for Air Transport Movements (ATM). These have been taken into account in determining the realistic worst case health assessment. **ES Chapter 6: Approach to Environmental Assessment** (Doc Ref. 5.1) provides further details on these sensitivity tests, which are taken into account by the health assessment conclusions set out in Section 18.8 below.

18.4.18 In terms of the operational period, the employment growth figures assessed in this ES chapter relate to the estimates presented in **ES Chapter 17: Socio-Economics** (Doc Ref. 5.1), which are drawn from the Local Impact Assessment prepared by Oxera (**ES Appendix 17.9.2: Local Economic Impact Assessment** (Doc Ref. 5.3), Annex 4).

Baseline data collection

Desk Study

18.4.19 Different communities have varying susceptibility to health and wellbeing effects (both adverse and beneficial) as a result of social and demographic structure, behaviour and relative economic circumstances.

18.4.20 The approach to defining the baseline involved collation and interpretation of published demographic, socio-economic and existing public health and healthcare capacity data. The following open source websites and datasets have been used in order to develop the health and wellbeing baseline:

- Office for National Statistics;
- NOMIS;
- Ministry of Housing, Communities and Local Government indices of multiple deprivation;
- OHID Fingertips Health Profile Tool;
- OHID Local Health Tool;
- NHS Quality Outcomes Framework (QOF) Database;
- NHS Digital; and
- Local authority Health and Wellbeing Board publications.

18.4.21 Relevant Joint Strategic Needs Assessment (JSNA) reports and Health and Wellbeing Strategies (HWS) have been analysed to provide additional context on local health circumstances, inequalities and public health priorities. These reports partly draw from the open source websites and datasets detailed above. The JSNA and HWS review is set out in **ES Appendix 18.5.1: Health Baseline Trends, Priorities and Vulnerable Groups** (Doc Ref. 5.3).

18.4.22 The baseline data provides insight into local health and socio-economic circumstances. Where quantitative assessment methods are being applied to pragmatically estimate the scale of change in selected health outcomes relevant to air quality and noise, local data has been used within equations that predict changes in baseline population health.

Assessment Criteria and Assignment of Significance

18.4.23 The methodology outlined in this section follows the IEMA 2022 guidance on determining EIA health significance (Pyper, et al., 2022a)[4]. The IEMA guidance was informed by the international consensus publication between impact assessment and public health practitioners (Cave, et al., 2020) and other UK guidance on health methods appropriate to EIA (Pyper, et al., 2021; Public Health England, 2020). The methods have been presented to the Health Topic Working Group (see Table 18.3.4) and agreed as a reasonable basis of assessment.

18.4.24 The EIA health chapter conclusions are presented in both EIA categories of significance, such as major, moderate, minor or negligible, and a narrative explaining this 'score' with reference to evidence, local context and any inequalities. The IEMA guidance sets out the criteria and indicative levels that support the professional judgement in 'scoring' and presenting a narrative.

18.4.25 The assessment of significance is based on the indicative matrix set out in Table 18.4.3. This shows how the significance of the effect takes into account the sensitivity of the population and the magnitude of the impact due to the Project.

Table 18.4.3: Indicative Assessment Matrix

Magnitude of Impact	Sensitivity			
	High	**Medium**	**Low**	**Very low**
High	Major	Moderate or major	Moderate or minor	Minor or negligible
Medium	Moderate or major	Moderate	Minor	Minor or negligible
Low	Moderate or minor	Minor	Minor	Negligible
Negligible	Minor or negligible	Minor or negligible	Negligible	Negligible

18.4.26 Where the matrix offers more than one significance option, professional judgement is used to decide which option is most appropriate.

[4] The methods for the ES Health and Wellbeing chapter have been updated from those used at PEIR, reflecting new IEMA guidance. The change to the methods was discussed and agreed with the Health and Major Accident and Disaster Topic Working Group of health stakeholders.

18.4.27 Effects of moderate and above are considered significant in terms of the EIA Regulations.

18.4.28 Table 18.4.4, Table 18.4.5 and Table 18.4.6 together summarise the assessment criteria. The approach uses professional judgement, drawing on consistent and transparency criteria for sensitivity and magnitude. It also references relevant contextual evidence to explain what significance means for human health in public health terms. While a judgment is made based on most relevant criteria, it is likely in any given analysis that some criteria will span score categories. Terms in bold within the tables indicate key terms that differentiate the category/score levels.

Table 18.4.4: Health Sensitivity Criteria

Category/ Score	Indicative criteria
High	**high** levels of deprivation (including pockets of deprivation); **reliance** on resources shared (between the population and the Project); existing **wide** inequalities between the most and least healthy; a community whose outlook is predominantly anxiety or **concern**; people who are **prevented** from undertaking daily activities; **dependants**; people with **very poor** health status; and/or people with a **very low** capacity to adapt.
Medium	**moderate** levels of deprivation; **few alternatives** to shared resources; existing **widening** inequalities between the most and least healthy; a community whose outlook is predominantly **uncertainty** with some concern; people who are **highly limited** from undertaking daily activities; people providing or requiring **a lot of care**; people with **poor** health status; and/or people with a **limited** capacity to adapt.
Low	**low** levels of deprivation; **many alternatives** to shared resources; existing **narrowing** inequalities between the most and least healthy; a community whose outlook is predominantly **ambivalence** with some concern; people who are **slightly limited** from undertaking daily activities; people providing or requiring **some care**; people with **fair** health status; and/or people with a **high** capacity to adapt.
Very low	**very low** levels of deprivation; **no** shared resources; existing **narrow** inequalities between the most and least healthy; a community whose outlook is predominantly **support** with some concern; people who are **not limited** from undertaking daily activities; people who are independent (not a carer or dependant); people with **good** health status; and/or people with a **very high** capacity to adapt.

Table 18.4.5: Health Magnitude Methodology Criteria

Category/ Score	Indicative criteria
High	**High** exposure or scale; **long-term** duration; **continuous** frequency; severity predominantly related to **mortality** or changes in morbidity (physical or mental health) for very severe illness/injury outcomes; **majority** of population affected; **permanent** change; **substantial** service quality implications.

Category/ Score	Indicative criteria
Medium	**Low** exposure or **medium** scale; **medium-term** duration; **frequent** events; severity predominantly related to moderate changes in **morbidity** or major change in quality-of-life; **large minority** of population affected; **gradual** reversal; **small** service quality implications.
Low	**Very low** exposure or **small** scale; **short-term** duration; **occasional** events; severity predominantly related to minor change in **morbidity** or moderate change in quality-of-life; **small minority** of population affected; **rapid** reversal; **slight** service quality implications.
Negligible	**Negligible** exposure or scale; **very short-term** duration; **one-off** frequency; severity predominantly relates to a minor change in **quality-of-life**; very few people affected; immediate reversal once activity complete; no service quality implication.

Table 18.4.6: Health Significance Methodology Criteria

Category/ Score	Indicative criteria
Major (significant)	The narrative explains that this is significant for public health because: ▪ Changes, due to the Project, have a **substantial** effect on the ability to deliver current health policy and/or the ability to narrow health inequalities, including as evidenced by referencing relevant policy and effect size (magnitude and sensitivity scores), and as informed by consultation themes among stakeholders, particularly public health stakeholders, that show **consensus** on the importance of the effect. ▪ Change, due to the Project, could result in a regulatory threshold or statutory standard being **crossed** (if applicable). ▪ There is likely to be a **substantial** change in the health baseline of the population, including as evidenced by the effect size and scientific literature showing there is a **causal** relationship between changes that would result from the Project and changes to health outcomes. ▪ In addition, health priorities for the relevant study area are of **specific** relevance to the determinant of health or population group affected by the Project.
Moderate (significant)	The narrative explains that this is significant for public health because: ▪ Changes, due to the Project, have an **influential** effect on the ability to deliver current health policy and/or the ability to narrow health inequalities, including as evidenced by referencing relevant policy and effect size, and as informed by consultation themes among stakeholders, which may show **mixed views**. ▪ Change, due to the Project, could result in a regulatory threshold or statutory standard being **approached** (if applicable). ▪ There is likely to be a **small** change in the health baseline of the population, including as evidenced by the effect size and scientific literature showing there is a **clear** relationship between changes that would result from the Project and changes to health outcomes. ▪ In addition, health priorities for the relevant study area are of **general** relevance to the determinant of health or population group affected by the Project.

Category/ Score	Indicative criteria
Minor (not significant)	The narrative explains that this is not significant for public health because: ▪ Changes, due to the Project, have a **marginal** effect on the ability to deliver current health policy and/or the ability to narrow health inequalities, including as evidenced by effect size of limited policy influence and/or that **no** relevant consultation themes emerge among stakeholders. ▪ Change, due to the Project, would be **well within** a regulatory threshold or statutory standard (if applicable); but could result in a guideline being crossed (if applicable). ▪ There is likely to be a **slight** change in the health baseline of the population, including as evidenced by the effect size and/or scientific literature showing there is only a **suggestive** relationship between changes that would result from the Project and changes to health outcomes. ▪ In addition, health priorities for the relevant study area are of **low** relevance to the determinant of health or population group affected by the Project.
Negligible (not significant)	The narrative explains that this is not significant for public health because: ▪ Changes, due to the Project, are **not related** to the ability to deliver current health policy and/or the ability to narrow health inequalities, including as evidenced by effect size or lack of relevant policy, and as informed by the Project having **no responses** on this issue among stakeholders. ▪ Change, due to the Project, would **not affect** a regulatory threshold, statutory standard or guideline (if applicable). ▪ There is likely to be a **very limited** change in the health baseline of the population, including as evidenced by the effect size and/or scientific literature showing there is an **unsupported** relationship between changes that would result from the Project and changes to health outcomes. ▪ In addition, health priorities for the relevant study area are **not** relevant to the determinant of health or population group affected by the Project.

Vulnerable group sub-populations and assessment of inequalities

18.4.29 Drawing on Table 18.4.4, the following general characterisations of how the 'general population' may differ from 'vulnerable group populations' were considered when scoring sensitivity. These statements are not duplicated in each assessment and apply (as relevant) to the issues discussed for both construction and operation.

- In terms of life stage, the general population can be characterised as including a high proportion of people who are independent, as well as those who are providing some care. By contrast, the vulnerable group population can be characterised as including a high proportion of people who are providing a lot of care, as well as those who are dependant.
- The general population can be characterised as experiencing low deprivation. However, the professional judgment is that the vulnerable group population experiences high deprivation (including where this is due to pockets of higher deprivation within low deprivation areas).
- The general population can be characterised as broadly comprised of people with good health status. Vulnerable groups, however, tend to include those parts of the population reporting bad or very bad health status.

- The general population tends to include a large majority of people who characterise their day-to-day activities as not limited. The vulnerable group population tends to represent those who rate their day-to-day activities as limited a little or limited a lot.
- Based on a professional judgement the general population's resilience (capacity to adapt to change) can be characterised as high whilst the vulnerable group population can be characterised as having limited resilience.
- Regarding the usage of affected infrastructure or facilities, the professional judgement is that the general population are more likely to have many alternatives to resources shared with the Project. For the vulnerable group population, the professional judgement is that they are more likely to have a reliance on shared resources.
- The general population includes the proportion of the community whose outlook on the Project includes support and ambivalence. The vulnerable group population includes the proportion of the community who are uncertain or concerned about the Project.

18.4.30 Table 18.4.7 sets out summary statistics relevant to the characterisation of the vulnerable group population. The combined statistics for the nine ward area were generated automatically using the OHID Local Health public health data tool. Combined statistics for the HLSA and Six Authority Area were generated manually. Further details are set out in **ES Appendix 18.5.2: Health and Wellbeing Baseline Data Tables** (Doc Ref. 5.3).

Table 18.4.7: Baseline – indicators relevant to vulnerable groups relevant across health determinants

Indicator Name	Nine ward (mean)	HLSA (mean)	Six Authority Area (mean)	South East	England
Population aged 0 to 15 years (%) - children and young people	21.6	19.9	18.7	19.3	19.2
Population aged 16 to 64 years (%) - working age	62.8	60.3	62.0	61.1	62.3
Population aged 65 years and over (%) - older people	15.6	19.8	19.4	19.7	18.5
Income deprivation (%) – low income vulnerability	9.8	7.0	10.6	9.1	12.9
Limiting long-term illness or disability (%) – poor health vulnerability	15.8	14.7	16.6	15.7	17.6

18.4.31 As seen in Table 18.4.7, the site specific study area (the nine ward area) has a slightly higher percentage of children and young people aged 0 to 15 years, compared to the national average, and also compared to all other comparators. The nine ward area also has a marginally higher percentage of working age people compared to the national average, and all other comparators. In contrast, the nine ward area has a lower percentage of older people (aged 65 and over) compared to the national average and all other comparators.

18.4.32 Income deprivation is lower in the nine ward study area than nationally, but higher than locally (HLSA) and regionally (in the South East). This is also the case with the percentage of people in the nine ward study area with a limiting long-term illness or disability.

18.5. Baseline Environment

Current Baseline Conditions

Introduction

18.5.1 Different communities have varying susceptibilities to health impacts and benefits as a result of social and demographic structure, behaviour and relative economic circumstances.

18.5.2 The aim of the following information, which summarises the more detailed health and wellbeing baseline trend information provided in **ES Appendix 18.5.1: Health Baseline Trends, Priorities and Vulnerable Groups** (Doc Ref. 5.3) and **ES Appendix 18.5.2: Health and Wellbeing Baseline Data Tables** (Doc Ref. 5.3), is primarily to put into context the local health circumstances of the communities within the HLSA and Six Authorities Area. It should be recognised that in describing the whole population, and the populations within the local and wider study area, there will be some individuals or groups of people who do not conform to the overall profile. In addition, specific parameters used within quantitative health assessments are referenced towards the end of this section.

18.5.3 Furthermore, baseline environmental conditions referenced in other EIA assessments (eg **ES Chapter 12: Traffic and Transport** (Doc Ref. 5.1), **ES Chapter 13: Air Quality** (Doc Ref. 5.1), **ES Chapter 14: Noise and Vibration** (Doc Ref. 5.1), **ES Chapter 17: Socio-economic Effects** (Doc Ref. 5.1) and **ES Chapter 19: Agricultural Land Use and Recreation** (Doc Ref. 5.1)) are noted as having informed the heath assessment. For the sake of brevity, these are not replicated within this section.

Demography, Deprivation and Socio-economic Indicators

18.5.4 The HLSA is relatively affluent, where for overall deprivation levels there are no Lower Super Output Areas (LSOAs) within the HLSA categorised in the 20% most deprived nationally, and 47% of the LSOAs within the HLSA are categorised in the 20% least deprived nationally. For the health domain specifically, there are also no LSOAs within the HLSA categorised within the 20% most deprived nationally, and 61% of the LSOAs within the HLSA are categorised in the 20% least deprived nationally (Ministry of Housing, Communities & Local Government, 2019). The areas with the highest levels of overall deprivation in the HLSA are in the southwest of Crawley (Southgate and Broadfield areas), with the least deprived areas located in the eastern half of Crawley (Pound Hill, Maidenbower) and in the northern parts of Horley.

18.5.5 For further information on socio-economic circumstances, which are a key determinant of health, refer to **ES Chapter 17: Socio-economic Effects** (Doc Ref. 5.1).

Physical and Mental Health Indicators

18.5.6 Male and female life expectancy and healthy life expectancy (ie the amount of years spent in good health) in the HLSA are both higher than the regional and national averages. Life expectancy and healthy life expectancy for males and females in the Six Authorities Area are also higher than the national average but are more comparable to the regional average.

18.5.7 All-age all-cause mortality in the HLSA is lower than both the regional and national averages; Crawley has the highest all-age all-cause mortality within the HLSA. In the Six Authorities Area,

all-age all-cause mortality is also lower than the national average, but higher than the regional average.

18.5.8 From analysis of under 75 mortality rates for cardiovascular disease and cancer, the under 75 mortality rate within the HLSA is consistently below the regional and national averages. Within the Six Authorities Area, the under 75 mortality rate for cardiovascular disease and cancer is consistently below the national average and more comparable to the regional average. The under 75 mortality rate for respiratory disease in the HLSA and Six Authorities Area has consistently been below the national average.

18.5.9 Regarding hospital admission rates, emergency hospital admissions for respiratory and cardiovascular diseases in both the HLSA and Six Authorities Area are lower when compared to the national average. This is consistent with mortality trends for cardiovascular and respiratory diseases whereby the under 75 mortality rate within the HLSA and Six Authorities Area are consistently below the national average.

18.5.10 Analysis of indicators relating to mental health, such as suicide rate and hospital stays for self-harm, show slight fluctuations over the years, but a generally improving trend. While hospital stays for self-harm in the Six Authorities Area are consistently higher than the regional and national averages, figures for the HLSA have decreased over the years to below the regional average, but higher than the national average. Dementia prevalence in the HLSA and Six Authorities Area is marginally higher than the regional and national averages, which is likely to reflect the higher than average age profile.

Lifestyle Indicators

18.5.11 The levels of childhood obesity in the HLSA and Six Authorities Area have remained relatively static over the years and below the regional and national averages. The proportion of the adult population classified as overweight or obese shows a decreasing trend overall in the HLSA (between 2015/16 to 2019/20) to a level lower than the regional and national averages – this contrasts with the increasing trends apparent in the Six Authorities Area, regionally and nationally. Participation in physical activity in the HLSA and Six Authorities Area has been increasing slightly over the years and was consistently higher than the regional and national averages until 2018/19, after which figures have decreased to levels more comparable to the national average.

18.5.12 Smoking prevalence in the HLSA and Six Authorities Area have shown a general decrease over the years. While smoking prevalence in the HLSA has consistently been lower than both the regional and national averages (from 2016 to 2019), smoking prevalence in the Six Authorities Area is consistently higher than the regional average, but more comparable to the national average.

18.5.13 Hospital stays for alcohol-related harm in the HLSA and Six Authorities Area have remained relatively static over the years. In the HLSA and Six Authorities Area, hospital stays for alcohol related harm have been consistently lower than the national average. Hospital stays for alcohol related harm in the HLSA have also been consistently lower than the regional average. However, this is not the case in the Six Authorities Area, where hospital stays for alcohol-related harm have been consistently higher than the regional average.

Baseline Parameters Used for Quantitative Assessment Purposes

18.5.14 While collection and interpretation of a wide range of baseline indicators is useful to put into context the local health circumstances, certain baseline parameters are used directly in quantitative health assessment calculations.

18.5.15 The quantitative health assessment (see Section 18.8 and **ES Appendix 18.8.1: Quantitative Health Assessment Results** (Doc Ref. 5.3)) has been completed for predicted changes in air quality and air noise exposure. Details of the baseline parameters used in this assessment are set out in Table 18.5.1 and Table 18.5.2. HLSA data is presented without a comparator as the baseline data is used in the health quantitative analyses for localised, not national or regional, effects.

Table 18.5.1: Baseline Parameters Used in Quantitative Health Assessment for Changes in Air Quality Exposure

Health Outcome	HLSA Average	Source
NO_2 natural cause mortality, 30+ years	1,329.9 per 100,000 population	Nomis – Official Census and Labour Market Statistics
$PM_{2.5}$ natural cause mortality, 30+ years		
NO_2 respiratory disease hospital admissions, all ages	657.4 per 100,000 population	NHS Digital – Hospital Admitted Patient Care Activity, 2021-22: Diagnosis. OHID Local Health – Emergency hospital admissions
$PM_{2.5}$ respiratory disease hospital admissions, all ages		
$PM_{2.5}$ cardiovascular disease hospital admissions, all ages	774.4 per 100,000 population	NHS Digital – Hospital Admitted Patient Care Activity, 2021-22: Diagnosis. OHID Local Health – Emergency hospital admissions

Table 18.5.2: Baseline Parameters Used in Quantitative Health Assessment for Changes in Noise Exposure

Health Outcome	HLSA Average	Source
Stroke incidence rate	116.6 per 100,000 population	NHS Digital, Hospital Admitted Patient Care Activity
Stroke mortality rate	32.9 per 100,000 population	NOMIS
Ischaemic Heart Disease (IHD) incidence rate	175.2 per 100,000 population	NHS Digital, Hospital Admitted Patient Care Activity
IHD mortality rate	68.6 per 100,000 population	NOMIS
Depression incidence rate, 18+ years	1.5%	NHS QOF database (via OHID fingertips)

Existing GAL Community Initiatives

18.5.16 GAL operate a range of existing initiatives to share the benefits generated by the airport among local communities by supporting community-related projects and programmes across the region. All community initiatives fall under the following categories: economy; environment; health and wellbeing; education; employment and skills; community investment; or community.

18.5.17 As employment is a key wider determinant of health, GAL's One Destination Employability Programme is particularly beneficial to the health and wellbeing of the local community. The programme constitutes a four-week training course, which is intended to equip long-term unemployed individuals with a range of skills to improve employability. Approximately 92% of those taking the course have been offered employment at the airport.

18.5.18 Healthcare provision is a more direct influencer of health and wellbeing. As such, GAL's support for charity partners Air Ambulance Kent Surrey Sussex, St. Catherine's Hospice and Surrey and Sussex Healthcare NHS Trust (amongst others) are relevant. Specifically, during the national lockdowns, GAL supported their charity partners with donations of digital advertising, profits of sales of masks, proceeds of charity collection globes and refreshments for front line workers.

18.5.19 Overall, as health and wellbeing are influenced by several factors, community initiatives falling under all categories supported by GAL will to some extent contribute to improving local health circumstances.

Conclusion

18.5.20 From analysis of available statistics, physical and mental local health circumstance in the HLSA and Six Authorities Area can be considered good, and trends are generally positive. In most circumstances, health status is better than the national average and more comparable to the regional average.

18.5.21 On this basis, it is not considered that the local populations would be particularly sensitive to socio-economic or environmental changes associated with the construction and operation of the Project. Further ward level public health indicator data is discussed in Section 18.8.

Future Baseline Conditions

18.5.22 IEMA guidance (Pyper, et al., 2022b) notes that in assessing change, regard should be had to both current and future residents. Furthermore, regard should be had to external factors that affect the future baseline of a population (Pyper, et al., 2022a).

18.5.23 Trends are analysed as part of the current baseline to provide insight into likely future local community circumstances. Overall, data collected show generally positive trends for health-specific data. As it is challenging to predict health-specific data with high confidence, it is considered appropriate and conservative to use present-day statistics for the purpose of this assessment, including assessment for future years.

18.5.24 Population health data presents a snapshot at a particular time. It is well recognised that population health is subject to continuing influences, both at the individual and community level. Influences may be environmental, such as seasonal variation in wellbeing and communicable diseases, they may also respond to socio-economic factors, such as migration and the availability of jobs.

18.5.25 Longer term trends and interventions in population health may influence the future baseline. Health and social care, public health initiatives and government policies aim to reduce inequalities and improve quality of life. The historic success of such interventions is increasingly challenged by national trends such as an ageing population, rising levels of obesity and the COVID-19 pandemic. The implications of COVID-19 for public health will take years to be reflected within statistical data releases, but it is expected that the pandemic will have exacerbated public health challenges. The pandemic disproportionately affected vulnerable groups, including due to age and ill-health.

18.5.26 For assessment purposes, the current health baseline is considered a suitable proxy of the future baseline. The current baseline used in this assessment includes appropriate health indicators to reflect the types of health outcomes that would also be relevant for the future population (eg in relation to age and long-term conditions). The health assessment methodology includes a categorisation of vulnerable population groups which, for example, allows for the effects of older people and people with existing poor health to be distinguished from the general population. The health assessment sensitivity score for each vulnerable group is independent of the population size within that group (Pyper, et al., 2022a), which would be the main change between the current and future baseline. The sensitivity scores within the health assessment therefore account for both current and future population characteristics.

18.5.27 It would not be proportionate (or consistent with the qualitative assessment approach taken) to quantitatively model the population's future health. This reflects the complexities of interactions between the wider determinants of health, as well as the potential for macro-economic changes in the next decade that are hard to predict. Any predication would have such wide error margins that it would greatly limit the value of the exercise. Annual national population health trend forecasting is undertaken as a government public health activity (HM Government, 2021b) and has been taken into account by the health assessment.

18.5.28 As population data are used for quantitative health and wellbeing assessment methods, population projection information has been applied within calculations for all relevant assessment years, where possible. In addition, any new residential receptors introduced as a result of other projects in the locality have been captured within modelling outputs from inter-related technical disciplines which inform the health and wellbeing assessment.

18.5.29 Regarding the potential influence on the health and wellbeing baseline associated with climate change, while it is probable that the effects of climate change will be realised to some extent by the assessment years of 2038 and 2047, these changes are not expected to materially alter the health and wellbeing baseline conditions.

18.6. Key Aspects of the Project

18.6.1 The assessment has been based on the Project identified within **ES Chapter 5: Project Description** (Doc Ref. 5.1).

18.6.2 Table 18.6.1 below identifies the key maximum design scenarios relevant to this assessment. Where options exist, the maximum design scenario selected is the one having the potential to result in the greatest effect on population health.

18.6.3 The health assessment is informed by other EIA chapters (**ES Chapter 8: Landscape, Townscape and Visual Resources** (Doc Ref. 5.1); **ES Chapter 10: Geology and Ground**

Conditions (Doc Ref. 5.1); **ES Chapter 11: Water Environment** (Doc Ref 5.1); **ES Chapter 12: Traffic and Transport** (Doc Ref 5.1); **ES Chapter 13: Air Quality** (Doc Ref 5.1); **ES Chapter 14: Noise and Vibration** (Doc Ref. 5.1); **ES Chapter 17: Socio-economic Effects** (Doc Ref. 5.1); and **ES Chapter 19: Agricultural Land Use and Recreation** (Doc Ref. 5.1)) that set out key aspects relevant to their assessments. The health assessment does not duplicate those.

Table 18.6.1: Maximum Design Scenarios

Potential Impact	Maximum Design Scenario	Justification
Initial Construction Period: 2024-2029		
Changes in local air, soil and water quality, noise exposure, construction transport and access to open space and public rights of way due to on-site construction and associated transport movements	Maximum design scenarios are specified in **ES Chapter 8: Landscape, Townscape and Visual Resources** (Doc Ref. 5.1); **ES Chapter 10: Geology and Ground Conditions** (Doc Ref. 5.1); **ES Chapter 11: Water Environment** (Doc Ref. 5.1); **ES Chapter 12: Traffic and Transport** (Doc Ref. 5.1); **ES Chapter 13: Air Quality** (Doc Ref. 5.1); **ES Chapter 14: Noise and Vibration** (Doc Ref. 5.1); and **ES Chapter 19: Agricultural Land Use and Recreation** (Doc Ref. 5.1).	The estimated impacts of the Project which could lead to the reasonably foreseeable largest adverse, or smallest beneficial, changes in population health. Justifications are set out in the respective chapters, for example, maximum areas of land take, allowance for activities at a range of locations within the red line boundary and peak intensity and durations of activities causing emissions, disturbance or disruption.
Construction-related employment opportunities and associated income generation (direct, indirect and catalytic)	Peak construction workforce numbers are stated in **ES Chapter 17: Socio-economic Effects** (Doc Ref. 5.1).	The estimated peak maximum numbers of construction workers required for completing the Project.
Introduction of a large workforce during construction		Potential adverse social-related health and wellbeing effects based on how the construction workforce is managed.
First Full Year of Opening: 2029, Interim Assessment Year: 2032		
Changes in local air, soil and water quality, noise and light exposure, transport and access to open space and public rights of way due to construction/operational activities and associated transport movements	Maximum design scenarios are specified in **ES Chapter 8: Landscape, Townscape and Visual Resources** (Doc Ref. 5.1); **ES Chapter 10: Geology and Ground Conditions** (Doc Ref. 5.1); **ES Chapter 11: Water Environment** (Doc Ref. 5.1); **ES Chapter 12: Traffic and Transport**	The estimated impacts of the Project which could lead to the reasonably foreseeable largest adverse, or smallest beneficial, changes in population health. Justifications are set out in the respective chapters, for example maximum areas of land take, allowance for activities at a range

Potential Impact	Maximum Design Scenario	Justification
	(Doc Ref. 5.1); **ES Chapter 13: Air Quality** (Doc Ref. 5.1); **ES Chapter 14: Noise and Vibration** (Doc Ref. 5.1); and **ES Chapter 19: Agricultural Land Use and Recreation** (Doc Ref. 5.1).	of locations within the red line boundary and peak intensity and durations of activities causing emissions, disturbance or disruption.
Construction and operational-related employment opportunities and associated income generation (direct, indirect and catalytic)	Peak workforce numbers are stated in **ES Chapter 17: Socio-economic Effects** (Doc Ref. 5.1).	The estimated peak maximum numbers of workers required for completing the Project.
Introduction of a large workforce during construction	Peak construction workforce numbers are stated in **ES Chapter 17: Socio-economic Effects** (Doc Ref. 5.1).	Potential adverse social-related health and wellbeing effects based on how the construction workforce is managed.
Design Year: 2038 and the long-term forecasting year 2047		
Changes in local air, soil and water quality, noise and light exposure, transport and access to open space and public rights of way due to operational activities and associated transport movements	Maximum design scenarios are specified in **ES Chapter 8: Landscape, Townscape and Visual Resources** (Doc Ref. 5.1); **ES Chapter 10: Geology and Ground Conditions** (Doc Ref. 5.1); **ES Chapter 11: Water Environment** (Doc Ref. 5.1); **ES Chapter 12: Traffic and Transport** (Doc Ref 5.1); **ES Chapter 13: Air Quality** (Doc Ref 5.1); **ES Chapter 14: Noise and Vibration** (Doc Ref. 5.1); and **ES Chapter 19: Agricultural Land Use and Recreation** (Doc Ref. 5.1).	The estimated impacts of the Project which could lead to the reasonably foreseeable largest adverse, or smallest beneficial, changes in population health. Justifications are set out in the respective chapters, for example maximum areas of land take, allowance for activities at a range of locations within the red line boundary and peak intensity and durations of activities causing emissions, disturbance or disruption.
Operational-related employment opportunities and associated income generation (direct, indirect and catalytic)	Peak operational workforce numbers are stated in **ES Chapter 17: Socio-economic Effects** (Doc Ref. 5.1).	The estimated increase in employment due to the Project.

18.7. Mitigation and Enhancement Measures Adopted as Part of the Project

18.7.1 In addition to the existing community initiatives detailed in Section 18.5, which contribute beneficially to local community health circumstances, a number of measures have been designed into the Project to reduce the potential for impacts on health and wellbeing. These are listed below in Table 18.7.1.

18.7.2 The health assessment takes as its input the residual effect conclusions of other ES chapters. To avoid double counting the benefits of mitigation and enhancement measures, the health assessment does not duplicate or repeat the measures specified in **ES Chapter 8: Landscape, Townscape and Visual Resources** (Doc Ref. 5.1); **ES Chapter 10: Geology and Ground Conditions** (Doc Ref. 5.1); **ES Chapters 11: Water Environment** (Doc Ref. 5.1); **ES Chapter 12: Traffic and Transport** (Doc Ref. 5.1); **ES Chapter 13: Air Quality (Doc Ref. 5.1)**; **ES Chapter 14: Noise and Vibration** (Doc Ref. 5.1); **ES Chapter 17: Socio-economic Effects** (Doc Ref 5.1); and **ES Chapter 19: Agricultural Land Use and Recreation** (Doc Ref 5.1). Relevant measures from these chapters are noted within the assessment as having been taken into account. Adopted mitigation measures are detailed within the relevant topic chapters and, where applicable, the **CoCP** (ES Appendix 5.3.2 (Doc Ref. 5.3)). Where relevant, environmental monitoring is described within the relevant topic chapters (air quality, noise, transport, etc).

18.7.3 Measures taken into account by the health assessment that are secured in the DCO include:

- **ES Appendix 5.3.2: Code of Construction Practice (CoCP)** (Doc Ref. 5.3)
- **ES Appendix 5.3.2: CoCP Annex 1 - Water Management Plan** (Doc Ref. 5.3)
- **ES Appendix 5.3.2: CoCP Annex 2 - Outline Construction Workforce Travel Plan** (Doc Ref. 5.3)
- **ES Appendix 5.3.2: CoCP Annex 3 - Outline Construction Traffic Management Plan** (Doc Ref. 5.3)
- **ES Appendix 5.3.2: CoCP Annex 4 - Soils Management Strategy** (Doc Ref. 5.3)
- **ES Appendix 5.2.2: Operational Lighting Framework** (Doc Ref. 5.3)
- **ES Appendix 5.4.1: Surface Access Commitments** (Doc Ref. 5.3)
- **ES Appendix 13.8.1: Air Quality Construction Phase Mitigation** (Doc Ref. 5.3)
- **ES Appendix 14.9.10: Noise Insulation Scheme (NIS)** (Doc Ref. 5.3)
- **ES Appendix 17.8.1: Employment, Skills and Business Strategy** (Doc Ref. 5.3)
- **ES Appendix 8.8.1: Outline Landscape and Ecology Management Plan** (Doc Ref. 5.3)
- **ES Appendix 19.8.2: Public Rights of Way Management Strategy** (Doc Ref. 5.3)

18.7.4 Further measures are secured through the Section 106 Agreement and are listed in the ES chapters that inform the health assessment.

18.7.5 Table 18.7.1 lists the mitigation and enhancement measures that have been adopted as part of the health assessment.

18.7.6 In relation to continuing to meet relevant statutory obligations, GAL will continue to provide: appropriate occupational healthcare to its employees as numbers increase; and port health activities (eg communicable illness surveillance at the airport) would be scaled in line with passenger growth.

18.7.7 Gatwick is also continuing collaboration with the local Integrated Care Board to explore options for improving Airport workers' access to NHS screening and clinics.

Table 18.7.1: Mitigation and Enhancement Measures

Measures Adopted as Part of the Project	Justification	How Secured
Promoting health equity by supporting uptake of the Noise Insulation Scheme for local vulnerable groups	Further targeted support to promote uptake of the NIS amongst vulnerable groups within the scheme area. For example, tenants eligibility, responding to language or literacy barriers, safeguarding and clear communication protocols for surveys and works in the homes of vulnerable persons.	**NIS** in **ES Appendix 14.9.10** (Doc Ref. 5.3), as a Schedule 2 requirement in the **Draft DCO** (Doc Ref. 2.1)
Healthcare for construction workers	Provision and implementation of a protocol setting out the first point of contact for health queries for construction workers. This will include physical and mental health promotion information, access to on-site first aid and provide information about the appropriate avenues for further healthcare support where necessary. Proportionate to the scale of workforce onsite and the need to supplement the normal 111 service, a dedicated healthcare practitioner would be available for construction workers to consult with. These initiatives would limit the need for workers to travel to use other local community facilities. The objective of the protocol is to minimise use of local NHS primary healthcare providers and inappropriate use of A&E services. The protocol will be prepared during the pre-construction period once a Principal Contractor has been appointed. The protocol would integrate with and complement the Principal Contractor's occupational health and occupational hygiene services that manage workplace health risks.	**CoCP** in **ES Appendix 5.3.2** (Doc Ref. 5.3) as a Schedule 2 requirement in the **Draft DCO** (Doc Ref. 2.1)
Healthcare for airport passengers and visitors	Onsite at the Airport GAL will provide a level of first aid and first responder expertise to determine the need for ambulance callouts that maintains, or improves upon, the current Gatwick Control Centre records for annual rate of passengers transferred to hospital as a percentage of total passengers. This will be achieved by scaling first responder provision commensurate with passenger numbers. This will include onsite personnel with appropriate training as well as equipment such as first aid kits and Automated External Defibrillators. The objective of this measure is to provide appropriate first responder healthcare for passengers experiencing a	**Section 106 agreement** in **Planning Statement**, Table 5.2 Section 106 Heads of Terms (Doc Ref. 7.1)

Measures Adopted as Part of the Project	Justification	How Secured
	medical event at the Airport, whilst minimising inappropriate use of ambulance and A&E services.	
Promoting health equity through benefits to local vulnerable groups	ES Appendix 17.8.1: **ESBS** (Doc Ref. 5.3) includes a series of training, employment and procurement initiatives that will aid in addressing existing local barriers to a range of employment opportunities locally. The ESBS includes relevant measures targeted at vulnerable groups. Specifically, as far as reasonably practicable (eg subject to standards and security checks) provide a targeted scheme of access to operational Airport training schemes and apprenticeships for young people in the local and regional area who are Not in Education, Employment, or Training (NEET). To work with local education and training providers to support opportunities to provide local adult learning linked to operational Airport related (or wider supply chain) job opportunities relevant to disadvantaged adults facing skills barriers to employment opportunities.	**Section 106 agreement** in **Planning Statement**, Table 5.2 Section 106 Heads of Terms (Doc Ref. 7.1)
Monitoring benefits to local vulnerable groups	Monitoring of the proportion of local people with long-term unemployment, high job instability or low income characteristics who enter employment with GAL would be undertaken as part of the Annual Monitoring Report described in the ESBS to confirm the benefit and further tailor the targeting of local vulnerable groups. Monitoring of the proportion of NEETs taking up, and completing, training opportunities with GAL would be undertaken to confirm the benefit and further tailor the targeting of local vulnerable groups. This information would be shared on an annual basis with West Sussex public health team via the Council.	**Section 106 agreement** in **Planning Statement**, Table 5.2 Section 106 Heads of Terms (Doc Ref. 7.1)

18.8. Assessment of Effects

Health and Wellbeing Effects from Changes to Air Quality

General

Approach

18.8.1 This section of the ES presents findings on how population health may be affected by changes in air quality. The section takes account of both UK statutory health protection standards and the

non-threshold effects of nitrogen dioxide (NO_2) and fine particulate matter (PM_{10} and $PM_{2.5}$)[5]. Emerging scientific understanding of ultra-fine particulate matter (UFP) as a public health issue is also discussed.

18.8.2 This section has been informed by **ES Chapter 13: Air Quality** (Doc Ref. 5.1), which sets out relevant assessment findings and mitigation measures that have been taken into account. Results of Chapter 13: Air Quality have informed the magnitude of change, with further details discussed for each assessment year. As noted in Chapter 13: Air Quality, at the time of writing the updated $PM_{2.5}$ standards for future years have recently been confirmed by Defra (UK Government, 2023). The health assessment follows the approach on $PM_{2.5}$ assessment set out in Chapter 13: Air Quality, ie using the 2028 interim target of 12 µg/m^3.

18.8.3 Consistent with the quantitative analysis discussed in **ES Chapter 13: Air Quality** (Doc Ref. 5.1), this qualitative health assessment is based on a comparison between the with and without the Project scenarios for the assessment years of 2029, 2032, 2038 and 2047. Consideration has also been given to the Central Case and Slow Fleet Transition Case for ATMs. Informing and validating the qualitative health assessment methodology, a quantitative analysis of the scale of change in relevant health outcomes has also been undertaken and is reported. Full results of this analysis are presented in **ES Appendix 18.8.1: Quantitative Health Assessment Results** (Doc Ref. 5.3).

18.8.4 The significance of the population health effect has had regard to the following evidence sources:

- Scientific literature that indicates the strength of relationship between changes in air quality and changes in health outcomes. Regard has also been given to issues of uncertainty reported in the literature and to non-threshold effects.
- Baseline population health indicators relevant to air quality are set out in Table 18.8.1. Further details are set out **ES Appendix 18.5.2: Health and Wellbeing Baseline Data Tables** (Doc Ref. 5.3).
- Health priorities that have been taken into account from a review of local JSNAs and HWSs are set out in **ES Appendix 18.5.1: Health Baseline Trends, Priorities and Vulnerable Groups** (Doc Ref. 5.3).
- Health policy on the consideration of health in planning decisions and reference to use of national limit values as a refence point, as set out in Section 18.2 and **ES Appendix 18.2.1: Summary of Local Planning Policy – Health and Wellbeing** (Doc Ref. 5.3).
- Consultation responses from health stakeholders and the public, as set out in Section 18.3 and **ES Appendix 18.3.1: Summary of Stakeholder Scoping Responses – Health and Wellbeing** (Doc Ref. 5.3) and the Project **Consultation Report** (Doc Ref. 6.1).
- Statutory health protection standards for air quality set out by the Air Quality Standards Regulations 2010 (amended in 2016) (HM Government, 2016). Regard has also been had to the WHO 2021 advisory guidelines (WHO, 2021).

Health outcomes

18.8.5 The scientific literature identifies the following general points relevant to potential exposures and health outcomes. The main health outcomes are likely to relate to increased risk of cardiovascular

[5] Particulate matter that is less than or equal to 10 µm in diameter (PM_{10}) or particulate matter that is less than or equal to 2.5 µm in diameter ($PM_{2.5}$).

and respiratory related conditions or events (including reduced lung function, hypertension and myocardial infraction) (ie due to fine PM and NO_2 interacting within the body), as well as general measures of population mortality and hospital service use (eg emergency department visits). Such outcomes relate generally to long-term ambient exposure, but may also be affected by short-term exposure peaks, eg due to meteorological conditions reducing normal levels of pollutant dispersion.

18.8.6 Environmental air pollution is associated with increased risk of respiratory and cardiovascular diseases. Environmental pollution exerts its detrimental effects on the heart by developing pulmonary inflammation, systemic inflammation, oxidative stress, endothelial dysfunction and prothrombotic changes (Meo & Suraya, 2015). The adverse effects on health of PM and NO_2 indicates that the effects occur at air pollution concentrations lower than those in guidelines (WHO, 2013). Long term exposure to particulate matter is associated with incidence of coronary events, and this association persists at levels of exposure below the current limit values (Cesaroni, et al., 2014). The magnitude of the long-term effects of NO_2 on mortality is at least as important as that of $PM_{2.5}$.

Indicators

Table 18.8.1: Baseline – summary indicators relevant to air quality health outcomes

Indicator Name	Unit	Nine ward (mean)	HLSA (mean)	Six Authority Area (mean)	South East	England
Fraction of mortality attributable to particulate air pollution (new method) (30+ years)	%	NA	5.3	5.3	5.4	5.5
Air pollution: fine particulate matter (new method - concentrations of total $PM_{2.5}$)	$\mu g/m^3$	NA	7.9	8.1	8.1	7.5
Under 75 mortality rate from cardiovascular diseases considered preventable (2019 definition)	Per 100, 000	NA	18.4	23.2	22.1	28.1
Under 75 mortality rate from respiratory disease considered preventable (2019 definition)	Per 100, 000	NA	14.9	17.9	16.6	20.2
Emergency hospital admissions for coronary heart disease	SAR[6]	83.0	76.5	76.2	78.0	100.0
Emergency hospital admissions for stroke	SAR	78.6	77.0	89.4	90.2	100.0
Emergency hospital admissions for Myocardial Infarction (heart attack)	SAR	75.2	76.2	76.8	85.1	100.0

Indicator Name	Unit	Nine ward (mean)	HLSA (mean)	Six Authority Area (mean)	South East	England
Emergency hospital admissions for Chronic Obstructive Pulmonary Disease (COPD)	SAR	78.9	64.1	68.4	72.9	100.0

Notes:

[6] The Standardised Admission Ratio (SAR) is a summary estimate of admission rates relative to the national pattern of admissions and takes into account differences in a population's age, sex and socioeconomic deprivation.

18.8.7 Table 18.8.1 shows air quality related health outcomes in the HLSA are better than the national and regional averages, notably under 75 mortality rates for preventable cardiovascular and respiratory diseases. This includes the fraction of morality attributable to particulate air pollution despite fine particulate matter concentrations being higher than the national average. For the nine ward area there are fewer small area statistics available. In the nine ward area emergency hospital admissions for coronary heart disease and stroke (conditions within cardiovascular disease) and COPD (a condition within respiratory disease) are higher than in the HLSA but still lower than the national average. The rate of emergency hospital admissions for myocardial infarction (a condition within cardiovascular disease) in the nine ward area are lower than HLSA, regional and national averages.

Likelihood

18.8.8 Potential effects on population health are considered likely because there is a plausible source-pathway-receptor relationship:

- the source is air pollutants (particularly NO_2, PM_{10} and $PM_{2.5}$) from demolition and construction activities, road traffic and, to a lesser extent, aviation emissions;
- the pathway is diffusion through the air; and
- receptors are residents and long-term occupiers of nearby properties and community buildings.

18.8.9 Furthermore, the potential effect is probable as no highly unusual conditions are required for the source-pathway-receptor linkage.

Populations

18.8.10 The population groups relevant to this assessment are:

- The 'site-specific' geographic population of communities in the **ES Chapter 13: Air Quality** (Doc Ref. 5.1) zone of influence (the 11 km by 10 km study area and the ARN study area), the health sensitivity of which is indicatively based on representative wards close to the Airport, see paragraph 18.4.12. In addition to residents near the Airport, this assessment qualitatively takes into account passengers, visitors and workers at the Airport in terms of any effect of short-term exposure to air pollutants indoors or outdoors.
- The sub-population vulnerable due to:
  - Young age vulnerability (children, young people and pregnant women).

- Old age vulnerability (older people).
- Low-income vulnerability (people with lower socio-economic status).
- Poor health vulnerability (people with existing poor respiratory or cardiovascular health).
- Access and geographical vulnerability (people for whom close proximity increases sensitivity).

18.8.11 For example, young children are particularly susceptible to air pollution because of their developing lungs, high breathing rates per bodyweight, and amount of time spent exercising outdoors. Other vulnerable groups include people with existing medical conditions (eg people with type 2 diabetes), the elderly, and pregnant women.

18.8.12 Age is the most consistent effect modifier of the association between short-term exposure to particulate matter and death and hospitalisation, with older persons experiencing higher risks. In addition to physiological changes that accompany age, older persons likely have different indoor/outdoor activity patterns, occupational exposures, and social networks. The very young may also be susceptible. Children face higher risks because their biological systems are under development, they breathe more air per body weight than adults, and they typically spend more time outdoors (Bell, et al., 2013). Those with lower socio-economic status (SES) face higher particulate matter associated risks, although there is only limited/suggestive evidence for modification by educational level, income, and employment status. SES could modify particulate matter associated health risks through differences in access to health care, baseline health status, occupational exposures, and nutrition (Bell, et al., 2013). The evidence suggests adverse effects of ambient air pollutants exposure (especially for PM) on type 2 diabetes and that people with diabetes might be more vulnerable to air pollutants exposure (Yang, et al., 2020; Liu, et al., 2019). Elevated air pollution episodes across a wide area are significantly associated with an increase in ambulance transfer data, including those for cardiac arrest, all-respiratory, and asthma transfers (Sangkharat, et al., 2019).

Thresholds and non-threshold effects

18.8.13 Whilst the literature supports there being thresholds set for health protection purposes, it also acknowledges that for both $PM_{2.5}$ and NO_2 there is no identifiable threshold below which there is no risk to health (WHO, 2013; COMEAP, 2011).

18.8.14 Health in EIA guidance (Pyper, et al., 2022b; Pyper, et al., 2022a; Cave, et al., 2020) indicates that the assessment should give the public confidence in thresholds set by government for the purpose of health protection having taken into account other social, economic and environmental considerations. The guidance directs discussion to considering the extent to which regulatory or statutory limit values would be met. In this context, where non-threshold health effects may occur, there should be a discussion about "*what is acceptable for the jurisdiction*" (emphasis added).

18.8.15 The Government (for the national jurisdiction) defines the statutory air quality standards as:

"concentrations recorded over a given time period, which are considered to be acceptable in terms of what is scientifically known about the effects of each pollutant on health and on the environment" (DEFRA, n.d.) (emphasis added).

"The standards are based on assessment of the effects of each pollutant on human health including the effects on sensitive subgroups" (DEFRA, 2011).

18.8.16 Section 18.2 and **ES Appendix 18.2.1: Summary of Local Planning Policy – Health and Wellbeing** (Doc Ref. 5.3) sets out the relevant policy context which includes the NPPF direction that planning policies and decisions should sustain and contribute towards compliance with relevant limit values or national objectives for pollutants.

18.8.17 The health assessment takes into account the non-threshold nature of air pollutants, including having regard to WHO guide values and how the air quality chapter modelling results compare to them. The 2021 WHO guide values are not referenced in national, regional or local policies. The 2021 values remain a relevant public health contextual consideration; however, the national statutory standards are the more relevant benchmark for informing an assessment of significance in the context of a UK planning determination. This approach aligns with Government policy, as well as EIA and HIA good practice (Pyper, et al., 2022b; Pyper, et al., 2022a; Cave, et al., 2020).

18.8.18 In accordance with the aforementioned guidance, the assessment of health significance is with reference to the statutory air quality standards set for the purpose of health protection by the Government. WHO air quality guideline values are referenced as an aspirational target. Relevant thresholds are set out in Table 18.8.2; for the assessment the most relevant metrics are the annual means, as these correspond with the air quality modelling undertaken by **ES Chapter 13: Air Quality** (Doc Ref. 5.1).

18.8.19 Table 18.8.2 and Table 18.8.3 shows how the assessment has been informed by comparing the predicted changes in concentrations against both the national health protection limit value and the WHO advisory guidelines. This comparison informs the discussion of magnitude below.

Table 18.8.2: Air quality national limit values and advisory guidelines relative to the Project's operational impact – Central Case

Central Case														
Pollutant	**National Limit Value (µg/m³)**	**WHO 2005 (µg/m³)**	**WHO 2021 (µg/m³)**	**2018 Base-line (µg/m³)**	**2029 (µg/m³)**			**2032 (µg/m³)**			**2038 (µg/m³)**			**Type of change**
					Without Project	**With Project**	**Change**	**Without Project**	**With Project**	**Change**	**Without Project**	**With Project**	**Change**	
NO_2	40	40	10	59.1	37.6	37.6	<0.1	36.1	36.2	0.1	36.6	36.7	0.1	Highest
					16.8	17.4	0.6	19.6	21.1	1.5	20.2	21.5	1.3	Greatest
PM_{10}	40	20	15	23.2	21.6	21.6	<0.1	21.7	21.7	<0.1	21.8	21.8	<0.1	Highest
					19.9	20.0	0.1	14.8	15.2	0.4	14.8	15.2	0.4	Greatest
$PM_{2.5}$	12^, 10*	10	5	15.8	14.2	14.2	<0.1	14.3	14.3	<0.1	14.3	14.3	<0.1	Highest
					12.9	13.0	0.1	10.2	10.4	0.2	10.2	10.4	0.2	Greatest

Notes:

^ 12 µg/m³ to be achieved by the end of January 2028

* 10 µg/m³ to be achieved by 2040

Table 18.8.3: Air quality national limit values and advisory guidelines relative to the Project's operational impact – Slow Fleet Transition Case

Slow Fleet Transition Case														
Pollutant (µg/m3)	National Limit Value (µg/m^3)	WHO 2005 (µg/m3)	WHO 2021[7] (µg/m^3)	2018 Base-line (µg/m^3)	2029 (µg/m^3)			2032 (µg/m^3)			2038 (µg/m^3)			Type of change
					Without Project	With Project	Change	Without Project	With Project	Change	Without Project	With Project	Change	
NO_2	40	40	10	59.1	37.6	37.6	<0.1	36.1	36.2	0.1	36.6	36.7	0.1	Highest
					16.8	17.4	0.6	20.4	21.9	1.5	20.5	21.8	1.3	Greatest
PM_{10}	40	20	15	23.2	21.6	21.6	<0.1	21.7	21.7	<0.1	21.8	21.8	<0.1	Highest
					19.9	20.0	0.1	14.8	15.2	0.4	14.8	15.2	0.4	Greatest
$PM_{2.5}$	12^, 10*	10	5	15.8	14.2	14.2	<0.1	14.3	14.3	<0.1	14.3	14.3	<0.1	Highest
					12.9	13.0	0.1	10.2	10.4	0.2	10.7	10.9	0.2	Greatest

Notes:

^ 12 µg/m^3 to be achieved by the end of January 2028

* 10 µg/m^3 to be achieved by 2040

[7] With Annual Mean interim targets to guide reduction efforts as follows (µg/m^3):

NO_2: 40, 30 and 20

PM_{10}: 70, 50, 30 and 20

$PM_{2.5}$: 35, 25, 15 and 10

18.8.20 With regard to interpreting Table 18.8.2 it is noted that the air quality assessment has been undertaken using a conservative approach for future background pollutant concentrations and road traffic emissions. The future background concentrations used for the years beyond 2030, for the 2032 and 2038 assessment years, assume that background concentrations are frozen at 2030 levels which has an effect on total concentrations. The future road traffic emissions were obtained from the Defra Emissions Factors Toolkit which provide the latest predictions for vehicle emission rates and vehicle split composition data up to 2050 for England (not London) roads and up to 2030 for London roads. For the 2032 and 2038 assessment years, the corresponding emissions data for England (not London) roads and 2030 emissions for London roads were used. These assumptions present a conservative approach as background concentrations and road traffic emissions are expected to reduce with technology improvements, changes in fleet composition, the introduction of cleaner vehicles in the fleet and increased uptake of electric vehicles.

18.8.21 The results, as set out in **ES Chapter 13: Air Quality** (Doc Ref. 5.1) and Table 18.8.2 indicate that for the highest and greatest changes:

- National air quality limit values for NO_2 and PM_{10} would be achieved with or without the Project.
- the WHO 2005 NO_2 guideline would be achieved with or without the Project, but the WHO 2005 PM_{10} and $PM_{2.5}$ guidelines would not be achieved with or without the Project (the WHO 2005 PM_{10} guideline is reached, but not exceeded by the Project at the location of greatest change).
- The WHO 2021 guidelines would not be achieved with or without the Project, and furthermore, the level of change between the DM and With Project scenarios does not affect the extent to which WHO 2021 advisory interim targets are met or not. The changes between the DM and With Project scenarios are very small in terms of both the highest level of exposure and the greatest change in exposure.

18.8.22 Table 18.8.4, Table 18.8.5 and Table 18.8.6 provide additional consideration of how the Project affects achievement of the updated $PM_{2.5}$ standards (UK Government, 2023). This supports the professional judgment as to the likely population health affect due to the Project.

18.8.23 For the interim 12 µg/m^3 standard, Table 18.8.4 shows that across assessment years, and for both construction and operation, the great majority of exceedances in the With Project scenario reflect baseline $PM_{2.5}$ concentrations. As noted in **ES Chapter 13: Air Quality** (Doc Ref. 5.1) the background concentrations used for years beyond 2030 assumed background concentrations frozen at 2030 levels. This is likely to present a conservative conclusion for the 2032 and 2038 assessment years.

- For both construction and operation in the assessment years (2029 to 2038) when the 2028 12 µg/m^3 standard would apply, there is a single receptor exceedance due to the Project (1 out of 1,783 receptors).
- Based on the 12 µg/m^3 results and professional judgement, the health assessment expects a very similar trend for exposures below this concentration. Ie with baseline $PM_{2.5}$ concentrations being the overriding component and a very small proportion of population level exposure arising from the changes due to the Project.

18.8.24 For the interim 12 µg/m^3 standard, Table 18.8.5 summarises **ES Chapter 13: Air Quality** (Doc Ref. 5.1) significance conclusions for $PM_{2.5}$ construction effects, showing the great majority (all but 4 of the 1,783 modelled receptors) experience negligible effects.

18.8.25 For the interim 12 µg/m^3 standard, Table 18.8.6 summarises **ES Chapter 13: Air Quality** (Doc Ref. 5.1) significance conclusions for $PM_{2.5}$ operational effects, again showing the great majority of modelled receptors experience negligible effects.

18.8.26 As explained in **ES Chapter 13: Air Quality** (Doc Ref. 5.1) it is not appropriate to undertake quantitative assessment against the 2040 $PM_{2.5}$ 10 µg/m^3 standard. For the health assessment, based on professional judgement informed by Table 18.8.2 and Table 18.8.4, it is likely that the appropriate population health characterisation of changes in exposures below 12 µg/m^3 due to the Project, in all assessment years, would be a very low change in exposure to very few people, with any exceedances of a standard or guideline likely to be due to baseline conditions.

18.8.27 Although there is uncertainty, by 2040 it is likely that baseline $PM_{2.5}$ concentrations will be lower than assumed in Table 18.8.4 due to the Government's statutory commitments to net zero by 2050 and associated current and emerging policies (HM Government, 2023; Department for Transport, 2021; HM Government, 2021; HM Government, 2021; HM Government, 2021) indirectly driving reductions in the main sources of $PM_{2.5}$. Main sources include domestic combustion, eg solid fuel burning, (27% of UK $PM_{2.5}$ in 2021), industrial combustion, eg power generation, (26% of UK $PM_{2.5}$ in 2021) and road transport, eg petrol and diesel vehicles, (13% of UK $PM_{2.5}$ in 2021) (DEFRA, 2023). Consequently, $PM_{2.5}$ exposure, even due to baseline, would likely relate to a small minority of the population.

Table 18.8.4: Number of receptors in the Chapter 13 air quality model exceeding the interim $PM_{2.5}$ standard

Scenario	Number of receptors ≥ 12 µg/m^3 With Project	
	Exceedances due to baseline conditions	Exceedances due to the Project change
Construction 2024	174	2
Construction 2029	127	0
Operational 2029	93	1
Operational 2032	97	0
Operational 2038	98	0

Notes:

- Of the 1,783 receptors modelled in ES Chapter 13: Air Quality.
- The great majority of exceedances in the With Project scenario reflect baseline concentrations. As noted in **ES Chapter 13: Air Quality** (Doc Ref. 5.1) the background concentrations used for years beyond 2030 assumed background concentrations frozen at 2030 levels. This is likely to present a conservative conclusion for the 2032 and 2038 assessment years. Consequently, the total number of exceedances would be expected to reduce, and it is likely there would be no exceedances due to the Project.
- The receptors in the **ES Chapter 13: Air Quality** model are a subset of all receptors, so the results are indicative of relative population exposure (eg 1 out of 1,783 receptors).

Table 18.8.5: Number of receptors by Chapter 13 air quality significance score for construction $PM_{2.5}$

	Number of receptors compared to the 2028 12 µg/m3 interim target		Number of receptors compared to the previous 20 µg/m3 target	
Scenario	**2024**	**2029**	**2024**	**2029**
Substantial beneficial	0	0	0	0
Moderate beneficial	0	0	0	0
Slight beneficial	0	0	0	0
Negligible	1,779	1,779	1,783	1,783
Slight adverse	2	3	0	0
Moderate adverse	2	1	0	0
Substantial adverse	0	0	0	0

Notes:

- The air quality chapter includes a review of the moderate adverse impacts and notes that a review of traffic changes in those areas indicates the project is unlikely to change traffic in those areas and the changes are attributed to modelled traffic noise as detailed in **Annex E of ES Chapter 12: Traffic and Transport** (Doc Ref. 5.1). As the changes are not representative of changes due to the Project, they are not considered significant and therefore overall, no significant effects are anticipated.

Table 18.8.6: Number of receptors by Chapter 13 air quality significance score for operational $PM_{2.5}$

	Number of receptors compared to the 2028 12 µg/m^3 interim target			Number of receptors compared to the previous 20 µg/m^3 target		
Scenario	**2029**	**2032**	**2038**	**2029**	**2032**	**2038**
Substantial beneficial	0	0	0	0	0	0
Moderate beneficial	0	0	0	0	0	0
Slight beneficial	0	0	0	0	0	0
Negligible	1,783	1,782	1,781	1,783	1,783	1,783
Slight adverse	0	1	2	0	0	0
Moderate adverse	0	0	0	0	0	0
Substantial adverse	0	0	0	0	0	0

Sensitivity of the population

18.8.28 The sensitivity of the population has had regard to the baseline, including JSNA findings, set out in Section 18.5, Table 18.8.1 and Appendices 18.5.1 and 18.5.2. Environmental baseline conditions, including air quality management areas (AQMAs), discussed in **ES Chapter 13: Air Quality** (Doc Ref. 5.1), have been taken into account. Common factors that differentiate the sensitivity of the general population and the vulnerable group population have been taken into account and are listed in paragraph 18.4.29.

18.8.29 The sensitivity of the general population is considered to be **low**. This reflects that most people in the site-specific area live, work or study at a distance from the Airport (or parts of the local road

network that are expected to experience additional vehicle movements) where emissions would be dispersed away from the source, reducing exposure associated with the Project. Furthermore, most people enjoy good respiratory health (eg do not have asthma) and are not at a life stage (eg infant or frail elderly) with particular sensitivity to air quality.

18.8.30 The sensitivity of vulnerable groups is considered **high**. This reflects the presence of populations (residents or workers) who (while at work or at home) are likely to spend extended periods near to the Project or parts of the local road network that are expected to experience additional vehicle movements. It also reflects the generally higher sensitivity of children and older people to air pollution. Within these groups people with existing respiratory conditions, such as asthma or COPD, may be particularly sensitive.

18.8.31 These conclusions on sensitivity are common to all assessment years and are not repeated to avoid duplication.

Summary of measures taken into account

18.8.32 The measures set out in **ES Chapter 13: Air Quality** (Doc Ref. 5.1) have been taken into account within the residual effects that have informed the health assessment. Further details are provided in **ES Chapter 13: Air Quality** Section 13.9, including Table 13.9.1, which describes: construction dust mitigation following IAQM best practice; use of low or zero emissions construction equipment and vehicles; management of construction traffic; management of operational traffic; airport operation; combustion plant; and odour management.

18.8.33 The construction phase includes measures adopted to mitigate and monitor dust and emissions and these are detailed in **ES Appendix 13.8.1: Construction Period Mitigation** (Doc Ref.5.3) and are included in the CoCP (**ES Appendix 5.3.2: CoCP** (Doc Ref. 5.3)).

18.8.34 The operational phase includes measures set out within the Carbon Action Plan (**ES Appendix 5.4.2: Carbon Action Plan** (Doc Ref.5.3)) and the Surface Access Commitments (**ES Appendix 5.4.1: Surface Access Commitments** (Doc Ref.5.3)) which will help to reduce emissions associated with the Project.

Initial Construction Period: 2024-2029 and 2029-2032

Introduction

18.8.35 This health assessment is informed by **ES Chapter 13: Air Quality** (Doc Ref. 5.1) modelling of the construction air quality emissions scenario in 2029. This construction scenario represents the peak construction periods between 2024 to 2029 and 2029 to 2032, which includes 2029 construction road traffic, aircraft-related and car park emissions for the DM and With Project scenarios. In addition, the year 2029 is considered to be the worst case in terms of construction activities being undertaken.

Construction Dust

18.8.36 Construction of the Project has the potential to influence health and wellbeing by contributing to nuisance dust emissions and effects associated with coarse particulate matter (from demolition activities, general on-site construction, earthworks or through trackout[6]). As stated in **ES Chapter**

[6] See Chapter 13: Air Quality for definitions of types of dust effects.

13: Air Quality (Doc Ref. 5.1), following the implementation of appropriate mitigation, the effects of construction-related activities on dust soiling and human health would be negligible and the effects would therefore not be significant.

Nitrogen Dioxide and Particulate Matter

18.8.37 The annual mean NO_2 air quality objective threshold is currently exceeded at one receptor location where the maximum is 40.7 µg/m^3; the change due to the Project is <0.1 µg/m^3. The objective is exceeded with or without the Project due to background levels.

18.8.38 No exceedances of air quality objective thresholds are predicted for annual mean PM_{10} concentrations at any modelled human receptor locations in 2029.

18.8.39 As set out in Table 18.8.4, Table 18.8.5 and Table 18.8.6, there are predicted exceedances of the $PM_{2.5}$ 2028 interim objective with or without the Project due to background levels. **ES Chapter 13: Air Quality** (Doc Ref. 5.1) predicts negligible impacts for all but one receptor. Four receptor locations are considered not representative, as the changes at these locations are driven by traffic model noise rather than changes due to the Project. The **ES Chapter 13: Air Quality** conclusion that there would be no significant effects reflects the very small degree of change in annual $PM_{2.5}$ concentrations due to the Project.

18.8.40 As stated in **ES Chapter 13: Air Quality** (Doc Ref. 5.1), the largest changes in annual mean concentrations in 2024 due to the Project in the initial construction period are predicted to be:

- 0.5 µg/m^3 for NO_2;
- 0.4 µg/m^3 for PM_{10}; and
- 0.2 µg/m^3 for $PM_{2.5}$.

18.8.41 As stated in **ES Chapter 13: Air Quality** (Doc Ref. 5.1), the largest changes in annual mean concentrations in 2029 due to the Project in the initial construction period are predicted to be:

- 0.2 µg/m^3 for NO_2;
- 0.4 µg/m^3 for PM_{10}; and
- 0.2 µg/m^3 for $PM_{2.5}$.

Conclusion

18.8.42 **ES Chapter 13: Air Quality** (Doc Ref. 5.1) concludes that no significant effects for air quality are anticipated for the construction of airfield works.

18.8.43 Based on the **ES Chapter 13: Air Quality** (Doc Ref. 5.1) assessment findings, which are informed by guidance issued by the Institute of Air Quality Management, the changes in NO_2 and PM_{10} concentrations of all modelled air pollutants are within statutory standards, levels considered acceptable in terms of health protection. Such standards take into account the potential for effects to vulnerable groups (DEFRA, 2011). Regarding $PM_{2.5}$, Table 18.8.4, Table 18.8.5 and Table 18.8.6 show that there are very few exceedances of the updated $PM_{2.5}$ interim standard (UK Government, 2023) due to the Project. With almost all effects rated as negligible by **ES Chapter 13: Air Quality** (Doc Ref. 5.1).

18.8.44 It is concluded that the magnitude of the change due to the Project is **low**. Any health effect would relate to *negligible* to *very low* changes in exposure to NO_2, PM_{10} and $PM_{2.5}$, which are anticipated to occur on a *frequent* basis over the *medium-term (medium-term relates to*

construction activities). Additional exposure due to the Project would represent an incremental addition to the existing baseline conditions resulting in a *very minor* change in *morbidity and mortality* related population health risk, eg associated with respiratory and cardiovascular health outcomes. Any health effect due to a very slight change in risk factors is likely limited to a *small minority* of the study area population and the effect on routine health service planning is likely *negligible*. The potential for non-threshold effects of NO_2 and $PM_{2.5}$ (even below WHO advisory guidelines and UK statutory standards) to population health has been taken into account in determining the magnitude of the change in health outcomes and the significance of potential air quality effects on population health.

18.8.45 The professional judgement is that the significance of the population health effect would be up to **minor adverse** (not significant). Regard has been given to the baseline context, the WHO 2021 advisory guidelines (WHO, 2021), the updated $PM_{2.5}$ standards (UK Government, 2023) and to non-threshold effects. The health assessment conclusion reflects there is a *very small* scale of change in air pollutants due to the Project.

18.8.46 The minor adverse (rather than negligible) score represents a conservative assessment finding given scientific uncertainty (and emerging evidence) about non-threshold health effects of NO_2, and $PM_{2.5}$. The score takes into account WHO advisory guidelines, the updated $PM_{2.5}$ standards and also reflects that air pollution is a specific local public health priority. The level of change in the health baseline due to the Project is likely to be *very limited*, with at most a *marginal* effect on the delivery of health policy and inequalities. This is a public health acknowledgement of the very small incremental contribution to air pollution that the Project would make, but also recognition that at the Project level this should not be considered a significant effect on population health or health inequalities.

18.8.47 NO_2 and PM_{10} annual mean concentrations would be maintained *well within* regulatory thresholds. For $PM_{2.5}$, although there are some exceedances of the updated $PM_{2.5}$ interim standard (UK Government, 2023), consistent with the conclusion reached in **ES Chapter 13: Air Quality** the change in $PM_{2.5}$ due to the Project is not considered significant for population health in EIA terms. Applying the significance methods in Table 18.4.6 (Pyper, et al., 2022a) it is relevant to note that it is not the case that "*Change, due to the Project, could result in a regulatory threshold or statutory standard being crossed…[or] approached*" [emphasis added]. Whilst baseline context is relevant, in this case it is likely that the baseline concentrations (and thus exceedances) are overestimates. **ES Chapter 13: Air Quality** notes that the background concentrations used for years beyond 2030 assumed background concentrations frozen at 2030 levels. This is likely to present a conservative conclusion for the 2032 and 2038 assessment years. As such, $PM_{2.5}$ standard exceedances due to baseline conditions are not indicative of significant Project effects for population health.

First Full Year of Opening: 2029

18.8.48 In the first full year of opening (2029) no exceedances of air quality objective thresholds are predicted for annual mean NO_2 or PM_{10} concentrations at any modelled human receptor locations.

18.8.49 As stated in **ES Chapter 13: Air Quality** (Doc Ref. 5.1), the largest changes in annual mean concentrations due to the Project in 2029 are predicted to be:

- 0.6 µg/m^3 for NO_2;

- 0.1 µg/m^3 for PM_{10}; and
- 0.1 µg/m^3 for $PM_{2.5}$.

18.8.50 It is concluded that the magnitude of the change due to the Project is **low** for the same reasons as set out in paragraph 18.8.44, with the addition that the duration of operational air quality effects is *long-term*. Low magnitude remains appropriate for long-term exposure to negligible or very low changes in pollutant concentrations, including non-threshold effects.

18.8.51 It is concluded that the significance of the effect for population health is **minor adverse** (not significant) for the same reasons as set out in paragraphs 18.8.45 to 18.8.47.

18.8.52 Validating this conclusion, the health assessment has undertaken a quantitative analysis, summarised in Table 18.8.7. The analysis shows the scale of change is very low. There is a slight reduction in air pollution in this assessment year, resulting in a very small improvement in the population health outcome measures. The model estimates effects over a population of 462,701 people, 308,725 of whom were estimated to be over the age of 30.

Table 18.8.7: Summary 2029 population health outcome measures, Central Case and central CRF (difference between the 2029 'DM' and 2029 'With Project' scenarios)

Health Outcome (annual)	Change due to the Project (number)	Change as an Incidence Rate per 100,000 people	Change as a percentage of the baseline rate
Total additional mortality for both NO_2 and $PM_{2.5}$ (people aged 30+ years) (COMEAP approach avoiding double counting)	0.066	0.021	0.00000002%
NO_2 additional respiratory disease admissions (all ages)	0.012	0.003	0.000000004%
$PM_{2.5}$ additional respiratory disease admissions (all ages)	-0.004	-0.001	-0.000000001%
Total additional respiratory disease admissions (all ages)	0.008	0.002	0.000000003%
$PM_{2.5}$ additional cardiovascular disease admissions (all ages)	-0.004	-0.001	-0.000000001%
Total additional hospital admissions (all ages)	0.004	0.001	0.000000001%

Interim Assessment Year: 2032

18.8.53 In the interim assessment year (2032) no exceedances of air quality objective thresholds are predicted for annual mean NO_2 or PM_{10} concentrations at any modelled human receptor locations.

18.8.54 As stated in **ES Chapter 13: Air Quality** (Doc Ref. 5.1), the largest changes in annual mean concentrations due to the Project in 2032 are predicted to be:

- 1.3 µg/m^3 for NO_2;
- 0.4 µg/m^3 for PM_{10}; and
- 0.2 µg/m^3 for $PM_{2.5}$.

18.8.55 It is concluded that the magnitude of the change due to the Project is **low** for the same reasons as set out in paragraph 18.8.44, with the addition that the duration of operational air quality effects is *long-term*. Low magnitude remains appropriate for long-term exposure to negligible or very low changes in pollutant concentrations, including non-threshold effects.

18.8.56 It is concluded that the significance of the effect for population health is **minor adverse** (not significant) for the same reasons as set out in paragraphs 18.8.45 to 18.8.47.

18.8.57 Validating this conclusion, the health assessment has undertaken a quantitative analysis, summarised in Table 18.8.8. The analysis shows a very low scale of change. There is a slight increase in air pollution in this assessment year, resulting in a very small reduction in the population health outcome measures. The model estimates effects over a population of 462,701 people, 308,725 of whom were estimated to be over the age of 30. The change in mortality risk across 308,725 people aged over 30 years old is equivalent to 1.086 (not actual mortality). There would be 0.220 additional hospital admissions for the population of 462,701 people associated with NO_2 and $PM_{2.5}$ cardiovascular and respiratory conditions. Further details are set out in **ES Appendix 18.8.1: Quantitative Health Assessment Results** (Doc Ref. 5.3). The quantitative analysis is a pragmatic estimate of changes in selected health outcomes to identify the scale of change associated with the Project changes; see **ES Appendix 18.4.1: Methods Statement for Health and Wellbeing** (Doc Ref. 5.3).

Table 18.8.8: Summary 2032 population health outcome measures, Central Case and central CRF (difference between the 2032 'DM' and 2032 'With Project' scenarios)

Health Outcome (annual)	Change due to the Project (number)	Change as an Incidence Rate per 100,000 people	Change as a percentage of the baseline rate
Total additional mortality for both NO_2 and $PM_{2.5}$ (people aged 30+ years) (COMEAP approach avoiding double counting)	1.086	0.352	0.00000026%
NO_2 additional respiratory disease admissions (all ages)	0.201	0.044	0.00000007%
$PM_{2.5}$ additional respiratory disease admissions (all ages)	0.009	0.002	0.000000003%
Total additional respiratory disease admissions (all ages)	0.210	0.045	0.00000007%
$PM_{2.5}$ additional cardiovascular disease admissions (all ages)	0.010	0.002	0.000000003%

Health Outcome (annual)	Change due to the Project (number)	Change as an Incidence Rate per 100,000 people	Change as a percentage of the baseline rate
Total additional hospital admissions (all ages)	0.220	0.048	0.00000007%

Design Year 2038

18.8.58 In the Design year (2038) no exceedances of air quality objective thresholds are predicted for annual mean NO_2 or PM_{10} concentrations at any modelled human receptor locations.

18.8.59 As stated in **ES Chapter 13: Air Quality** (Doc Ref. 5.1), the largest changes in annual mean concentrations due to the Project in 2038 are predicted to be:

- 1.1 µg/m^3 for NO_2;
- <0.1 µg/m^3 for PM_{10}; and
- <0.1 µg/m^3 for $PM_{2.5}$.

18.8.60 It is concluded that the magnitude of the change due to the Project is **low** for the same reasons as set out in paragraph 18.8.44, with the addition that the duration of operational air quality effects is *long-term*. Low magnitude remains appropriate for long-term exposure to negligible or very low changes in pollutant concentrations, including non-threshold effects.

18.8.61 It is concluded that the significance of the effect for population health is **minor adverse** (not significant) for the same reasons as set out in paragraphs 18.8.45 to 18.8.47.

18.8.62 Validating this conclusion, the health assessment has undertaken a quantitative analysis, summarised in Table 18.8.9. The analysis shows a very low scale of change. There is a slight increase in air pollution in this assessment year, resulting in a very small reduction in the population health outcome measures. The model estimates effects over a population of 462,701 people, 308,725 of whom were estimated to be over the age of 30. The change in mortality risk across 308,725 people aged over 30 years old is equivalent to 0.420 (not actual mortality). There would be 0.131 additional hospital admissions for the population of 462,701 people associated with NO_2 and $PM_{2.5}$ cardiovascular and respiratory conditions. Further details are set out in **ES Appendix 18.8.1: Quantitative Health Assessment Results** (Doc Ref. 5.3). The quantitative analysis is a pragmatic estimate of changes in selected health outcomes to identify the scale of change associated with the Project changes; see **ES Appendix 18.4.1: Methods Statement for Health and Wellbeing** (Doc Ref. 5.3).

Table 18.8.9: Summary 2038 population health outcome measures, Central Case and central CRF (difference between the 2038 'DM' and 2038 'With Project' scenarios)

Health Outcome (annual)	Change due to the Project (number)	Change as an Incidence Rate per 100,000 people	Change as a percentage of the baseline rate
Total additional mortality for both NO_2 and $PM_{2.5}$ (people aged 30+ years) (COMEAP	0.635	0.206	0.00000015%

approach avoiding double counting)			
NO_2 additional respiratory disease admissions (all ages)	0.118	0.025	0.00000004%
$PM_{2.5}$ additional respiratory disease admissions (all ages)	0.006	0.001	0.000000002%
Total additional respiratory disease admissions (all ages)	0.124	0.027	0.00000004%
$PM_{2.5}$ additional cardiovascular disease admissions (all ages)	0.007	0.002	0.000000002%
Total additional hospital admissions (all ages)	0.131	0.028	0.00000004%

Year 2047

18.8.63 By 2047 (future year of the Project) it is anticipated that there will be improvements in background vehicle emissions. As vehicle emissions are the source likely to result in any significant impact due to proximity to receptors, **ES Chapter 13: Air Quality** (Doc Ref. 5.1) concludes that despite the uncertainty of predicting emissions for a future year of 2047, it has been concluded that the 2047 future year is not at risk of resulting in a significant impact to air quality.

18.8.64 The previous year assessment scenarios (2032 and 2038) therefore represent more conservative years in terms of air quality impacts. As there was no detailed dispersion assessment for 2047, there is no prediction of air quality concentrations included for this scenario.

18.8.65 It is concluded that the magnitude of the change due to the Project is **low** for the same reasons as set out in paragraph 18.8.44, with the addition that the duration of operational air quality effects is *long-term*. Low magnitude remains appropriate for long-term exposure to negligible or very low changes in pollutant concentrations, including non-threshold effects.

18.8.66 It is concluded that the significance of the effect for population health is **minor adverse** (not significant) for the same reasons as set out in paragraphs 18.8.45 to 18.8.47.

Ultrafine particulates in all assessment years and scenarios

18.8.67 This section discusses changes to UFPs, from surface access and aircraft movements, as a public health issue.

18.8.68 This section is a supplement to the air quality assessment and is assessed separately so it is clear that UFP as a public health issue has been investigated and taken into account by the health assessment. The issue of UFP is also discussed in **ES Chapter 13: Air Quality** (Doc Ref. 5.1).

18.8.69 For the reasons set out in **ES Chapter 13: Air Quality** (Doc Ref. 5.1) it is not possible to predict UFP concentrations; this chapter is however able to undertake a qualitative assessment of the potential for likely significant population health effects using good practice methods (Pyper, et al., 2022b; Pyper, et al., 2022a; Cave, et al., 2020). This does not affect the validity of the assessment and puts it on a par with most other determinants of health.

18.8.70 UFPs are particulates present in the air with a diameter of 0.1µm (100nm) or less. Epidemiological studies indicate that exposure to ambient UFP in the air could pose a health risk and is therefore an important public health issue (Viher Hrženjak, et al., 2020).

18.8.71 Due to their small size, UFPs are believed to exert higher toxicity than larger particles (Ohlwein, et al., 2019), for example they cause more pulmonary inflammation and are retained longer in the lung than fine particles (eg $PM_{2.5}$) (Schraufnagel, 2020). Although their potential toxicological effects are known, their precise role in many illnesses is still unknown, and there is a lack of sufficient epidemiological evidence for the development of guidelines for UFP.

18.8.72 The WHO global air quality guidelines in 2021 (WHO, 2021) recognised that there is growing evidence of toxicological effects of UFP, however, concluded that the evidence is not sufficient to formulate air quality guideline levels for exposure.

18.8.73 UFPs are one of many public health issues for which there is currently not sufficient aetiological or effect size evidence to inform a clear policy position. It is part of the impact assessment process to appropriately reflect on and respond to such uncertainties. In this case, whilst there is a lack of full scientific certainty, the available epidemiological evidence suggests a relatedly small effect size. This conclusion is based on a review of the recent literature, including having regard to the strength of evidence, the quality of research (internal validity) and its application to the context of this Project (external validity).

18.8.74 The literature review focused on recent good quality evidence sources, namely systematic reviews, meta-analyses and randomised controlled trials, as well as other clinical trials and the following synthesis summaries relevant points. The aim was to identify findings that post-dated the WHO 2021 conclusions to determine if there was a change in the available evidence-base.

18.8.75 The evidence is still weak for epidemiological findings on UFP respiratory effects, as the related exposure data is still sparse and diverse. UFPs in cities are mainly traffic related. There is some limited evidence of effects on respiratory health among children and during the warm season across all ages (Samoli, et al., 2020). The evidence suggests adverse short-term associations with inflammatory and cardiovascular changes, which may be at least partly independent of other pollutants. For other health outcomes, the evidence on independent health effects of UFP remains inconclusive or insufficient (Ohlwein, et al., 2019). Short-term exposure to ambient UFP is associated with decreased heart rate variability, predominantly as an immediate response within hours, but not over the day or following days (Zhang, et al., 2022). Long-term exposure to $PM_{2.5}$ and PM_{10} is significantly associated with risk of hypertension, but there is not a significant association for particle sizes smaller than $PM_{2.5}$ (Qin, et al., 2021).

18.8.76 UFP is elevated in and around airports. However, a lack of standard methods and instrumentation make comparisons of measured concentrations among studies difficult. In addition, there are very few long-term studies and only a few airports have been studied, making it difficult to provide broad generalisations. Differences in airport and aircraft operations, geography, and meteorology have a significant impact on the results (Riley, et al., 2021). Exposure to jet engine emissions is associated with similar adverse health effects as exposure to diesel exhaust particles and other traffic emissions (Bendtsen, et al., 2021). UFPs from aviation and road traffic in airport surroundings are therefore likely to have similar effects on public health (He, et al., 2020). Whilst urban areas in the vicinity of airports are at risk of increased exposure, the high exposure group comprises workers on the apron close to jet engines, with those indoors or with landside jobs classified as a low exposure group (Bendtsen, et al., 2021). Exposure in vulnerable population

groups such as children is still not well understood. Available studies indicate that microenvironments with the greatest levels of UFP relate to being close to heavy traffic or near cooking and cleaning activities (García-Hernández, et al., 2020). The following three recent airport related studies are noted:

- Wing et al (2020) investigated the risk of pre-term birth in a large sample of women living within 15km of Los Angeles airport in the USA (four runways). In utero exposure to aircraft-origin UFPs was significantly associated with pre-term birth (birth occurring before 37 weeks), independent of demographics, noise and traffic-related air pollution exposures. Health outcomes associated with pre-term birth were not measured. The USA context of income level affecting use of air conditioning and healthcare access, as well as $PM_{2.5}$ exposure, were not ruled out as other factors in this association. The strength of evidence is considered moderate, though study quality is considered low due to potential confounders despite the large sample size. The US context, particularly the healthcare model, limits the generalisability of the findings to the UK context.
- Wu et al (2021) present a similar study relating to the association between tumour and UFPs. As with Wing et al (2020), the study was around Los Angeles airport and the correlation was not shown to be causal, as other confounding factors may explain or heavily modify the relationship. The plausibility of a relationship is however tentatively supported by a non-aviation study (Weichenthal, et al., 2020), which considered spatial variation in UFPs and tumour for two Canadian cities. Caution remains as Weichenthal et al. (2020) were not able to control for all confounders, eg there was not data on family tumour history or life-time exposure to ionization radiation. Generalisability to a UK context is also not established.
- Lammers et al., (2020) investigated short-term (5 hr) semi-controlled exposure to UFP for 21 healthy young adults at Schiphol Airport in the Netherlands (six runways). The results indicated that following the exposure to aviation, but not road transport UFPs, there was a small reduction in markers for lung function (measured by volume of air exhaled after a deep breath) and heart function (measured by QTc interval, which relates to how quickly the heart recharges between beats). Respiratory and cardiovascular health outcomes were not measured. Both strength of evidence and study quality is considered low, reflecting the very small sample size, potential confounders including noise and inconsistencies in protocol. For example, the participants were not habituated to airport noise and the noise of landing aircraft close to the test site was not controlled for, which might suggest that the physiological responses were to noise (Tascanov, et al., 2021; Cardoso, et al., 2006) rather than UFPs.

18.8.77 It is relevant context that the studies undertaken to date focus on very large airports, for example, Amsterdam Airport Schiphol has 6 runways and Los Angeles International Airport has 4 runways. Even at those locations the epidemiology for UFP significantly affecting population health effects remains an area of continuing research. Research to date does not show evidence of UFPs having a large effect on population health outcomes.

18.8.78 Our assessment considers the potential effects on population health in terms of a source-pathway-receptor linkage. However, it should be noted that the scientific literature is not sufficiently advanced to clearly link UFPs to health outcomes. The establishment of a 'likely' effect is therefore tentative.

- The source is UFP from road traffic and aviation emissions.
- The pathway is diffusion through the air.

- Receptors are residents and long-term occupiers of nearby properties and community buildings.

18.8.79 The generation of UFPs from road transport and aviation sources is probable and no highly unusual conditions are required for the source-pathway-receptor linkage, though as noted, the extent to which health effects may occur is unclear.

18.8.80 The population groups relevant to this assessment are the same as for other air quality effects; see paragraph 18.8.10.

18.8.81 The health assessment conservatively assumes that like $PM_{2.5}$ there would be non-threshold effects associated with UFPs, though this is not clear from the available literature.

18.8.82 The sensitivity of the general population is considered to be low and the sensitivity of vulnerable groups is considered high for the same reasons set out in the main air quality health assessment (paragraphs 18.8.29 and 18.8.30 respectively).

18.8.83 It is concluded that the magnitude of the change due to the Project, comparing the DM and With Project scenarios in all assessment years, is **low**. The scale of change in UFPs due to the Project is considered to be *small*. This judgement takes into account the very small relative changes for other types of particulate matter discussed in **ES Chapter 13: Air Quality** (Doc Ref. 5.1). Whilst it is acknowledged that this is only an indicator for UFP, the UFPs are of common combustion engine source origin (taking into account that there are volatile and non-volatile components). The realistic worst-case assessment is of a *low or very low* increase in UFP concentrations experienced by the local population. It is noted that low concentrations are partly due to high levels of dispersion, which are more likely for UFPs of aviation origin than road transport origin due to greater separation between the source (airborne engine) and the receptors (people on the ground). The magnitude conclusion also takes into account that the change in UFP exposure is likely to be *long-term* and experienced on a *frequent* basis. The effect, based on current literature, is likely to relate to a *very minor* change in population health risk related to morbidity, mortality and hospital admissions for respiratory, cardiovascular and pre-term birth health outcomes, noting that causal links to these outcomes are not well established. Whilst exposure is likely to extend to a *large minority* of the local population, the effect on routine health service planning is likely *negligible* based on current scientific understanding.

18.8.84 The effect is characterised as being *adverse* in direction, *permanent* and due to a *direct* health pathway (albeit a pathway that has not been clearly established by the scientific literature). The professional judgement is that the significance of any UFP effect for population health would be up to **minor adverse** (not significant). The conclusion reflects that the literature does not support exposure-response regulatory thresholds, standards or guidelines that would define a level below which effects might be considered negligible. The minor adverse (rather than negligible) score is a conservative assessment finding on the basis of scientific uncertainty (and emerging evidence) about UFP. Based on the levels of current *suggestive* scientific knowledge, and accounting for a precautionary approach, it is unlikely that the change in UFPs would have more than a *marginal* effect on inequalities or on delivering health policy. Any change in the health baseline would be *slight*.

18.8.85 The appropriate response is for public health to maintain a watching brief on UFP as a topic area. The monitoring of UFPs is therefore supported, including correlating results with use of sustainable aviation fuel (SAF) at the airport and, as appropriate, future hydrogen and/or electric

aircraft transition. SAF use may reduce UFPs due to its very low sulphur content, though the relationship requires investigation.

18.8.86 As noted in **ES Chapter 13: Air Quality** (Doc Ref. 5.1), in addition to monitoring key pollutants such as NO_2, PM_{10} and $PM_{2.5}$ GAL commits to participating in national industry body studies of UFP emissions at airports.

Conclusion

18.8.87 Overall, the **minor adverse** air quality assessments reflect that, whilst any reduction in air quality may be considered detrimental to some degree for public health, ie not negligible, the change due to the Project is not significant for population health in EIA Regulation terms.

18.8.88 The differences between the Central Case and the slow transition case have been considered and they are not considered to materially affect the conclusions as to the significance of the population health effects.

Further Mitigation and Future Monitoring

18.8.89 No further mitigation or monitoring measures are proposed. Appropriate mitigation and monitoring during construction is set out in **ES Appendix 13.8.1: Air Quality Construction Phase Mitigation** (Doc Ref. 5.3). **ES Chapter 13: Air Quality** (Doc Ref. 5.1) section 13.9 sets out mitigation measures to reduce effects as far as practicable, as well as operational air quality monitoring, including a commitment to participate in national aviation industry body studies of UFP emissions at airports.

Significance of Effects

18.8.90 The residual significance of effects would remain unchanged, ie **minor adverse** (not significant) effects for population health.

Health and Wellbeing Effects from Changes in Noise Exposure

General

Approach

18.8.91 This section of the ES presents findings on the population health implications of changes in daytime and night-time noise from aviation (both air noise and ground noise), as well as from surface access. In reaching population health conclusions this section takes account of the extent and degree of change in effects above the Significant Observed Adverse Effect Level (SOAEL), as well as changes that are anticipated to occur between the SOAEL and the Lowest Observed Adverse Effect Level (LOAEL). Supplementary metrics and a physiological sleep disturbance assessment have also informed the professional judgements reached.

18.8.92 This section has been informed by **ES Chapter 14: Noise and Vibration** (Doc Ref. 5.1), which sets out relevant assessment findings and mitigation measures that have been taken into account. Results of Chapter 14: Noise and Vibration have informed the magnitude of change, with further details discussed for each assessment year.

18.8.93 Consistent with the quantitative analysis discussed in **ES Chapter 14: Noise and Vibration** (Doc Ref. 5.1), this qualitative health assessment is based on a comparison between the with and without the Project scenarios for the assessment years of 2024-2029, 2029, 2032, 2038 and

2047. For air noise the focus of discussion is on effects in 2032, as this is the year in which the largest magnitude of noise increase is expected. For all assessment years, consideration has also been given to the Central Case and Slower Fleet Transition for ATMs. Informing and validating the qualitative health assessment methodology, a quantitative analysis of the scale of change in relevant health outcomes has also been undertaken and is reported. Full results of this analysis are presented in **ES Appendix 18.8.1: Quantitative Health Assessment Results** (Doc Ref. 5.3). Further health effect quantification, including on air noise effects to sleep disturbance and annoyance (amenity), is set out in **ES Appendix 14.9.2: Air Noise Modelling** (Doc Ref. 5.3).

18.8.94 The significance of the population health effect has had regard to the following evidence sources:

- Scientific literature summarised in paragraph 18.8.96 that indicates an established relationship between changes in noise and changes in health outcomes, albeit the strength of evidence for linking aviation noise to changes in health outcomes is limited. Regard has been given to issues of uncertainty reported in the literature and to contextual factors that influence attitudes to noise.
- Baseline population health indicators relevant to noise are set out in Table 18.8.10, further details are set out in **ES Appendix 18.5.2: Health and Wellbeing Baseline Data Tables** (Doc Ref. 5.3).
- Health priorities that have been taken into account from a review of local JSNAs and HWSs are set out in **ES Appendix 18.5.1: Health Baseline Trends, Priorities and Vulnerable Groups** (Doc Ref. 5.3).
- Health policy on the consideration of health in planning decisions and reference to use of national limit values as a refence point, as set out in Section 18.2 and **ES Appendix 18.2.1: Summary of Local Planning Policy – Health and Wellbeing** (Doc Ref. 5.3).
- Consultation responses from health stakeholders and the public, as set out in Section 18.3 and **ES Appendix 18.3.1: Summary of Stakeholder Scoping Responses – Health and Wellbeing** (Doc Ref. 5.3) and the Project **Consultation Report** (Doc Ref. 6.1).
- Regulatory thresholds for health protection are set out by the British Standard Institution (BSI) BS 5228-1:2009+A1:2014 Code of practice for noise (BSI, 2014a) and vibration (BSI, 2014b) control on construction and open sites; and BS 4142:2014+A1:2019 Methods for Rating and Assessing Industrial and Commercial Sound (BSI, 2019). **ES Chapter 14: Noise and Vibration** (Doc Ref. 5.1) describes how appropriate thresholds are set, including that:
  - LOAELs are provided in the Consultation Response on UK Airspace Policy: A Framework for Balanced Decisions on the Design and Use of Airspace (Department for Transport, 2017),
  - SOAELs are defined with reference to Government expectations of compensation and noise insulation schemes specified in the Aviation Policy Framework (Department for Transport, 2013).
- Regard has also been had to WHO advisory guidelines (WHO, 2009) and (WHO, 2018) including the supporting systematic review (Basner & McGuire, 2018).

Health outcomes

18.8.95 The scientific literature identifies the following general points relevant to potential exposures and health outcomes. The main health outcomes relevant to this determinant of health are cardiovascular and cardio-metabolic, as well as mental health outcomes (eg stress, anxiety or

depression relating to annoyance). Sleep disturbance, particularly associated with changes to night-time noise levels, has the potential to affect daytime functioning, physical health and mental health. Cognitive performance in children, particularly at school, is also a potential outcome.

18.8.96 Noise is an important public health issue. It has negative impacts on human health and well-being and is a growing concern (WHO, 2018). Noise is pervasive in everyday life and can cause both auditory and non-auditory health effects (Basner, et al., 2014). Noise is linked to health outcomes such as annoyance, sleep disturbance, cardiovascular and metabolic disease, and cognitive impairment in schoolchildren (Peris & Fenech , 2020). Physiologically, noise leads to oxidative stress, vascular dysfunction, autonomic imbalance, and metabolic abnormalities (Münzel, et al., 2018).

18.8.97 In terms of mental health, wellbeing and quality of life, evidence from UK studies is mixed. The national Survey of Noise Attitudes 2014 failed to find associations between aircraft noise and self-reported health or the Warwick Edinburgh Mental Wellbeing Scale. A UK study using census data for people living around 17 airports and a measure of wellbeing, found that daytime aircraft noise was associated with wellbeing, but no association was found between night-time aircraft noise exposure and wellbeing. Another study from the UK using census data from around Belfast Airport failed to find an association between aircraft noise and self-reported mental health (Clark, et al., 2020). Overall, the quality of evidence for aircraft and road traffic noise effects on physiological and psychological health outcomes in a UK context remains low-quality (Clark, et al., 2020).

18.8.98 The circumstance of how noise is associated with health outcomes is also important. A WHO systematic review (Basner & McGuire, 2018) found that when individuals were asked whether road, rail, or aircraft noise affected sleep, a significant increase in the odds of being highly sleep disturbed was found for a 10 dBA increase in outdoor noise levels for all sources. However, no significant increase was found when the noise source was not mentioned in the question. This suggests that for self-reported measures it is annoyance or attitude to the noise that may be driving the increase of reported disturbance. Whilst the literature supports there being thresholds at which effects (such as annoyance and sleep disturbance) are likely, it also acknowledges the subjective nature of responses to noise and the higher sensitivity and vulnerability of subsets of the population. In this regard, noise effects can be considered to have non-threshold effects, with characteristics other than sound levels also determining the influence on health outcomes. Issues such as frequency, tone and character have been taken into account, eg the sound characteristics of the A220 aircraft. The following points from the WHO systematic review (Basner & McGuire, 2018) on noise are also noted as they give context to any change in noise levels:

- Noise is only one reason for sleep disturbance. There are many other external (eg temperature, humidity, light levels) and internal (eg sleep disorders, health conditions, bad dreams) causes.
- Whether or not noise will disturb sleep also depends on situational (eg depth of sleep phase, background noise level) and individual (eg noise sensitivity) moderators.
- It is normal for a healthy adult to briefly awaken approximately 20 times during an 8 hr bed period (most of these awakenings are too short to be remembered the next morning).

18.8.99 The WHO 2009 night noise guidelines (WHO, 2009) (Page 108, Table 5.4) find that where a population is exposed to average annual night-time noise above 55dB (the SOAEL used in this assessment) "*The situation is considered increasingly dangerous for public health. Adverse*

health effects occur frequently, a sizeable proportion of the population is highly annoyed and sleep-disturbed. There is evidence that the risk of cardiovascular disease increases". Such conclusions are a clear indication that where the SOAEL is experienced across the whole or great majority of a population (which is not the case here), this would be significant for public health. The WHO noise guidelines (WHO, 2018) also confirms on a composite day-evening-night metric (L_{den}) that the evidence for changes in cardiovascular health outcomes is limited, particularly where changes are much smaller than 10 dB (which is the case here):

- there is "*very low quality*" evidence for a change in health outcome risk, as described by the concentration response function (CRF) for ischaemic heart disease incidence (CRF of 1.09, 95% CI: 1.04–1.15, per 10 dB increase above 47dB).
- there is "*low quality*" evidence for a change in health outcome risk, as described by the CRF for hypertension incidence (CRF of 1.0 (ie no risk change), 95% CI: 0.77–1.30 per 10 dB increase).

18.8.100 Effects related to annoyance are likely to be the dominant health outcome. Effects may also relate to sleep disturbance and educational outcomes (WHO Environmental Noise Guidelines 2018, Section 3.3, Tables 29 and 31).

- Effects related to annoyance[7] are likely to be the dominant health outcome, with "moderate quality" evidence that the percentage of the population highly annoyed having an odds ratio of 4.78 (95% CI: 2.27–10.05) per 10 dB increase above 33 dB.
- Effects related to sleep disturbance[8] are also likely, with "moderate quality" evidence that the percentage of the population highly sleep-disturbed having an odds ratio of 1.94 (nearly twice as likely) (95% CI: 1.61–2.33) per 10 dB increase above 35 dB.
- There is also "moderate quality" evidence for a change in educational outcomes[9], with a 1-2 month delay in reading and total oral comprehension per 5 dB increase above 55 dB.

18.8.101 The health assessment highlights any instances where the change in noise results in widespread new exposures, or reductions in exposures, across a population which are above thresholds defined in the **ES Chapter 14: Noise and Vibration** (Doc Ref. 5.1) noise assessment as being significant (ie above SOAEL). In such cases, populations are defined in relation to the relevant geographic extent for the source of exposure. Within these populations, vulnerabilities to noise are considered including where daytime rest is important due to poor health or age. Any widespread changes in noise below the thresholds of noise assessment significance are also considered in relation to the public health implication (ie between LOAEL and SOAEL).

[7] WHO Environmental Noise Guidelines 2018 (pdf p.84). Section 3.3 Aircraft noise, Table 29

[8] WHO Environmental Noise Guidelines 2018 (pdf p.90). Section 3.3 Aircraft noise, Table 31

[9] WHO Environmental Noise Guidelines 2018 (pdf p.84). Section 3.3 Aircraft noise, Table 29

Indicators

Table 18.8.10: Baseline – summary indicators relevant to noise health outcomes

Indicator Name	Units	Nine ward (mean)	HLSA (mean)	Six Authority Area (mean)	South East	England
The rate of complaints about noise	Per 1,000	NA	5.1	10.7	7.5	12.0
The percentage of the population exposed to road, rail and air transport noise of 65dB(A) or more, during the daytime	%	NA	NA	6.6	4.9	5.5
The percentage of the population exposed to road, rail and air transport noise of 55 dB(A) or more during the night-time	%	NA	NA	9.7	8.6	8.5
Self reported wellbeing: people with a high anxiety score (16+ years)	%	NA	NA	24.7	22.3	22.6
Under 75 mortality rate from cardiovascular diseases considered preventable (2019 definition)	Per 100,000	NA	18.4	23.2	22.1	28.1
Hypertension: QOF prevalence (all ages)	%	NA	14.0	13.8	14.1	14.0
Depression: QOF prevalence (18+ years)	%	NA	11.8	12.7	13.1	12.7
Emergency hospital admissions for intentional self harm	SAR	127.3	99.6	104.4	108.3	100.0

18.8.102 Table 18.8.10 shows the rate of complaints about noise is lower in the HLSA compared to national and regional averages. The rate of complaints about noise is also lower in the Six Authority Area compared to the national average; this is despite the percentage of people exposed to elevated transport noise being higher in the Six Authority Area compared to the national average.

18.8.103 There is a mixed picture of indictors relevant to mental health and wellbeing (noting that noise is only one contributing factor to these metrics). Self-reported high anxiety is a measure relevant to the psychological effects of noise. A greater number of people report a high anxiety score in the Six Authority Area than the regional and national average. Smaller area anxiety data is not available for the nine ward area or HLSA; however the proportions of the population with a primary care depression diagnosis is lower in the HLSA compared to regional and national comparators. High local sensitivity to influences on mental health is however assumed and is indicated by the rate of emergency hospital admissions for intentional self-harm being higher in the nine ward area compared to the regional and national average.

18.8.104 In relation to a measure relevant to physiological effects of noise, the under 75 mortality rates for preventable cardiovascular disease is lower in the HLSA compared to the Six Authorities Area and regional and national comparators (again noting that noise is only one contributing factor to

this metric). On the other hand, the proportions of the population with a primary care hypertension (high blood pressure) diagnosis are similar in the HLSA compared to regional and national comparators. As with mental health, localised physical health sensitivity to noise is assumed.

Likelihood

18.8.105 A potential population health effect is considered likely because there is a plausible source-pathway-receptor relationship:

- the source is construction noise and vibration, aviation (air noise and ground noise) and surface access (road traffic noise);
- the pathway is pressure waves through the air (and ground for vibration); and
- receptors are residents in the local communities near the Airport and its flightpaths.

18.8.106 Furthermore, the potential effect is probable as no highly unusual conditions are required for the source-pathway-receptor linkage.

Populations

18.8.107 The population groups relevant to this assessment are:

- The 'site-specific' geographic population of communities in the **ES Chapter 14: Noise and Vibration** (Doc Ref. 5.1) zone of influence, (more than 20 km from the airport and beyond this for overflights), the health sensitivity of which is indicatively based on representative wards close to the Airport, see paragraph 18.4.12.
- The sub-population vulnerable due to:
  - Young age vulnerability (children and young people including for educational disturbance).
  - Old age vulnerability (older people may spend more time in affected dwellings).
  - Low-income vulnerability (people living in deprivation, including those on low incomes may have fewer resources to adapt, eg seek respite or install insulation. Furthermore, those who are economically inactive may spend more time in affected dwellings).
  - Poor health vulnerability (people with existing poor physical and mental health may spend more time in affected dwellings).
  - Access and geographical vulnerability (people for whom close proximity to project change increases sensitivity).

18.8.108 In terms of vulnerable groups, the results from sleep studies in children have suggested that they are less likely to awaken to noise events than adults, with a difference in sensitivity of approximately 10 dBA. However, despite being less sensitive, children are still considered a vulnerable group due to their developmental state and also because of the difference in their sleep patterns. Children have earlier bedtimes and longer sleep durations than adults, which may overlap with periods not accounted for by night-time metrics (Basner & McGuire, 2018). Children are also more vulnerable for cognitive effects of noise. They are not per se more vulnerable as a group, but more at risk because of less-developed coping strategies, and they are in a sensitive developmental period. This is indicative of a life phase effect rather than an age effect. Children seem to be less vulnerable for awakenings due to noise but more vulnerable for physiological effects during sleep and related motility (van Kamp & Davies, 2013). Evidence does not indicate that the elderly are more vulnerable to noise in terms of annoyance and sleep disturbance. Age-specific comparisons rather show an inverted U-shaped relation and indicate that both young and

older people are less at risk as far as annoyance and disturbance are concerned. But possibly, the elderly are more vulnerable regarding cardiovascular effects, and this may be a combined effect of air pollution and noise (van Kamp & Davies, 2013).

Metrics

18.8.109 As explained in **ES Chapter 14: Noise and Vibration** (Doc Ref. 5.1), the primary metrics for quantifying community effects of aircraft noise in the UK are LAeq,16h, which is an average noise metric covering the daytime period from 07:00 to 23:00 and LAeq,8h covering the night-time period from 23:00 to 07:00. Other supplementary metrics reported in Chapter 14: Noise and Vibration are also taken into account by the health assessment to reflect how aircraft noise may be experienced. These include:

- N65 day, the number of aircraft during an average summer day above L_{max} 65 dB.
- N60 night, the number of aircraft during an average summer night above L_{max} 60 dB.
- L_{den} and L_{night} noise contours.
- L_{max} contours and levels at representative community locations.
- Awakenings based on a physiological sleep disturbance assessment.

18.8.110 **ES Chapter 14: Noise and Vibration** (Doc Ref. 5.1) explains the thresholds applied to the $L_{Aeq,16h}$ and $L_{Aeq,8h}$ primary metrics. The most relevant for the health assessment are SOAEL and LOAEL. The levels for SOAEL and LOAEL are set out in Chapter 14: Noise and Vibration. The relative changes in noise levels are also taken into account and are set out in Chapter 14: Noise and Vibration.

18.8.111 The **ES Chapter 14: Noise and Vibration** (Doc Ref. 5.1) air noise predictions have been made for locations of residential properties and at other noise-sensitive locations (such as schools, churches and healthcare facilities). The following metrics are discussed:

- Summer day $L_{Aeq,16h}$[10];
- Summer day 16-hour N65[11] counts;
- Summer night $L_{Aeq,\ 8h}$[12];
- Summer night N60 counts;
- Annual L_{den}[13];
- Annual L_{night}[14]; and
- Night-time L_{Amax}[15].

[10] Noise averaged over the 16 daytime hours of 7am to 11pm

[11] The number of events with a L_{Amax} ≥65 dB(A)

[12] Noise averaged over the eight night-time hours of 11pm to 7am

[13] Day-evening-night, a 24-hour noise average in which evening and night noise are weighted more than day noise

[14] As $L_{Aeq,\ 8h}$ but an annual average

[15] Maximum sound level

Thresholds and non-threshold effects

18.8.112 The number of people experiencing noise effects at or above the SOAEL is a guide for the health assessment as to the potential for health effects within a population. If the SOAEL is experienced by all, or the majority, of a population the potential for a significant adverse population health effect is high. If, as is the case here, the SOAEL is experienced by a small minority of a population the potential for a significant adverse population health effect is more limited. In these circumstances additional context is informative, for example the degree of change experienced. In this case the great majority of changes are no greater than 2dB, which suggests that the additional noise would not be noticed by most people and would have limited potential to affect population health. To treat the SOAEL as a hard threshold where population health effects become significant with a minority of the population experiencing exceedances would not reflect the actual change in population health outcomes that would be expected.

18.8.113 The changes in exposure between the LOAEL and SOAEL are noted, as chronic noise exposure across all or the great majority of the population may also contribute to adverse population health outcomes. Again, the degree of change is also relevant and a change of 2dB or less has very limited potential to affect population health (Department of Health, 2021; Maynard, et al., 2010; Civil Aviation Authority, n.d.; West Sussex County Council et al., 2015; Stansfeld, et al., 2009).

Central fleet forecast summary population count tables

18.8.114 Table 18.8.11 sets out population counts at 3 dB increments by assessment year for the With Project scenario. Table 18.8.12 does similarly for the DM scenario.

18.8.115 Table 18.8.13 shows the change due to the Project by subtracting the DM population counts from the With Project population counts for each 3 dB increment in each assessment year.

18.8.116 Table 18.8.14 shows the summed population counts either ‘between the LOAEL and SOAEL’ or ‘at or above the SOAEL’ due to the Project. These counts are the difference between the With Project and DM scenarios, ie the change due to the Project.

18.8.117 As explained in **ES Chapter 14: Noise and Vibration** (Doc Ref. 5.1) and as shown in Table 18.8.14 the 2032 assessment year is the worst case in terms of the Project noise impact. There are a few instances where the population counts either ‘between the LOAEL and SOAEL’ or ‘at the SOAEL and above’ are higher in other assessment years. The following points explain why 2032 remains the worst case year, and thus the focus of the assessment:

- All the population counts are rounded to the nearest one hundred people. For this reason, the difference between a count of 100 and 200 in Table 18.8.14 is not material and could be a difference of only a few people.
- The overall trend is of decreasing levels of noise in 2038 and 2047 compared to 2032, this is illustrated by noise contour maps set out in **ES Chapter 14: Noise and Vibration** (Doc Ref. 5.1).
- The differences between the noise contours for the With Project and DM scenarios, ie the change due to the project, shifts the contour boundaries across a landscape with variation in population densities.

18.8.118 For this reason, despite, in absolute terms, a reducing trend in the population affected after 2032, in both the With Project scenario (Table 18.8.11) and DM scenario (Table 18.8.12) there is a

relative increase in the population between the LOAEL and SOAEL in 2038 and 2047 (Table 18.8.14) compared to 2032.

18.8.119 Notwithstanding this, 2032 remains the worst case year as in 2038 and 2047 the actual noise levels experienced would be lower, even though a larger population is affected between the LOAEL and SOAEL (Table 18.8.14). The assessment later in this section discusses in further detail the dual considerations of exposure above a threshold and the level of noise they would experience.

18.8.120 Even if 2032 is not considered to be the worst case year for a particular indicator of change, the effects in 2038 and 2047 are sufficiently comparable to those in 2032 that the assessment conclusions for 2032 on the significance of population health effects would be the same for 2038 and 2047.

Table 18.8.11: Central fleet forecast – non-cumulative contour counts – With Project scenario

Noise Metric	2019	2029	2032	2038	2047
$L_{eq,\ 16\ hour}$ day:					
51 dB to 54 dB	14,200	11,300	9,800	9,000	9,100
54 dB to 57 dB	7,300	6,600	6,800	5,700	5,500
57 dB to 60 dB	1,100	1,000	1,000	800	800
60 dB to 63 dB	950	600	700	500	500
63 dB to 66 dB	250	400	300	300	300
66 dB to 69 dB	150	200	200	200	200
69 dB to 72 dB	100	-	-	-	-
$L_{eq,\ 8\ hour}$ night:					
45 dB to 48 dB	15,550	13,200	11,700	9,400	9,400
48 dB to 51 dB	6,550	6,100	5,500	4,900	4,800
51 dB to 54 dB	4,000	3,000	3,100	2,900	2,900
54 dB to 55 dB	300	300	300	200	200
55 dB to 57 dB	500	600	500	400	400
57 dB to 60 dB	450	200	200	200	200
60 dB to 63 dB	150	100	100	200	200
63 dB to 66 dB	150	200	200	100	100

Notes: Populations are estimated to the nearest 100, see further detail on noise model methods in ES Chapter 14: Noise and Vibration (Doc Ref. 5.1).

Table 18.8.12: Central fleet forecast - non-cumulative contour counts - DM scenario

Noise Metric	2019	2029	2032	2038	2047
$L_{eq,\ 16\ hour}$ day:					
51 dB to 54 dB	14,200	12,800	9,400	7,300	7,200
54 dB to 57 dB	7,300	6,200	4,900	4,100	4,000
57 dB to 60 dB	1,100	900	900	900	900
60 dB to 63 dB	950	600	500	400	400
63 dB to 66 dB	250	300	200	100	100
66 dB to 69 dB	150	100	100	100	100
69 dB to 72 dB	100	100	100	100	100
$L_{eq,\ 8\ hour}$ night:					
45 dB to 48 dB	15,550	13,600	9,900	7,600	7,600
48 dB to 51 dB	6,550	5,800	5,300	4,800	4,700
51 dB to 54 dB	4,000	3,000	2,600	2,300	2,300
54 dB to 55 dB	300	300	100	200	200
55 dB to 57 dB	500	500	400	400	400
57 dB to 60 dB	450	200	200	100	100
60 dB to 63 dB	150	100	200	200	200
63 dB to 66 dB	150	200	100	100	100

Notes: Populations are estimated to the nearest 100, see further detail on noise model methods in ES Chapter 14: Noise and Vibration (Doc Ref. 5.1).

Table 18.8.13: Central fleet forecast - non-cumulative contour counts - Change due to Project

Noise Metric	2019	2029	2032	2038	2047
$L_{eq,\ 16\ hour}$ day:					
51 dB to 54 dB	-	-1,500	400	1,700	1,900
54 dB to 57 dB	-	400	1,900	1,600	1,500
57 dB to 60 dB	-	100	100	-100	-100
60 dB to 63 dB	-	-	200	100	100
63 dB to 66 dB	-	100	100	200	200
66 dB to 69 dB	-	100	100	100	100
69 dB to 72 dB	-	- 100	- 100	-100	-100
$L_{eq,\ 8\ hour}$ night:					
45 dB to 48 dB	-	- 400	1,800	1,800	1,800
48 dB to 51 dB	-	300	200	100	100
51 dB to 54 dB	-	-	500	600	600

54 dB to 55 dB	-	-	200	-	-
55 dB to 57 dB	-	100	100	-	-
57 dB to 60 dB	-	-	-	100	100
60 dB to 63 dB	-	-	-100	-	-
63 dB to 66 dB	-	-	100	-	-

Notes: Populations are estimated to the nearest 100, see further detail on noise model methods in ES Chapter 14: Noise and Vibration (Doc Ref. 5.1).

Table 18.8.14: Central fleet forecast - non-cumulative contour counts - Change due to Project for 'between LOAEL and SOAEL' and 'at or above the SOAEL'

	Noise Metric	2019	2029	2032	2038	2047
$L_{eq,\ 16\ hour}$ day:						
Between LOAEL and SOAEL	51 dB to 54 dB	0	-1,000	2,600	3,300	3,400
	54 dB to 57 dB					
	57 dB to 60 dB					
	60 dB to 63 dB					
SOAEL and above	63 dB to 66 dB	0	100	100	200	200
	66 dB to 69 dB					
	69 dB to 72 dB					
$L_{eq,\ 8\ hour}$ night:						
Between LOAEL and SOAEL	45 dB to 48 dB	0	- 100	2,700	2,500	2,500
	48 dB to 51 dB					
	51 dB to 54 dB					
	54 dB to 55 dB					
SOAEL and above	55 dB to 57 dB	0	100	100	100	100
	57 dB to 60 dB					
	60 dB to 63 dB					
	63 dB to 66 dB					

Notes: Populations are estimated to the nearest 100, see further detail on noise model methods in ES Chapter 14: Noise and Vibration (Doc Ref. 5.1).

Slower transition fleet summary population count tables

18.8.121 Table 18.8.15 sets out population counts at 3 dB increments by assessment year for the With Project scenario. Table 18.8.16 does similarly for the DM scenario.

18.8.122 Table 18.8.17 shows the change due to the Project by subtracting the DM population counts from the With Project population counts for each 3 dB increment in each assessment year.

18.8.123 Table 18.8.18 shows the summed population counts either 'between the LOAEL and SOAEL' or 'at or above the SOAEL' due to the Project. These counts are the difference between the With Project and DM scenarios, ie the change due to the Project.

18.8.124 As explained in **ES Chapter 14: Noise and Vibration** (Doc Ref. 5.1) and as shown in Table 18.8.18, 2032 assessment year is the worst case in terms of the Project noise impact. There is one instance where the population counts 'between the LOAEL and SOAEL' is higher in 2047 than 2032. The following points explain why 2032 remains the worst case year, and thus the focus of the assessment:

- As with the Central Case, the overall trend is of decreasing levels of noise in 2038 and 2047 compared to 2032, this is illustrated by noise contour maps set out in **ES Chapter 14: Noise and Vibration** (Doc Ref. 5.1).
- The differences between the noise contours for the With Project and DM scenarios, ie the change due to the project, shifts the contour boundaries across a landscape with variation in population densities.

18.8.125 For this reason, despite, in absolute terms, a reducing trend in the population affected after 2032, in both the With Project scenario (Table 18.8.11) and DM scenario (Table 18.8.12); there is a relative increase in the population between the LOAEL and SOAEL in 2047 (Table 18.8.18) compared to 2032.

18.8.126 Notwithstanding this, 2032 remains the worst case year as in 2047 the actual noise levels experienced would be lower, even though a larger population is affected between the LOAEL and SOAEL (Table 18.8.18). The assessment later in this section discusses in further detail the dual considerations of exposure above a threshold and the level of noise they would experience.

Table 18.8.15: Slower transition fleet forecast - non-cumulative contour counts - With Project scenario

Noise Metric	2019	2029	2032	2038	2047
$L_{eq,\ 16\ hour}$ day:					
51 dB to 54 dB	14,200	14,000	15,500	10,300	9,400
54 dB to 57 dB	7,300	6,800	7,000	6,700	6,600
57 dB to 60 dB	1,100	1,400	2,500	1,000	900
60 dB to 63 dB	950	700	800	700	700
63 dB to 66 dB	250	300	300	200	200
66 dB to 69 dB	150	300	200	300	300
69 dB to 72 dB	100	-	100	-	-
$L_{eq,\ 8\ hour}$ night:					
45 dB to 48 dB	15,550	15,300	16,600	11,800	11,900
48 dB to 51 dB	6,550	6,100	6,500	5,300	5,200
51 dB to 54 dB	4,000	3,700	3,900	3,300	3,400
54 dB to 55 dB	300	200	300	300	300
55 dB to 57 dB	500	500	500	500	500
57 dB to 60 dB	450	400	400	200	200
60 dB to 63 dB	150	100	100	100	100
63 dB to 66 dB	150	200	200	200	200

Notes: Populations are estimated to the nearest 100, see further detail on noise model methods in ES Chapter 14: Noise and Vibration (Doc Ref. 5.1).

Table 18.8.16: Slower transition fleet forecast - non-cumulative contour counts - DM scenario

Noise Metric	2019	2029	2032	2038	2047
$L_{eq,\ 16\ hour}$ day:					
51 dB to 54 dB	14,200	14,900	14,400	9,500	9,000
54 dB to 57 dB	7,300	6,800	6,900	5,000	4,700
57 dB to 60 dB	1,100	1,200	1,000	800	700
60 dB to 63 dB	950	700	700	600	500
63 dB to 66 dB	250	300	300	200	200
66 dB to 69 dB	150	100	100	100	100
69 dB to 72 dB	100	100	100	100	100
$L_{eq,\ 8\ hour}$ night:					
45 dB to 48 dB	15,550	15,500	14,600	9,900	9,500
48 dB to 51 dB	6,550	6,100	6,100	5,200	4,700
51 dB to 54 dB	4,000	3,600	3,400	2,600	3,000
54 dB to 55 dB	300	200	200	100	100
55 dB to 57 dB	500	600	600	400	400
57 dB to 60 dB	450	300	200	200	200
60 dB to 63 dB	150	100	100	200	200
63 dB to 66 dB	150	200	200	100	100

Notes: Populations are estimated to the nearest 100, see further detail on noise model methods in ES Chapter 14: Noise and Vibration (Doc Ref. 5.1).

Table 18.8.17: Slower transition fleet forecast - non-cumulative contour counts - Change due to Project

Noise Metric	2019	2029	2032	2038	2047
$L_{eq,\ 16\ hour}$ day:					
51 dB to 54 dB	-	- 900	1,100	800	400
54 dB to 57 dB	-	-	100	1,700	1,900
57 dB to 60 dB	-	200	1,500	200	200
60 dB to 63 dB	-	-	100	100	200
63 dB to 66 dB	-	-	-	-	-
66 dB to 69 dB	-	200	100	200	200
69 dB to 72 dB	-	- 100	-	- 100	- 100

Noise Metric	2019	2029	2032	2038	2047
$L_{eq,\ 8\ hour}$ night:					
45 dB to 48 dB	-	- 200	2,000	1,900	2,400
48 dB to 51 dB	-	-	400	100	500
51 dB to 54 dB	-	100	500	700	400
54 dB to 55 dB	-	-	100	200	200
55 dB to 57 dB	-	- 100	- 100	100	100
57 dB to 60 dB	-	100	200	-	-
60 dB to 63 dB	-	-	-	- 100	- 100
63 dB to 66 dB	-	-	-	100	100

Notes: Populations are estimated to the nearest 100, see further detail on noise model methods in ES Chapter 14: Noise and Vibration (Doc Ref. 5.1).

Table 18.8.18: Slower transition fleet forecast - non-cumulative contour counts - Change due to Project for 'between LOAEL and SOAEL' and 'at or above the SOAEL'

	Noise Metric	2019	2029	2032	2038	2047
$L_{eq,\ 16\ hour}$ day:						
Between LOAEL and SOAEL	51 dB to 54 dB 54 dB to 57 dB 57 dB to 60 dB 60 dB to 63 dB	0	- 700	2,800	2,800	2,700
SOAEL and above	63 dB to 66 dB 66 dB to 69 dB 69 dB to 72 dB	0	100	100	100	100
$L_{eq,\ 8\ hour}$ night:						
Between LOAEL and SOAEL	45 dB to 48 dB 48 dB to 51 dB 51 dB to 54 dB 54 dB to 55 dB	0	- 100	3,000	2,900	3,500
SOAEL and above	55 dB to 57 dB 57 dB to 60 dB 60 dB to 63 dB 63 dB to 66 dB	0	-	100	100	100

Notes: Populations are estimated to the nearest 100, see further detail on noise model methods in ES Chapter 14: Noise and Vibration (Doc Ref. 5.1).

Sensitivity of the population

18.8.127 The sensitivity of the population has had regard to the baseline, including JSNA findings, set out in Section 18.5, Table 18.8.10 and Appendices 18.5.1 and 18.5.2. Common factors that differentiate the sensitivity of the general population and the vulnerable group population have been taken into account and are listed in paragraph 18.4.29.

18.8.128 The sensitivity of the general population is considered to be **medium**. The classification of medium reflects that existing noise stressors affect a wide area and the population is likely to have heightened sensitivity to aviation noise as an issue. Existing proximity to the baseline noise conditions of the Airport and its flightpaths, as well as local road network, suggests the affected population already has a level of exposure to transport noise that affects cardio-metabolic, annoyance, educational and sleep disturbance outcomes.

18.8.129 The sensitivity of the vulnerable sub-population is considered **high**. This reflects the presence of populations who (while at work or at home) are likely to spend extended periods near to the Airport, its flightpaths, or parts of the local transport network that are expected to experience additional movements. Vulnerability in this case is particularly linked to: living close to sources of noise; age (both young people and older people); existing poor health (eg long-term illness); spending more time in affected dwellings (eg due to low economic activity, shift work or ill health); vulnerability due to deprivation or health inequalities (including potential for more deprived communities to live in areas of high noise disturbance); or having strong views or high degrees of uncertainty about the Project (which may be associated with health effects even below thresholds that are generally considered acceptable).

18.8.130 In relation to the sensitivity of the affected populations, it is noted that even within the sub-population who experience increased noise and who are potentially more sensitive to its effects, only a proportion would experience a change in risk factors; and of those, only a further sub-proposition may experience a change in health outcomes. This small minority is further reduced by those who experience the greatest effects being eligible for the enhanced noise insulation scheme that accompanies the Project (see **ES Chapter 14: Noise and Vibration** (Doc Ref. 5.1) for further details).

18.8.131 Also relevant to the sensitivity of the population affected is that the flight paths are not changing as part of Project. Consequently, for those affected, the change is within the context of overflights already experienced. This is relevant as the literature (Basner & McGuire, 2018) notes that whilst evidence is limited and habituation is not complete, "*subjects exposed to noise usually habituate*". For example:

> *'exposure-response relationships derived in the field (where subjects have often been exposed to the noise for many years) are usually much shallower than those derived in laboratory settings…' (Basner & McGuire, 2018)* (page 4).

18.8.132 These conclusions on sensitivity are common to all assessment years and are not repeated to avoid duplication.

Summary of measures taken into account

18.8.133 The measures set out in **ES Chapter 14: Noise and Vibration** (Doc Ref. 5.1) have been taken into account within the residual effects that have informed the health assessment. Further details

are provided in **ES Chapter 14: Noise and Vibration** Section 14.8, including Table 14.8.1, Table 14.8.3 and Table 14.8.4.

18.8.134 For construction Section 14.8 describes: works outside of daytime weekday working hours have been minimised; and use of percussive piling technique have been avoided where practicable. The contractors will be required to take steps to further minimise noise and vibration using best practicable means in accordance with **ES Appendix 5.3.2: Code of Construction Practice** (Doc Ref. 5.3). Lead contractors will seek to obtain prior consent from the relevant local authority under Section 61 of the Control of Pollution Act 1974 for the proposed construction works. Noise monitoring will be carried out to confirm the best practicable means.

18.8.135 For air noise Section 14.8 describes: engagement with the local community; air noise mitigation at source; land use planning and management; air noise operating procedures, including departure noise limits; and the noise insulation schemes, including inner and outer zones linked to noise contours. **ES Chapter 14: Noise and Vibration** also describes a noise envelope.

18.8.136 For ground noise Section 14.8 describes: earthworks and bunding; noise barriers; and acoustic design of plant and fixed noise sources.

18.8.137 For road traffic noise Section 14.8 describes: measures in the road scheme design; noise barriers on North and South Terminal roundabouts; and traffic management and speed reductions.

Initial Construction Period: 2024-2029

Construction Noise

18.8.138 This section discusses changes in noise and vibration exposure during construction of the Project. Construction activities taking place during the initial construction period are anticipated to occur during the day, evening and night-time periods.

18.8.139 This health assessment is informed by **ES Chapter 14: Noise and Vibration** (Doc Ref. 5.1) modelling across the 15 year construction programme from 2024 to 2038. In the period from 2024 to 2029 all the runway and taxiways and some airfield facilities are anticipated to be built and in 2028 and 2029 part of the highway improvements would be built. The majority of the heavy engineering work required at night is anticipated to be within this period, and the majority of the most significant noise impacts are in this period.

18.8.140 As stated in **ES Appendix 14.9.1: Construction Noise Modelling** (Doc Ref. 5.3), the communities bordering the airport perimeter with the most potential in 2024-2028 to experience residual localised adverse changes in night-time noise exposure during the initial construction period, include receptors on: Charlwood; Charlwood Road; Bonnetts Lane and Lowfield Heath. For the 2029 night-time period, effects relate to Povey Cross, Longbridge Road (Horley) and Riverside (Horley).

18.8.141 The quantitative analysis presented in **ES Chapter 14: Noise and Vibration** (Doc Ref. 5.1), reflects a reasonable worst case in the initial assessment, then takes a cautious view of on-site mitigation measures that the contractor may be able to take to reduce noise levels and the associated impact at source or with further noise barriers.

18.8.142 As indicated by **ES Chapter 14: Noise and Vibration** (Doc Ref. 5.1) residual construction noise above the SOAEL is not expected to affect any residential properties during the daytime, and

approximately 10 during the night-time. In all cases, insulation would be offered to all properties predicted to be exposed to noise levels above SOAEL. In public health terms this is likely to both reduce the number of people affected and the severity of affect, eg on annoyance or sleep disturbance.

18.8.143 Mitigation is expected be secured through the Section 61 application process whereby the local authorities will vet the contractor's proposed methods of working to ensure the Best Practicable Means to minimise noise and vibration are adopted.

18.8.144 **ES Chapter 14: Noise and Vibration** (Doc Ref. 5.1) anticipates a residual temporary moderate adverse (significant) effect overall. This effect is driven by construction noise sources. Significant effects are not expected from vibration.

18.8.145 For public health, the magnitude of change due to the proposed construction works is **low**. In terms of population health, the *medium* scale of change in noise levels described in **ES Chapter 14: Noise and Vibration** (Doc Ref. 5.1), would be limited to a *small minority* of the population in communities closest to construction activities. There would be some annoyance associated with the construction activities. Health outcomes are likely to predominantly relate to a *minor* change in quality of life, or a *very minor* change in cardiovascular or mental wellbeing morbidity. The changes would be of *frequent* construction related noise exposures over a *short- to medium-term* duration. Construction noise is not expected to result in disruption of work or education due to the bespoke mitigation proposed for non-residential receptors discussed in Chapter 14: Noise and Vibration. The commitments on noise insulation, as well as the standard good practice measures that would be set out in the **CoCP** (**ES Appendix 5.3.2** (Doc Ref. 5.3)) and through the Section 61 application process can reasonably be relied upon to avoid widespread high noise and vibration exposures. Annoyance related health outcomes would be expected to reverse *rapidly* on completion of the works. There are unlikely to be healthcare service implications as a result of construction noise and vibration.

18.8.146 Taking into account sensitivity and magnitude scores, the construction noise impacts of the Project are considered to result in a **minor adverse** (not significant) effect on population health. This assessment conclusion reflects that although construction noise is an issue of concern to communities and the scientific literature indicates a *clear* association between elevated and sustained noise disturbance and reduced health outcome, the changes would result in a *very limited* effect in the local health baseline. The commitment to insulate dwellings affected above the SOAEL, and the use of the Section 61 application process, keeps construction noise *within limits* intended to safeguard health. The temporary and localised construction noise effects would, at most, have a *marginal* effect on health inequalities and are *not* expected to affect the delivery of health policy.

Road Traffic Noise

18.8.147 This section considers construction transport related exposures. The assessment of traffic noise takes into account that it is not proposed to route construction traffic on smaller roads or through villages. However, there would be construction traffic associated with the Project at night during highways works and to support other construction activities being undertaken during the night-time period. As such, general traffic using affected routes may divert to other roads, which may increase noise levels elsewhere.

18.8.148 **ES Chapter 14: Noise and Vibration** (Doc Ref. 5.1) finds that significant effects are not expected from noise or vibration due to direct or indirect construction road traffic effects.

18.8.149 The magnitude of any health effect would likely be **low to negligible**. This reflects a *small* scale of change over the *short- to medium* term associated with *frequent* construction traffic vehicle movements or *occasional* displaced traffic effects. These changes could result in a *very minor* change in quality of life for a *small minority* of the local population along affected transport routes.

18.8.150 Road traffic noise impacts of the Project are considered to result in a **negligible** (not significant) effect on population health. This assessment conclusion reflects that chronic health effects from long-term elevated transport noise are not expected to arise due to the temporary and low magnitude nature of construction traffic. Any effect on the local health baseline would be very limited, with similarly limited potential to affect health policy delivery or health inequalities.

First Full Year of Opening: 2029

Construction Noise

18.8.151 Construction activities, including night-time working, would be undertaken during the first full year of opening (2029). As stated in **ES Chapter 14: Noise and Vibration** (Doc Ref. 5.1), modelling was undertaken for six periods within 2029 to ensure that the worst case noise impacts were assessed. These include night works on the A23 Brighton Road bridge, the Network Rail bridge, the Balcombe Road bridge and the M23 Spur embankment widening.

18.8.152 As set out in **ES Chapter 14: Noise and Vibration** (Doc Ref. 5.1), residual effects after mitigation are expected at a small number of dwellings in the Longbridge Road and Riverside areas.

18.8.153 It is concluded that the magnitude of the change due to the Project is **low** for the same reasons as set out in paragraph 18.8.145 (see 2029 assessment year).

18.8.154 It is concluded that the significance of the effect for population health is **minor adverse** (not significant) for the same reasons as set out in paragraph 18.8.146 (see 2029 assessment year).

18.8.155 **ES Chapter 14: Noise and Vibration** (Doc Ref. 5.1) modelling from 2030 to 2038, identifies a small number of exceedances of the SOAEL in the Balcombe Road area in 2030 where the receptors would similarly benefit from insulation and further mitigation as described in Chapter 14: Noise and Vibration. No additional population health effect is anticipated for 2031 or other construction years.

Air Noise

Introduction

18.8.156 **ES Chapter 14: Noise and Vibration** (Doc Ref. 5.1) presents a quantitative analysis of the change in levels of noise from aircraft (air noise) due to the Project. The assessment spans the 2029, 2032, 2038 and 2047 assessment years. Consistent with a proportionate approach to reporting findings, Chapter 14: Noise and Vibration focuses its commentary to the year of greatest effect, 2032. Data for other years of lower effect is provided in **ES Appendix 14.9.2: Air Noise Modelling** (Doc Ref. 5.3).

18.8.157 The health assessment takes the same approach. A quantitative analysis to support an understanding of the scale of change in population health outcomes has been undertaken. This is

reported in full for the worst-case year of 2032. Data for other assessment years is provided in **ES Appendix 18.8.1: Quantitative Health Assessment Results** (Doc Ref. 5.3). The geographical area affected in 2029 is similar but slightly smaller to that during 2032.

18.8.158 Based on data in **ES Appendix 14.9.2: Air Noise Modelling** (Doc Ref. 5.3), Table 18.8.19 and Table 18.8.20 summarise the change in population exposed between the LOAEL and the SOAEL and above the SOAEL.

Table 18.8.19: Summary daytime population exposed in 2029

	Baseline 2019	Difference between the 'DM' and 'With Project' scenarios		Slow transition case compared to Central Case
		Central Case	Slow Transition Case	
Between LOAEL of 51dB $L_{Aeq,16h}$ and SOAEL	23,550	-1,000	-700	300
Above SOAEL of 63dB $L_{Aeq,16h}$	500	100	100	0
Notes: Populations are estimated to the nearest 100, see further detail on noise model methods in ES Chapter 14: Noise and Vibration (Doc Ref. 5.1).				

Table 18.8.20: Summary night-time population exposed in 2029

	Baseline 2019	Difference between the 'DM' and 'With Project' scenarios		Slow transition case compared to Central Case
		Central Case	Slow Transition Case	
Between LOAEL of 45dB $L_{Aeq,8h}$ and SOAEL	26,400	-100	-100	0
Above SOAEL of 55dB $L_{Aeq,8h}$	1,250	100	0	-100
Notes: Populations are estimated to the nearest 100, see further detail on noise model methods in ES Chapter 14: Noise and Vibration (Doc Ref. 5.1).				

18.8.159 It is concluded that the magnitude of the change due to the Project is **low** for the same reasons as set out in paragraph 18.8.170 (see 2032 assessment year).

18.8.160 It is concluded that the significance of the effect for population health is **minor adverse** (not significant) for the same reasons as set out in paragraph 18.8.171 (see 2032 assessment year). This is a conservative conclusion given that there are overall reductions in the number of people affected between the LOAEL and SOAEL, which represents a slight beneficial effect.

18.8.161 Validating this conclusion, the health assessment has undertaken a quantitative analysis, summarised in Table 18.8.21. The analysis shows that the change in air noise in this assessment year results in a very small influence on population health outcome measures. The model estimates daytime effects to the population in the noise contours of >51dB$_{Leq\ 16\ hr}$ and over, which

is a population of approximately 21,000 people in the DM scenario and approximately 20,100 in the With Project scenario.

18.8.162 The change in incidence rates for stroke, ischaemic heart disease (IHD) and depression are all very small (less than one person a year). The change in mortality risk for IHD across the affected population is equivalent to 0.004 (not actual mortality). Further details are set out in **ES Appendix 18.8.1: Quantitative Health Assessment Results** (Doc Ref. 5.3). The quantitative analysis is a pragmatic estimate of changes in selected health outcomes to identify the scale of change associated with the Project changes, see **ES Appendix 18.4.1: Methods Statement for Health and Wellbeing** (Doc Ref. 5.3).

18.8.163 The quantitative analysis reflects the health indicators that can be most reliably modelled. The higher concentration response functions of other health outcomes, such as for hypertension, annoyance and sleep disturbance (the latter two are modelled in **ES Chapter 14: Noise and Vibration** (Doc Ref. 5.1)), have been taken into account qualitatively by the assessment conclusion on significance, but are not modelled by the health assessment. For example, whilst there are estimates for hypertension incidence concentration response functions in the scientific literature, there are not baseline hypertension incidence rates published locally or even nationally to support a project effect level calculation. The role of the quantitative health calculation is to provide an indication of scale of change in health outcomes, not to exhaustively estimate all health outcome changes. The modelling fulfils this function and is proportionate in providing indicators relevant to the scale of change in physical and mental health outcomes. The indicators selected avoid double counting, for example hypertension may ultimately lead to outcomes such as stroke and IHD and similarly annoyance and sleep disturbance may ultimately lead to depression as an outcome.

Table 18.8.21: Summary 2029 air noise population health outcome measures, Central Case and central CRF (difference between the 2029 'DM' and 2029 'With Project' scenarios)

Health Outcome (annual)	Change due to the Project (number)	Change as an Incidence Rate per 100,000 people	Change as a percentage of the baseline rate
Stroke incidence	0.003	0.01	0.0000001%
Ischaemic Heart Disease (IHD) incidence	0.004	0.02	0.0000001%
IHD mortality[16]	0.004	0.02	0.0000001%
Depression incidence (aircraft)	- 0.096	- 0.48	- 0.030%
Notes: The change per 100,000 people is to provide a standardised rate, as requested by public health stakeholders, as the affected population is much less than 100,000 there would not be this number of new cases			

Ground Noise

18.8.164 As stated in **ES Chapter 14: Noise and Vibration** (Doc Ref. 5.1), ground noise impacts predicted in the first full year of opening (2029) would be lower than for the interim assessment

[16] Change in mortality risk in the local population equivalent to this number of deaths (not actual deaths).

year (2032), because the use of the northern runway is expected to increase beyond 2029. As per the approach in Chapter 14: Noise and Vibration, the health and wellbeing assessment relating to ground noise focusses on the 2032 assessment year as a worst-case for ground noise.

Road Traffic Noise

18.8.165 As stated in **ES Chapter 14: Noise and Vibration** (Doc Ref. 5.1), construction-related road traffic noise would continue into 2029. The impacts of this have been considered in the initial construction period assessment.

Interim Assessment Year: 2032

Air Noise

18.8.166 Table 18.8.22 and Table 18.8.23 summarise the change in population exposed between the LOAEL and the SOAEL and above the SOAEL.

Table 18.8.22: Summary daytime population exposed in 2032

	Baseline 2019	Difference between the 'DM' and 'With Project' scenarios		Slow transition case compared to Central Case
		Central Case	Slow Transition Case	
Between LOAEL of 51dB $L_{Aeq,16h}$ and SOAEL	23,550	2,600	2,800	200
Above SOAEL of 63dB $L_{Aeq,16h}$	500	100	100	0

Notes: Populations are estimated to the nearest 100, see further detail on noise model methods in ES Chapter 14: Noise and Vibration (Doc Ref. 5.1).

Table 18.8.23: Summary night-time population exposed in 2032

	Baseline 2019	Difference between the 'DM' and 'With Project' scenarios		Slow transition case compared to Central Case
		Central Case	Slow Transition Case	
Between LOAEL of 45dB $L_{Aeq,8h}$ and SOAEL	26,400	2,700	3,000	300
Above SOAEL of 55dB $L_{Aeq,8h}$	1,250	100	100	0

Notes: Populations are estimated to the nearest 100, see further detail on noise model methods in ES Chapter 14: Noise and Vibration (Doc Ref. 5.1).

18.8.167 In relation to daytime noise, as reported in **ES Chapter 14: Noise and Vibration** (Doc Ref. 5.1), the great majority of the population newly either exposed between the LOAEL and SOAEL or above the SOAEL would experience a relative change in noise of less than 2dB; in most cases the changes are less than 1dB. These changes are unlikely to result in significant population

health effects. Where there are larger changes in the relative noise levels, the Project's NIS would mitigate against potentially significant effects. All dwellings predicted to experience changes of greater than 3dB would be eligible for full noise insulation under the new Inner Zone NIS (estimated at a population of approximately 105 people (40 properties)). A further approximately 105 people (40 properties) are predicted to have increases of greater than 1dB above SAOEL and would also be eligible under the NIS. Whilst it cannot be guaranteed that every resident would take-up the offer of insulation, this degree of mitigation makes a significant change in population health unlikely. Chapter 14: Noise and Vibration concludes there would be some residual moderate adverse effects due to disturbance of outside activities for these people. It is also relevant that Chapter 14: Noise and Vibration Table 14.9.10 shows a population of approximately 500 people who would experience reduced daytime noise effects in 2032 of between 1dB and 3dB.

18.8.168 In relation to night-time noise, as reported in **ES Chapter 14: Noise and Vibration** (Doc Ref. 5.1), all of the population newly exposed either between the LOAEL and SOAEL or above the SOAEL would experience a relative change in noise of less than 2dB; in the vast majority of cases the changes are less than 1dB. These changes are unlikely to result in significant population health effects. All changes above 1dB would be in areas eligible for the new Outer Zone NIS. All those affected by the small relative change in noise above the SOAEL would be eligible for full noise insulation under the new Inner Zone NIS.

18.8.169 **ES Chapter 14: Noise and Vibration** (Doc Ref. 5.1) identifies 50 noise sensitive community buildings that are predicted to experience noise levels at or above 51 dB $L_{eq\ 16\ hr}$ in 2032 with the Project. These comprise 21 schools, one hospital, 18 places of worship and seven other community buildings. The majority (42 of the 50 receptors) would experience a change of less than 1dB. The remainder changes of less than 2dB. Chapter 14: Noise and Vibration notes that a noise insulation scheme has been included for any school adversely affected.

18.8.170 The magnitude of any health effect would be **low.** For both daytime and night-time air noise there is a *very low* change in exposure, whether considering effects between the LOAEL and SOAEL or above the SOAEL. Effects would be over the *long-term* (albeit noting that noise levels reduce after 2032) and would be experienced *frequently*. The change in exposure corresponds to a *minor* change in risk factors for sleep disturbance, cardio-metabolic and annoyance related morbidity and quality of life, with any health effect from this change in risk factors affecting a *small minority* of the study area population, and in the case of effects above SOAEL, a very small minority. There are not expected to be quantifiable healthcare service implications. This takes into account the discussion of supplementary indicators in **ES Chapter 14: Noise and Vibration** (Doc Ref. 5.1).

18.8.171 The overall population health effect from noise is characterised as being adverse in direction, permanent and due to direct health pathways. The professional judgement is that the significance of the population health effect would be **minor adverse** (not significant).

18.8.172 The conclusion can be broken down as follows. Overall, the majority of the study area population would be below the SOAEL in all scenarios (and assessment years). In relation to the very small minority affected above SOAEL, taking into account the NIS as embedded mitigation, it is anticipated that the majority of those affected would have their effects reduced. A minor adverse effect is considered appropriate to reflect that not all people would take up the scheme and there may be practical limitations on its effectiveness for some people, eg for structural reasons,

outdoor activities or due to personal choice to open windows in summer even where ventilation is provided. In line with good practice, the NIS has had specific regard to indoor air quality and provides solutions to supplement fresh air supply through acoustic ventilators to allow windows to remain closed.

18.8.173 In relation to those between LOAEL and SOAEL who will experience a very low increase in noise (less than 3dB, with many below 1dB) the incremental effect to a larger number of people (albeit still a small minority of the population) is in population health terms noteworthy (ie not negligible); but equally given the very small change and the many other sources contributing to the local soundscape it is not considered a significant project level effect.

18.8.174 The effects are considered minor adverse as although there are sufficient *causal* associations established by the scientific literature, and the relevant thresholds of LOAEL and SOAEL are *crossed* (excluding effects of the NIS), the low magnitude of relative change due to the Project would likely give rise to only a *slight* change in the population health baseline, even accounting for the presence of more vulnerable sub-populations. The effect is considered to have only a *marginal* effect on the ability to deliver current health policy. This conclusion places weight on the Project mitigation measures, including minimising noise emissions at source, effective communication between GAL and local communities, and the NIS as described in **ES Chapter 14: Noise and Vibration** (Doc Ref. 5.1).

18.8.175 Validating this conclusion, the health assessment has undertaken a quantitative analysis, summarised in Table 18.8.24. The analysis shows that the change in noise in this assessment year results in a very small influence on population health outcome measures. The model estimates daytime effects to the population in the noise contours of >51dB$_{Leq\ 16\ hr}$ and over, which is a population of approximately 16,100 people in the DM scenario and approximately 18,800 in the With Project scenario.

18.8.176 Small changes (of less than one person per year) in incidence rates for stroke, IHD and depression are identified. The change in mortality risk for IHD across the affected population is equivalent to 0.184 (not actual mortality). Further details are set out in **ES Appendix 18.8.1: Quantitative Health Assessment Results** (Doc Ref. 5.3). The quantitative analysis is a pragmatic estimate of changes in selected health outcomes to identify the scale of change associated with the Project changes, see **ES Appendix 18.4.1: Methods Statement for Health and Wellbeing** (Doc Ref. 5.3).

Table 18.8.24: Summary 2032 air noise population health outcome measures, Central Case and central CRF (difference between the 2032 'DM' and 2032 'With Project' scenarios)

Health Outcome (annual)	Change due to the Project (annual number of people)	Change as an Incidence Rate per 100,000 people	Change as a percentage of the baseline rate
Stroke incidence	0.135	0.72	0.000006%
Ischaemic Heart Disease (IHD) incidence	0.231	1.23	0.000007%
IHD mortality	0.184	0.98	0.000004%
Depression incidence (aircraft)	0.929	4.94	0.309%

Notes:

- The change per 100,000 people is to provide a standardised rate, as requested by public health stakeholders, as the affected population is much less than 100,000 there would not be this number of new cases.
- Change in mortality risk in the local population equivalent to this number of deaths (not actual deaths).

18.8.177 The physiological sleep disturbance assessment is reported in **ES Chapter 14: Noise and Vibration** (Doc Ref. 5.1), section 14.12, with further detail in **ES Appendix 14.9.2: Air Noise Modelling** (Doc Ref. 5.3). A key finding of that assessment is that even in the worst case year for noise impacts (2032), there would be less than one additional awakening per summer night per person as a result of the Project in the area where the additional flights are closest to populations. The author of the systematic review underpinning the WHO guidelines on noise notes that:

'On average, there should be less than one additional awakening induced by aircraft noise' (Basner, et al., 2006) (p. 2780).

18.8.178 Basner, et al. (2006, p.2781) also note:

'It is not deemed necessary from a medical point of view to completely avoid additional awakenings induced by aircraft noise. It is rather assumed impacts of aircraft noise on health can be excluded in areas where less than one additional awakening is expected to be induced by aircraft noise on average'.

18.8.179 The latter statement can be considered a conservative approach given that Basner, et al. were considering an airport with a large change in night-time noise. Basner et al. (2012) also note in relation to awakenings that where there are already elevated numbers of awakenings then one additional awakening is "very likely less harmful" compared to where the background situation is of very few awakenings. This is relevant given the existing operational airport context.

Ground Noise

18.8.180 As stated in **ES Chapter 14: Noise and Vibration** (Doc Ref. 5.1), noise barriers would be included as mitigation adopted as part of the Project to reduce ground noise. Once mitigation is taken into account, the worst-case increase in noise levels during the daytime period ($L_{eq\ 16\ hr}$) at any receptor location would be +6 dB, with some receptors experiencing a decrease of up to -1 dB. During the night-time period ($L_{eq\ 8\ hr}$), the worst-case increase in noise levels at any receptor location would be +5 dB, with some receptors experiencing a decrease of up to -2 dB.

18.8.181 **ES Chapter 14: Noise and Vibration** (Doc Ref. 5.1) predicts residual moderate daytime ground noise effects for approximately 57 people (22 properties) across Charlwood Road, Lowfield Heath and Rowley Farm. For night-time ground noise, Chapter 14: Noise and Vibration identifies moderate effects for approximately 96 people (37 properties) affected across Charlwood, Charlwood Road, Povey Cross, Lowfield Heath and Rowley Farm. In both the daytime and night-time cases, the majority of these dwellings are covered by either the existing or the new NIS.

18.8.182 **ES Chapter 14: Noise and Vibration** (Doc Ref. 5.1) notes that eligibility for the NIS Inner Zone noise insulation package will, if necessary, be based on measurements of levels of ground noise carried out after the Project is operating so that significant effects on heath and quality of life are avoided. Given the localised nature of ground noise effects, which correlate with areas near the airport benefiting from the NIS, there are unlikely to be public health implications from noise level changes between the LOAEL and SOAEL.

18.8.183 The magnitude of ground noise effects on health is considered to be **low.** For both daytime and night-time ground noise there is a *low* change in exposure (noting that the highest exposures 5 dB to 6 dB reported in **ES Appendix 14.9.3: Ground Noise Modelling** (Doc Ref. 5.3) are not representative of the population level effect) and are on places affected by other noise from other sources in the area, notably road traffic noise. Effects would be over the *long-term* (albeit noting that noise levels reduce after 2032) and would be experienced *frequently*. The change in exposure corresponds to a *minor* change in risk factors for sleep disturbance, cardio-metabolic and annoyance related morbidity and quality of life, with any health effect from this change in risk factors affecting a *small minority* of the study area population. The focus of the assessment on effects at or above the SOAEL is considered proportionate. There are not expected to be quantifiable healthcare service implications. This takes into account the discussion of supplementary indicators in **ES Chapter 14: Noise and Vibration** (Doc Ref. 5.1).

18.8.184 The significance of the resultant effect is considered **minor adverse** (not significant) for population health for the same reasons as set out in paragraph 18.8.174. The conclusion gives weight to the effectiveness of the NIS, including modifying the Inner Zone boundary as necessary so that significant effects on health and quality of life would be avoided. Vulnerable population groups, including infants at the Bear and Bunny nursery have been taken into account in reaching this conclusion. A minor adverse effect is considered appropriate to reflect that not all people would take up the NIS and there may be practical limitations on its effectiveness for some people, eg for structural reasons, outdoor activities or due to personal choice to open windows in summer even where ventilation is provided.

Traffic Noise

18.8.185 The Project will influence the distribution of traffic on the local road network; it also includes highway improvements. Noise mitigation including traffic management and speed restrictions have been incorporated into the highway design.

18.8.186 Absolute noise levels and changes in noise exposure due to road traffic have been assessed in **ES Chapter 14: Noise and Vibration** (Doc Ref. 5.1), using Design Manual for Roads and Bridges (DMRB) methods. The assessment considers a selection of receptor locations, representing the closest nearby communities/dwellings to the Project.

18.8.187 As baseline noise levels were above the SOAEL in five of the seven receptors analysed for the daytime and four of the seven receptors analysed for the night-time, the change in noise

exposure is informative. Overall, noise reductions are predicted at the majority of receptors, with a worst-case increase in noise exposure of less than 2 dB at any receptor.

18.8.188 At Riverside Garden Park there are slight increases in noise in some areas and slight reductions in others. The changes are not expected to affect levels of community use of the park or associated health and wellbeing benefits.

18.8.189 A **low** magnitude of effect is expected from changes in road traffic noise. For both daytime and night-time traffic noise there is a *very low* change in exposure, albeit experienced *frequently* over the *long-term*. The change in exposure corresponds to a *minor* change in risk factors for sleep disturbance, cardio-metabolic and annoyance related morbidity and quality of life. The slight change in risk factors is likely to affect a *large minority* of the local population, reflecting changes along the highway network. This includes a professional judgment that there would be limited implications for public health from changes in noise levels between the LOAEL and SOAEL based on the analysis undertaken by **ES Chapter 14: Noise and Vibration** (Doc Ref. 5.1) that focuses on effects above SOAEL. The context of widespread baseline exceedances of SOAEL and the generally positive effects of the highway improvements in reducing noise levels is noted. As noted in Chapter 14: Noise and Vibration, no locations, including on the wider highway network, are expected to experience a change of 3dB or greater.

18.8.190 The significance of the resultant effect is considered **minor adverse** (not significant) for population health for the same reasons as set out in paragraph 18.8.174. The potential for the local population to experience slight changes, beneficial and adverse, in chronic exposure to traffic noise that may affect physiological health outcomes has been taken into account.

Design Year 2038

Air Noise

18.8.191 As noted previously, in line with proportionate reporting and following the approach in **ES Chapter 14: Noise and Vibration** (Doc Ref. 5.1), the assessment for Design Year 2038 is summarised only, as effects would be lower than those reported in 2032.

18.8.192 **ES Chapter 14: Noise and Vibration** (Doc Ref. 5.1) states that in all cases, noise contours are smaller, and levels forecast for 2038 with the Project are lower, than those forecast for 2032 with the Project. The effects of the Project would be lower than in 2032 and any mitigation provided for the impacts in 2032 would also be adequate in 2038.

18.8.193 Reporting here is limited to noting that the geographical area affected in 2038 is similar to that during 2032.

18.8.194 Table 18.8.25 and Table 18.8.26 summarise the change in population exposed between the LOAEL and the SOAEL and above the SOAEL.

18.8.195 In interpreting Table 18.8.25 and Table 18.8.26 see paragraphs 18.8.117 to 18.8.126 where it is clarified that 2032 remains the worst case assessment year.

Table 18.8.25: Summary daytime population exposed in 2038

	Baseline 2019	Difference between the 'DM' and 'With Project' scenarios		Slow transition case compared to Central Case
		Central Case	Slow Transition Case	
Between LOAEL of 51dB $L_{Aeq,16h}$ and SOAEL	23,550	3,300	2,800	-500
Above SOAEL of 63dB $L_{Aeq,16h}$	500	200	100	-100

Notes: Populations are estimated to the nearest 100, see further detail on noise model methods in ES Chapter 14: Noise and Vibration (Doc Ref. 5.1).

Table 18.8.26: Summary night-time population exposed in 2038

	Baseline 2019	Difference between the 'DM' and 'With Project' scenarios		Slow transition case compared to Central Case
		Central Case	Slow Transition Case	
Between LOAEL of 45dB $L_{Aeq,8h}$ and SOAEL	26,400	2,500	2,900	400
Above SOAEL of 55dB $L_{Aeq,8h}$	1,250	100	100	0

Notes: Populations are estimated to the nearest 100, see further detail on noise model methods in ES Chapter 14: Noise and Vibration (Doc Ref. 5.1).

18.8.196 It is concluded that the magnitude of the change due to the Project is **low** for the same reasons as set out in paragraph 18.8.170 (see 2032 assessment year).

18.8.197 It is concluded that the significance of the effect for population health is **minor adverse** (not significant) for the same reasons as set out in paragraph 18.8.171 (see 2032 assessment year).

18.8.198 Validating this conclusion, the health assessment has undertaken a quantitative analysis, summarised in Table 18.8.27. The analysis shows that the change in noise in this assessment year results in a very small influence on population health outcome measures. The model estimates daytime effects to the population in the noise contours of >51dB$_{Leq\ 16\ hr}$ and over, which is a population of approximately 13,000 people in the DM scenario and approximately 15,500 in the With Project scenario.

18.8.199 The change in depression incidence is estimated as equivalent to 1.041 people per year. Smaller changes (of less than one person per year) in incidence rates for stroke and IHD are also identified. The change in mortality risk for IHD across the affected population is equivalent to 0.187 (not actual mortality). Further details are set out in **ES Appendix 18.8.1: Quantitative Health Assessment Results** (Doc Ref. 5.3). The quantitative analysis is a pragmatic estimate of changes in selected health outcomes to identify the scale of change associated with the Project

changes, see **ES Appendix 18.4.1: Methods Statement for Health and Wellbeing** (Doc Ref. 5.3).

Table 18.8.27: Summary 2038 air noise population health outcome measures, Central Case and central CRF (difference between the 2038 'DM' and 2038 'With Project' scenarios)

Health Outcome (annual)	Change due to the Project (number)	Change as an Incidence Rate per 100,000 people	Change as a percentage of the baseline rate
Stroke incidence	0.138	0.83	0.000007%
Ischaemic Heart Disease (IHD) incidence	0.235	1.42	0.000008%
IHD mortality	0.187	1.13	0.000005%
Depression incidence (aircraft)	1.041	6.31	0.394%

Notes:

- The change per 100,000 people is to provide a standardised rate, as requested by public health stakeholders, as the affected population is much less than 100,000 there would not be this number of new cases.
- Change in mortality risk in the local population equivalent to this number of deaths (not actual deaths).

Ground Noise

18.8.200 As stated in **ES Appendix 14.9.3: Ground Noise Modelling** (Doc Ref. 5.3), noise barriers would be included as mitigation adopted as part of the Project to reduce ground noise. Once mitigation is taken into account, the worst-case increase in noise levels during the daytime period ($L_{eq\ 16\ hr}$) at any receptor location would be +6 dB, with some receptors experiencing a decrease of up to -1 dB. During the night-time period ($L_{eq\ 8\ hr}$), the worst-case increase in noise levels at any receptor location would be +5 dB, with some receptors experiencing a decrease of up to -3 dB.

18.8.201 The predicted levels are in the context of lower overall predicted noise levels with the Project in 2038 due to a larger proportion of quieter, next generation aircraft in the fleet.

18.8.202 As per the interim assessment year (2032), on the basis that the Inner Zone boundary would be modified as necessary so that significant effects on health and quality of life are avoided, the overall magnitude of impact on health and wellbeing would be **low**. In the context of a high sensitivity receptor, the significance of the resultant effect is considered **minor adverse**, which is not significant in terms of the EIA Regulations.

Traffic Noise

18.8.203 In line with proportionate reporting and following the approach in **ES Chapter 14: Noise and Vibration** (Doc Ref. 5.1), the assessment for Design Year 2038 is summarised only, as effects would be lower than those reported in 2047.

18.8.204 As stated in **ES Chapter 14: Noise and Vibration** (Doc Ref. 5.1), the DMRB does not require an assessment of road traffic noise in 2038. Instead, road traffic noise 15 years after the opening of the roads associated with the Project (2047) is assessed.

18.8.205 **ES Chapter 14: Noise and Vibration** (Doc Ref. 5.1) concludes that operational traffic noise impacts are anticipated to be less in 2038 than the impacts assessed from 2047.

18.8.206 It is concluded that the magnitude of the change due to the Project is **low** for the same reasons as set out in paragraph 18.8.221 (see 2047 assessment year, which references the justification in paragraph 18.8.189 linking back to the worst case 2032 assessment year).

18.8.207 It is concluded that the significance of the effect for population health is **minor adverse** (not significant) for the same reasons as set out in paragraph 18.8.222 (see 2047 assessment year, which references the justification in paragraph 18.8.190 linking back to the worst case 2032 assessment year).

Year 2047

Air Noise

18.8.208 As noted previously, in line with proportionate reporting and following the approach in **ES Chapter 14: Noise and Vibration** (Doc Ref. 5.1), the assessment for Design Year 2047 is summarised only, as effects would be lower than those reported in 2032.

18.8.209 **ES Chapter 14: Noise and Vibration** (Doc Ref. 5.1) states that in all cases, noise contours are smaller, and levels forecast for 2047 with the Project are lower, than those forecast for 2032 with the Project. The effects of the Project would be lower than in 2032 and any mitigation provided for the impacts in 2032 would also be adequate in 2047.

18.8.210 Reporting here is limited to noting that the geographical area affected in 2047 is similar to that during 2032.

18.8.211 Table 18.8.28 and Table 18.8.29 summarise the change in population exposed between the LOAEL and the SOAEL and above the SOAEL.

18.8.212 In interpreting Table 18.8.28 and Table 18.8.29 see paragraphs 18.8.117 to 18.8.126 where it is clarified that 2032 remains the worst case assessment year.

Table 18.8.28: Summary daytime population exposed in 2047

	Baseline 2019	Difference between the 'DM' and 'With Project' scenarios		Slow transition case compared to Central Case
		Central Case	Slow Transition Case	
Between LOAEL of 51dB $L_{Aeq,16h}$ and SOAEL	23,550	3,400	2,700	-700
Above SOAEL of 63dB $L_{Aeq,16h}$	500	200	100	-100

Notes: Populations are estimated to the nearest 100, see further detail on noise model methods in ES Chapter 14: Noise and Vibration (Doc Ref. 5.1).

Table 18.8.29: Summary night-time population exposed in 2047

	Baseline 2019	Difference between the 'DM' and 'With Project' scenarios		Slow transition case compared to Central Case
		Central Case	Slow Transition Case	
Between LOAEL of 45dB $L_{Aeq,8h}$ and SOAEL	26,400	2,500	3,500	1,000
Above SOAEL of 55dB $L_{Aeq,8h}$	1,250	100	100	0

Notes: Populations are estimated to the nearest 100, see further detail on noise model methods in ES Chapter 14: Noise and Vibration (Doc Ref. 5.1).

18.8.213 It is concluded that the magnitude of the change due to the Project is **low** for the same reasons as set out in paragraph 18.8.170 (see 2032 assessment year).

18.8.214 It is concluded that the significance of the effect for population health is **minor adverse** (not significant) for the same reasons as set out in paragraph 18.8.171 (see 2032 assessment year).

18.8.215 Validating this conclusion, the health assessment has undertaken a quantitative analysis, summarised in Table 18.8.30. The analysis shows that the change in noise in this assessment year results in a very small influence on population health outcome measures. The model estimates daytime effects to the population in the noise contours of >51dB$_{Leq\ 16\ hr}$ and over, which is a population of approximately 12,800 people in the DM scenario and approximately 16,400 in the With Project scenario.

18.8.216 The change in depression incidence is estimated as equivalent to 1.052 people per year. Smaller changes (of less than one person per year) in incidence rates for stroke and IHD are also identified. The change in mortality risk for IHD across the affected population is equivalent to 0.186 (not actual mortality). Further details are set out in **ES Appendix 18.8.1: Quantitative Health Assessment Results** (Doc Ref. 5.3). The quantitative analysis is a pragmatic estimate of changes in selected health outcomes to identify the scale of change associated with the Project changes, see **ES Appendix 18.4.1: Methods Statement for Health and Wellbeing** (Doc Ref. 5.3).

Table 18.8.30: Summary 2047 air noise population health outcome measures, Central Case and central CRF (difference between the 2047 'DM' and 2047 'With Project' scenarios)

Health Outcome (annual)	Change due to the Project (number)	Change as an Incidence Rate per 100,000 people	Change as a percentage of the baseline rate
Stroke incidence	0.137	0.84	0.000007%
Ischaemic Heart Disease (IHD) incidence	0.235	1.43	0.000008%
IHD mortality	0.186	1.14	0.000005%
Depression incidence (aircraft)	1.052	6.42	0.401%

Notes:

- The change per 100,000 people is to provide a standardised rate, as requested by public health stakeholders, as the affected population is much less than 100,000 there would not be this number of new cases.
- Change in mortality risk in the local population equivalent to this number of deaths (not actual deaths).

Ground Noise

18.8.217 In line with proportionate reporting and following the approach in **ES Chapter 14: Noise and Vibration** (Doc Ref. 5.1), the assessment for Design Year 2047 is summarised only as effects would be lower than those reported in 2032 and 2038.

18.8.218 **ES Chapter 14: Noise and Vibration** (Doc Ref. 5.1) concludes that due to the changing fleet which includes a greater number of next generation aircraft by 2047, the predicted ground noise (and subsequent effects) in the assessment year are lower than for both 2032 and 2038.

18.8.219 It is concluded that the magnitude of the change due to the Project is **low** for the same reasons as set out in paragraph 18.8.183 (see 2032 assessment year).

18.8.220 It is concluded that the significance of the effect for population health is **minor adverse** (not significant) for the same reasons as set out in paragraph 18.8.184 (see 2032 assessment year).

Road Traffic Noise

18.8.221 It is concluded that the magnitude of the change due to the Project is **low** for the same reasons as set out in paragraph 18.8.189 (see 2032 assessment year).

18.8.222 It is concluded that the significance of the effect for population health is **minor adverse** (not significant) for the same reasons as set out in paragraph 18.8.190 (see 2032 assessment year).

Conclusion

18.8.223 Overall, the **minor adverse** noise scores reflect that, whilst any increase in aviation (both air noise and ground noise) and surface access noise may be considered detrimental to some degree for public health, ie not negligible, the change due to the Project is not significant for population health in EIA Regulation terms.

18.8.224 The differences between the Central Case and the Slow Transition case have been considered and they are not considered to materially affect the conclusions as to the significance of the population health effects.

Further Mitigation and Future Monitoring

18.8.225 No further mitigation measures are proposed. Appropriate mitigation is discussed in **ES Chapter 14: Noise and Vibration** (Doc Ref. 5.1), including measures relevant to vulnerable groups in the NIS. Appropriate monitoring measures are discussed in Chapter 14: Noise and Vibration, including Flight Performance Team reports, annual Noise Contour Reports, and annual reporting against the Noise Envelope limits.

Significance of Effects

18.8.226 The residual significance of effects would remain unchanged, ie **minor adverse** (not significant) effects for population health.

Health and Wellbeing Effects from Changes in Transport Nature and Flow Rate

General

Approach

18.8.227 This section of the ES presents findings on the population health implications of changes in operational road traffic affecting road safety, travel times, accessibility and active/sustainable travel for community residents, emergency services, airport visitors/passengers and airport staff.

18.8.228 This section has been informed by **ES Chapter 12: Traffic and Transport** (Doc Ref. 5.1).

18.8.229 Consistent with the quantitative analysis discussed in **ES Chapter 12: Traffic and Transport** (Doc Ref. 5.1), this qualitative health assessment is based on a comparison between the with and without the Project scenarios for the assessment years of 2024-2029, 2029, 2032 and 2047. Consideration has also been given to the Central Case and Slow Fleet Transition Case for ATMs, including how this affects surface access. As noted in **ES Chapter 12: Traffic and Transport** Section 12.4, there is not a requirement for assessing traffic and transport effects in 2038. DMRB guidance requires assessment for opening year and plus 15-year assessment, which is covered as 2047.

18.8.230 The significance of the population health effect has had regard to the following evidence sources:

- Scientific literature summarised in paragraphs 18.8.232 to 18.8.235 indicates the strength of relationship between changes in severance (accessibility), road safety or pedestrian and cyclist amenity and changes in health outcomes.
- Baseline population health indicators relevant to transport are set out in Table 18.8.31. Further details are set out in **ES Appendix 18.5.2: Health and Wellbeing Baseline Data Tables** (Doc Ref. 5.3).
- Health priorities that have been taken into account from a review of local JSNAs and HWSs are set out in **ES Appendix 18.5.1: Health Baseline Trends, Priorities and Vulnerable Groups** (Doc Ref. 5.3).
- Health policy on the consideration of health in planning decisions and reference to promoting sustainable transport is set out in Section 18.2 and **ES Appendix 18.2.1: Summary of Local Planning Policy – Health and Wellbeing** (Doc Ref. 5.3).
- Consultation responses from health stakeholders and the public, as set out in Section 18.3 and **ES Appendix 18.3.1: Summary of Stakeholder Scoping Responses – Health and Wellbeing** (Doc Ref. 5.3) and the Project **Consultation Report** (Doc Ref. 6.1).
- Statutory standards and regulatory thresholds for health protection are not relevant to this determinant of health.

Health outcomes

18.8.231 The scientific literature identifies the following general points relevant to potential exposures and health outcomes. For road safety, health effects may be associated with the severity or frequency of road traffic incidents. For accessibility, health effects may be associated with emergency response times or non-emergency treatment outcomes associated with delays or non-attendance. For active/sustainable travel, health effects may relate to physical health (eg cardiovascular health) and mental health conditions (eg stress, anxiety or depression) associated with obesity and levels of physical activity.

18.8.232 Transportation is an important social determinant of health. The primary function of transport is the movement of people and goods between places, enabling access to employment, economic, and social opportunities as well as to essential services. Transport which is affordable and accessible may be viewed as an important determinant of health by facilitating access to key socio-economic opportunities. Inadequate transport provision may add to social exclusion among already vulnerable groups (Thomson, et al., 2008).

18.8.233 Injuries and deaths caused by motor-vehicles are indisputable and already closely monitored with many effective interventions in place to minimise this harm (Thomson, et al., 2008). Road traffic accidents as an unexpected traumatic event, may not only lead to death or serious physical injuries, but also puts survivors at an increased risk for a wide range of psychiatric disorders, particularly acute stress disorder (Dai, et al., 2018; Lin, et al., 2018). Lower socio-economic status, and riding on the road or pavements is associated with bicycling injury (Embree, et al., 2016). Bicycle-related injuries involving motor vehicles are associated with a high incidence of head injuries and extremity fractures. Age plays a critical role in the severity and anatomic distribution of injuries sustained, with a stepwise increase in mortality with increasing age (Lustenberger, et al., 2010).

18.8.234 Transportation barriers are important to healthcare access, particularly for those with lower incomes. Transportation barriers lead to rescheduled or missed appointments, delayed care, and missed or delayed medication use. These consequences may lead to poorer management of chronic illness and thus poorer health outcomes (Syed, et al., 2013).

18.8.235 Walking and cycling for transportation (ie active transportation), provide substantial health benefits from increased physical activity. Health gains exceed detrimental effects of traffic incidents and air pollution exposure (Mueller, et al., 2015). Active transport to work or school is significantly associated with improved cardiovascular health and lower body weight (Xu, et al., 2013). The provision of convenient, safe and connected walking and cycling infrastructure is at the core of promoting active travel (Winters, et al., 2017). Physically active transport (ie walking or cycling) has been directly related to increased residential density, street connectivity, mixed land use and amenities within a walkable distance (Thomson, et al., 2008).

Indicators

Table 18.8.31: Baseline – summary indicators relevant to transport health outcomes

Indicator Name	Units	Nine ward (mean)	HLSA (mean)	Six Authority Area (mean)	South East	England
Killed and seriously injured (KSI) casualties on England's roads	Per billion vehicle miles	NA	NA	145.8	97.7	95.6
Percentage of physically active children and young people (5-16 years)	%	NA	32.4	47.1	48.1	47.2
Percentage of physically active adults (19+ years)	%	NA	72.2	68.8	69.2	65.9

Percentage of adults walking for travel at least three days per week (16+ years)	%	NA	12.8	18.2	14.9	15.1
Percentage of adults cycling for travel at least three days per week (16+ years)	%	NA	1.4	2.2	2.4	2.3
Depression: QOF prevalence (18+ years)	%	NA	11.8	12.7	13.1	12.7

18.8.236 Table 18.8.31 shows transport related health outcomes. In the HLSA the percentage of adults, but not children and young people, who are physically active is better than the national and regional averages. Road safety statistics are not reported at the nine ward area or HLSA but are higher in the Six Authorities Area compared to regional and national comparators. In the HLSA the percentage of adults who walk or cycle for travel at least three days per week is lower than the regional and national averages. Notwithstanding this, the proportions of the population with a primary care depression diagnosis is lower in the HLSA compared to regional and national comparators (noting that active travel is only one contributing factor to mental health). Based on the data, high local sensitivity to active travel opportunity and road safety is assumed.

Likelihood

18.8.237 A potential population health effect is considered likely because there is a plausible source-pathway-receptor relationship:

- The source is vehicles on the road network.
- The pathway is changes in driver delay, severance, pedestrian delay, pedestrian amenity, public transport amenity and accidents and safety. This links with physical activity and active travel. It also links with emergency response times.
- Receptors are local road users, including those using motor vehicles as well as pedestrians and cyclists, as well as emergency services using the road network.

18.8.238 Furthermore, the potential effect is probable as no highly unusual conditions are required for the source-pathway-receptor linkage.

Populations

18.8.239 The population groups relevant to this assessment are:

- The ‘site-specific’ geographic population of communities in the **ES Chapter 12: Traffic and Transport** (Doc Ref. 5.1) study areas (Gatwick Airport area and Study Area links for assessment 1 & 2), the health sensitivity of which is indicatively based on representative wards close to the Airport, see paragraph 18.4.12.
- The ‘local’ geographic population of communities in the Chapter 12: Traffic and Transport Area of Detailed Modelling.
- The sub-population vulnerable due to:
  - Young age vulnerability (children and young people as potentially more vulnerable road users).
  - Old age vulnerability (older people as potentially more vulnerable road users).

- Low-income vulnerability (people living in deprivation, including those on low incomes for whom travel costs or alternatives may be limiting).
- Poor health vulnerability (people with existing poor physical and mental health in relation to health trip journey times).
- Access and geographical vulnerability (people who experience existing access barriers or who rely on the affected routes, including healthcare and other amenities).

18.8.240 Transportation barriers disproportionately affect the most vulnerable groups of society who carry the highest burden of chronic diseases; therefore, it is critical to identify interventions that improve access to transportation. Transportation services offered in combination with other tailored services improve health outcomes (Starbird, et al., 2019).

'Improving neighbourhood walkability, quality of parks and playgrounds, and providing adequate active transport infrastructure is likely to generate positive impacts on activity in children and adults' (Smith, et al., 2017) (p.24).

18.8.241 An activity friendly neighbourhood that is walkable, dense, accessible, equipped with walk/cycle facilities and safe from traffic is associated with more active transportation to school in children (D'Haese, et al., 2015). Traffic calming and presence of playgrounds/recreation areas are associated with more walking and less pedestrian injury amongst children (Rothman, et al., 2014).

Sensitivity of the population

18.8.242 The sensitivity of the population has had regard to the baseline, including JSNA findings, set out in Section 18.5, Table 18.8.31 and Appendices 18.5.1 and 18.5.2. Common factors that differentiate the sensitivity of the general population and the vulnerable group population have been taken into account and are listed in paragraph 18.4.29.

18.8.243 The sensitivity of the general population is **low**. This reflects that most people in the site specific and local study areas would only make occasional use of the affected section of the road network. It also includes those for whom the road network affords many alternative routes. The general population comprise those members of the community with a high capacity to adapt to changes in access, including changes in healthcare access, for example due to greater resources and good physical and mental health.

18.8.244 The sensitivity of the vulnerable group population is **high**. Vulnerability in this case is linked to mode of travel, including pedestrians and cyclists being more sensitive to road safety changes, age (young people and older people) being more vulnerable to accident severity, those reliant on services accessed on affected sections of the road network (eg traveling to schools) and those in areas of higher deprivation. Deprived populations may already face more access barriers compared to the general population and therefore be more sensitive to access changes. Low incomes may compound access barriers by limiting adaptive response. Vulnerability also includes those accessing health services (emergency or non-emergency) at times and locations affected by congestion. Ambulance services (and the recipients of their care) are particularly sensitive to delays in response times (time taken to arrive and stabilise the patient). Ambulances are generally less affected by congestion due to the priority given to them travelling under blue lights. People in poor or very poor health may be more frequent users of healthcare service and therefore be more sensitive to access changes.

18.8.245 These conclusions on sensitivity are common to all assessment years and are not repeated to avoid duplication.

Summary of measures taken into account

18.8.246 The measures set out in **ES Chapter 12: Traffic and Transport** (Doc Ref. 5.1) have been taken into account within the residual effects that have informed the health assessment. Further details are provided in **ES Chapter 12: Traffic and Transport** Section 12.8, including Table 12.8.1, which describes: surface access improvements for highways; surface access improvements for active travel; construction travel and traffic planning, including monitoring; and temporary diversion routes during construction.

18.8.247 Construction stage measures include those set out in the **Outline Construction Workforce Travel Plan** (ES Appendix 5.3.2: CoCP Annex 2 (Doc Ref. 5.3)) and the **Outline Construction Traffic Management Plan** (OCTMP) (ES Appendix 5.3.2: CoCP Annex 3 (Doc Ref. 5.3)).

18.8.248 Operation stage measures include highway improvements which form part of the Project (M23 Spur, Airport Way, North and South Terminal Roundabouts and Longbridge Roundabout). Surface Access Commitments (SACs) are set out in **ES Appendix 5.4.1: Surface Access Commitments** (Doc Ref. 5.3), such as on mode share for different types of transport options used to access the Airport. Traffic monitoring is also included within the SACs.

Initial Construction Period: 2024-2029

Introduction

18.8.249 As stated in **ES Chapter 12: Traffic and Transport** (Doc Ref. 5.1), only airfield construction traffic would be generated by the Project during this period, and the proposal is for the main route to the Airport for construction materials vehicles to be via the strategic road network and M23 Junction 9, except where this would not be appropriate (for instance for local suppliers). The estimated vehicle trip generation is 33 vehicles (Heavy Goods Vehicles (HGVs) and Light Goods Vehicles (LGVs)) in and out per hour along the M23 Spur, and 150 construction worker vehicles in the AM peak hour.

Severance

18.8.250 Community severance can occur when transport infrastructure or motorised traffic acts as a physical or psychological barrier to the movement of pedestrians, which has associated health and wellbeing effects.

18.8.251 As stated in **ES Chapter 12: Traffic and Transport** (Doc Ref. 5.1), no road link is expected to experience an increase in overall traffic flows of over 30% (ie the threshold for severance effects) as a result of the Project. Chapter 12: Traffic and Transport rates this as a negligible adverse effect.

Driver Delay

18.8.252 **ES Chapter 12: Traffic and Transport** (Doc Ref. 5.1) identifies the potential for some additional delay at junctions, including two in the Croydon area and one in Epsom. Chapter 12: Traffic and Transport identifies that most junctions (over 1,000) would experience negligible adverse effects and a very small number of junctions a minor adverse effect with no mitigation required.

Pedestrian and Cyclist Delay

18.8.253 **ES Chapter 12: Traffic and Transport** (Doc Ref. 5.1) notes that construction traffic has limited potential to interact with the main pedestrian and cyclist routes, which tend to be separated from the highway. Chapter 12: Traffic and Transport rates any effect as negligible adverse.

Pedestrian and Cyclist Amenity

18.8.254 As stated in **ES Chapter 12: Traffic and Transport** (Doc Ref. 5.1), a doubling of traffic volume or a change in traffic composition can adversely affect pedestrian and cyclist amenity. Any change in pedestrian and cyclist amenity can have associated impacts on health and wellbeing through the modification of healthy behaviour.

18.8.255 Traffic modelling indicates volumes would not double on any road link analysed. While there would be some change in traffic composition, the greatest change in the percentage of HGVs (number of HGVs divided by total vehicle number) is on Fell Road (Link: cy33) in the AM1[17] peak period, where the percentage of HGVs increases from 3.5% to 9.2%. This reflects the number of HGVs increasing from 9 to 23 on this link and other traffic remaining broadly the same. **ES Chapter 12: Traffic and Transport** (Doc Ref. 5.1) rates this as a minor adverse change, with effects elsewhere rated as negligible adverse.

Accidents and Safety

18.8.256 As stated in **ES Chapter 12: Traffic and Transport** (Doc Ref. 5.1), suitable measures to minimise the impact of construction-related traffic would be implemented as part of the **OCTMP** (ES Appendix 5.3.2: CoCP Annex 3 (Doc Ref. 5.3)). Following this, the effect on road safety due to predicted increases in construction-related traffic volumes is rated by Chapter 12: Traffic and Transport as negligible adverse.

Effects on Public Transport Amenity

18.8.257 **ES Chapter 12: Traffic and Transport** (Doc Ref. 5.1) notes that the number of construction workers travelling by rail is expected to be low and measures in the **Outline Construction Worker Travel Plan** (ES Appendix 5.3.2: CoCP Annex 2 (Doc Ref. 5.3)), including a bus service, and staggered shift start and end times would reduce pressure on public transport services. On this basis Chapter 12: Traffic and Transport expects a negligible adverse effect.

Conclusion

18.8.258 The magnitude of change due to the Project is **low**. This reflects that:

- In relation to road safety, a *small to negligible* scale of change in road traffic would have a corresponding very small increase in accident risk (simply as a function of traffic volumes). Such events would remain *occasional* over the *medium-term*. Severity relates to a very minor change in risk of injury or mortality (with outcome reversal gradual or permanent). *Very few* people would be affected, with *no or slight* implications for healthcare services.
- In relation to journey time, the change for those undertaking both short local journeys and long-distance travel on the wider highway network is potentially *frequent* but of *small to negligible* scale. Any changes in journey times are expected to continue over the *medium-*

[17] The AM Peak 1 is between 07:00 to 08:00.

term. Where the journey time reduction relates to healthcare access the change is likely to result in a *very minor* change in risk for morbidity or mortality associated with time critical treatment. The frequency with which health related journeys may be affected is likely to be *occasional*, with a *small minority* of people affected and *no or only slight* implications for healthcare services.

- In relation to active/sustainable travel the scale of change in use of active or public transport is *small to negligible*. The *medium-term* changes for those making *frequent or occasional* use of such transport modes are expected to make a *very minor* contribution to quality-of-life and morbidity (eg burden of cardiovascular disease and/or mental health) associated with physical activity for a *small minority* of the population. Sustained behavioural change due to the Project change is not expected.

18.8.259 The effect is characterised as being adverse in direction, temporary and due to direct and indirect health pathways. The significance of the population health effect is up to a **minor adverse** (not significant) effect due to the very slight reduction in road safety, slight increase in journey times and slight reduction in active travel amenity associated with increased traffic volumes. This is a conservative assessment finding. The conclusion reflects that whilst the scientific literature supports clear or causal associations between the Project changes and health outcomes, the changes to road safety, journey times and active or sustainable travel are of a scale that would have only a marginal effect on the delivery of health policy and, at most, a marginal influence on inequalities. The limited degree of change would result in very limited change from the local population health baseline.

18.8.260 Construction vehicle use of the strategic road network is expected to be monitored as part of the **OCTMP** (ES Appendix 5.3.2: CoCP Annex 3 (Doc Ref. 5.3)). No further mitigation or monitoring measures are proposed.

First Full Year of Opening: 2029

Introduction

18.8.261 As stated in **ES Chapter 12: Traffic and Transport** (Doc Ref. 5.1), the annual passenger numbers for 2029 are expected to increase from 57.3 million in the 2029 future baseline to 61.3 million with the Project, an increase of 4 million passengers per year. This would be accompanied by rail, bus and coach improvements (see Chapter 12) as part of the **ES Appendix 5.4.1: Surface Access Commitments** (Doc Ref. 5.3) and to support achieving GAL's mode share commitments.

Severance

18.8.262 There is no material difference from the **ES Chapter 12: Traffic and Transport** (Doc Ref. 5.1) assessment conclusions described for 2024-2029, (see paragraph 18.8.251). Chapter 12: Traffic and Transport rates any effect as negligible adverse.

Driver Delay

18.8.263 There is no material difference from the **ES Chapter 12: Traffic and Transport** (Doc Ref. 5.1) assessment conclusions described for 2024-2029, (see paragraph 18.8.252). Chapter 12: Traffic and Transport rates most effects as negligible adverse with a minor adverse at a very small number of junctions.

Pedestrian and Cyclist Delay

18.8.264 There is no material difference from the **ES Chapter 12: Traffic and Transport** (Doc Ref. 5.1) assessment conclusions described for 2024-2029, (see paragraph 18.8.253). Chapter 12: Traffic and Transport rates any effect as negligible adverse.

Pedestrian and Cyclist Amenity

18.8.265 The conclusions of **ES Chapter 12: Traffic and Transport** (Doc Ref. 5.1) are very similar to those described for 2024-2029. The highest increase in the percentage of HGVs (number of HGVs divided by total vehicle number) would be 2.8 percentage points on Northgate Road (link: NT3) in the AM2 peak. The predicted increase is from 18.6% to 21.3%. Chapter 12: Traffic and Transport rates any effect as negligible adverse.

Accidents and Safety

18.8.266 As stated in **ES Chapter 12: Traffic and Transport** (Doc Ref. 5.1), the predicted increases in traffic volumes are not expected to be significant and no changes to the highway layouts are proposed. Chapter 12: Traffic and Transport rates any effect as negligible adverse.

Effects on Public Transport Amenity

18.8.267 Additional passenger numbers would contribute to crowding on public transport, including rail services. **ES Chapter 12: Traffic and Transport** (Doc Ref. 5.1) concludes that there would be a minor adverse effect on rail crowding, taking into account northbound and southbound capacity, including standing capacity.

Conclusion

18.8.268 It is concluded that the magnitude of the change due to the Project is **low** for the same reasons as set out in paragraph 18.8.258 (see 2024-2029 assessment).

18.8.269 It is concluded that the significance of any adverse effect for population health is **minor adverse** (not significant) for the same reasons as set out in paragraph 18.8.259 (see 2024-2029 assessment).

18.8.270 In addition, there is an expected benefit to public health from a greater modal share of public transport being delivered where this results in sustained behavioural change. This effect is characterised as being positive in direction, permanent and due to direct and indirect health pathways. The significance of the population health effect is up to **minor beneficial** (not significant) and is due to the increase in active travel associated with use of public transport. The conclusion reflects that the scientific literature establishes a clear association between greater active travel, including as a component of multi-modal public transport use, and improved physical and mental health outcomes. The scale of the change may have a slight beneficial effect on the health baseline, with a consequent marginal benefit to delivering health policy. Such promotion of sustainable travel aligns with local health priorities relating to both obesity and air quality.

Highway Construction Period (2029 to 2032)

Introduction

18.8.271 As stated in **ES Chapter 12: Traffic and Transport** (Doc Ref. 5.1), the Project would include embedded highway improvement works providing grade separation of traffic movements at the North and South Terminal Roundabouts and upgrading the Longbridge Roundabout. The works are described in full in **ES Chapter 5: Project Description** (Doc Ref. 5.1). Diversions and temporary closures of lanes or roads would be required, with alternate routes in place and signposted. Work would be scheduled to avoid the busiest times. Night-working would be minimised but cannot be avoided altogether. Chapter 12: Traffic and Transport notes the roles of the **OCTMP** (ES Appendix 5.3.2: CoCP Annex 3 (Doc Ref. 5.3)) and **Outline Construction Workforce Travel Plan** (ES Appendix 5.3.2: CoCP Annex 2 (Doc Ref. 5.3)) in reducing impacts.

Severance

18.8.272 **ES Chapter 12: Traffic and Transport** (Doc Ref. 5.1) concludes that five links will experience a change of more than 30% in traffic flow during the highway construction period. Chapter 12: Traffic and Transport rates effects at Northgate Road, South Terminal Access, Reigate Road and Lee Street in Horley as minor adverse. The effect on the B2135 Steyning Road / Church Road is rated by Chapter 12: Traffic and Transport as moderate adverse.

Driver Delay

18.8.273 **ES Chapter 12: Traffic and Transport** (Doc Ref. 5.1) identifies temporary driver delay at a number of junctions, including due to lane closures and/or increases in traffic. The locations include: M23/M25 interchange; South Terminal - Airport Way Roundabout East / A23, Gatwick; London Rd / Airport Way, Gatwick; Longbridge Roundabout; and London Rd / A23. Chapter 12: Traffic and Transport finds that the junctions would operate within or close to capacity and that no mitigation is required and the overall effect of this phase of the Project on driver delay is considered to be minor adverse.

Pedestrian and Cyclist Delay

18.8.274 Works to the Longbridge Roundabout would require temporary changes to pedestrian and cycle routes. **ES Chapter 12: Traffic and Transport** (Doc Ref. 5.1) rates the effect as minor adverse. No change at other locations is expected.

Pedestrian and Cyclist Amenity

18.8.275 Traffic modelling indicates traffic volumes would not double on any road link analysed. Whilst there would be some large percentage changes in the proportion of HGVs on some roads, the absolute numbers are small. The largest change is of around an additional 18 HGV movements per hour. The **CoCP** (ES Appendix 5.3.2: Doc Ref. (5.3) and **OCTMP** (ES Appendix 5.3.2: CoCP Annex 3 (Doc Ref. 5.3) would direct Project and other Gatwick HGVs away from these routes. Construction works on Longbridge roundabout may temporarily reduce footway width/separation from traffic, which would affect amenity of these routes. **ES Chapter 12: Traffic and Transport** (Doc Ref. 5.1) rates the effects as minor adverse.

Accidents and Safety

18.8.276 As stated in **ES Chapter 12: Traffic and Transport** (Doc Ref. 5.1), suitable measures to minimise the impact of construction-related traffic would be implemented as part of the **OCTMP**

(ES Appendix 5.3.2: CoCP Annex 3 (Doc Ref. 5.3) . Following this, the effect on road safety due to predicted increases in construction-related traffic volumes is rated by Chapter 12: Traffic and Transport as minor adverse along the construction routes, and no change on all other roads.

Effects on Public Transport Amenity

18.8.277 Use of public transport is expected to increase due to airport passenger growth and members of the highway construction workforce who travel by rail. The effects on public transport capacity (overcrowding) are rated as negligible adverse by **ES Chapter 12: Traffic and Transport** (Doc Ref. 5.1).

Conclusion

18.8.278 It is concluded that the magnitude of the change due to the Project is **low** for the same reasons as set out in paragraph 18.8.258 (see 2024-2029 assessment).

18.8.279 It is concluded that the significance of any adverse effect for population health is **minor adverse** (not significant) for the same reasons as set out in paragraph 18.8.259 (see 2024-2029 assessment).

18.8.280 For this period of work the potential for a beneficial effect due to greater modal share of public transport is more limited, with any effect captured with the assessment conclusion for 2029, see paragraph 18.8.270.

Interim Assessment Year: 2032

Introduction

18.8.281 As stated in **ES Chapter 12: Traffic and Transport** (Doc Ref. 5.1), the annual passenger numbers for 2032 are expected to increase from 59.4 million in the future baseline to 72.3 million with the northern runway fully operational, an increase of 12.9 million passengers per year. To accommodate this forecast increase, the highway improvements which form part of the Project are anticipated to be completed by this point. This includes grade separation of traffic movements at South Terminal and North Terminal Roundabouts and improvements at Longbridge Roundabout.

Severance

18.8.282 **ES Chapter 12: Traffic and Transport** (Doc Ref. 5.1) concludes that eight links will experience a change of more than 30% in traffic flow during the highway construction period. Chapter 12: Traffic and Transport rates effects at Airport Way, A217 London Road, North Terminal Access, Longbridge Way, Gatwick Way, South Terminal Access and M23 J9 northbound slip as negligible adverse. The effect on the North Terminal Roundabout is rated by Chapter 12: Traffic and Transport as minor adverse.

Driver Delay

18.8.283 The highway improvements that would be in operation by this period aim to alleviate significant adverse changes in driver delay due to the Project.

18.8.284 **ES Chapter 12: Traffic and Transport** (Doc Ref. 5.1) identifies the potential for some additional delay at three junctions: M23 / M25 interchange, Gatwick / Perimeter Road North and M23 Junction 9 roundabout. The Chapter 12: Traffic and Transport review of these locations confirms

that there is sufficient capacity and therefore the effect would be minor adverse. For other junctions effects are negligible adverse.

Pedestrian and Cyclist Delay

18.8.285 The highway works improve pedestrian and cycle accessibility at the North Terminal, South Terminal and Longbridge Roundabout junctions, including separating these routes from traffic where practicable. Existing off-road routes and National Cycle Route 21 underneath Airport Way near South Terminal would also be retained. **ES Chapter 12: Traffic and Transport** (Doc Ref. 5.1) identifies minor beneficial effects.

Pedestrian and Cyclist Amenity

18.8.286 Traffic modelling indicates volumes would double on North Terminal Roundabout (Link ID: 006) and M23 Gatwick Interchange (Link ID: cl17). **ES Chapter 12: Traffic and Transport** (Doc Ref. 5.1) concludes these effects are minor adverse, which in part reflects the increased capacity following the highway improvements as well as other considerations discussed in Chapter 12: Traffic and Transport.

18.8.287 While there would be some change in traffic composition, the percentage of HGVs (number of HGVs divided by total vehicle number) on the road link which experience the highest increase in traffic flows is around 7% on Longbridge Way (Link ID: NT2) in the in the AM2 and PM periods, which **ES Chapter 12: Traffic and Transport** (Doc Ref. 5.1) identifies as a minor adverse effect. Effects elsewhere are rated as negligible adverse.

Accidents and Safety

18.8.288 As stated in **ES Chapter 12: Traffic and Transport** (Doc Ref. 5.1), the design of the proposed highway improvements would, in addition to surface improvements that promote safety, separate through traffic from the North Terminal and South Terminal Roundabouts. This would reduce traffic flows through the junctions and consequent risk of conflict. Chapter 12: Traffic and Transport concludes effects would be minor beneficial for the areas affected by the highway improvements, and negligible adverse on all other roads.

Effects on Public Transport Amenity

18.8.289 There is no material difference from the **ES Chapter 12: Traffic and Transport** (Doc Ref. 5.1) assessment conclusions described for 2029, (see paragraph 18.8.267). Chapter 12: Traffic and Transport rates any effect as minor adverse.

Conclusion

18.8.290 It is concluded that the magnitude of the change due to the Project is **low** for the same reasons as set out in paragraph 18.8.258 (see 2024-2029 assessment).

18.8.291 It is concluded that the significance of any adverse effect for population health is **minor adverse** (not significant) for the same reasons as set out in paragraph 18.8.259 (see 2024-2029 assessment).

18.8.292 In addition, there is an expected benefit to public health from a greater modal share of public transport being delivered. The effect relates to **ES Appendix 5.4.1: Surface Access**

Commitments (Doc Ref. 5.3) and the achieving of GAL's mode share commitments and is captured with the assessment conclusion for 2029, (see paragraph 18.8.270).

18.8.293 Furthermore, benefits would also accrue from the highway improvements, which include important active travel enhancements. Such improvement in pedestrian and cycle routes are likely to promote positive behavioural change. To avoid double counting, these benefits are discussed under the 'Lifestyle Factors' determinant of health.

Year 2047

Introduction

18.8.294 As stated in **ES Chapter 12: Traffic and Transport** (Doc Ref. 5.1), the annual passenger numbers for 2047 are expected to increase from 67.2 million in the future baseline scenario to 80.2 million with the Project, an increase of 13 million passengers per year. The highway improvements that opened in 2032 would continue to provide benefits in 2047.

Severance

18.8.295 **ES Chapter 12: Traffic and Transport** (Doc Ref. 5.1) concludes that 16 links will experience a change of more than 30% in traffic flow during the highway construction period. Chapter 12: Traffic and Transport rates effects at Airport Way, A217 London Road, North Terminal Roundabout, North Terminal Entry/Exit, Faraday Road (Croydon), Wentworth Drive (Crawley), Southbridge Road (Croydon), Coombe Road (Croydon), South End (Croydon), Lower Coombe Street (Croydon), St James's Road (Croydon), Lansdowne Road (Croydon), Bartlett Street (Croydon) and M23 J9 northbound slip as minor adverse. Two locations, Southbridge Road and Spierbridge Road, would experience a moderate adverse effect, although review of the modelling indicates that the apparent effects in these locations are likely to be related to changes in modelled outputs which are not expected to occur in practice, and both locations would experience a very small amount of traffic related to the Airport. Effects at other locations are rated as negligible adverse by Chapter 12: Traffic and Transport.

Driver Delay

18.8.296 **ES Chapter 12: Traffic and Transport** (Doc Ref. 5.1) identifies the potential for some additional delays, notably at 22 junctions. The Chapter 12: Traffic and Transport confirms that in some locations, the apparent effects in these locations are likely to be related to changes in modelled outputs which are not expected to occur in practice, and both locations would experience a very small amount of traffic related to the Airport. In other locations, the network would operate within or close to capacity and the overall performance of the network would not be materially affected. Overall for these locations, Chapter 12: Traffic and Transport concludes that the effects on driver delay would be minor adverse. For other junctions effects are negligible or minor adverse.

Pedestrian and Cyclist Delay

18.8.297 As noted in **ES Chapter 12: Traffic and Transport** (Doc Ref. 5.1), the highway improvements included as part of the Project would change some pedestrian and cycle routes at the North Terminal, South Terminal and Longbridge Roundabout junctions. The proposed changes to the Longbridge Roundabout include sections of segregated paths and new pedestrian and cycle signalised crossings on all arms. Other works include a new path connection for pedestrians and cyclists between Longridge roundabout and the airport on the western side of A23 London Road, a new shared-use ramp for pedestrians and cyclists to Riverside Garden Park, a new signal

controlled pedestrian crossing across A23 London Road. Chapter 12: Traffic and Transport identifies minor beneficial effects from these improvements.

Pedestrian and Cyclist Amenity

18.8.298 Traffic modelling indicates volumes would double on North Terminal Roundabout (Link ID: 006), M23 Gatwick Interchange (Link ID: cl17) and Southbridge Road, Croydon (Link ID: cy01). **ES Chapter 12: Traffic and Transport** (Doc Ref. 5.1) concludes effects are minor adverse for North Terminal Roundabout and M23 Gatwick Interchange, and moderate adverse for Southbridge Road, although on Southbridge Road the apparent effect is likely to be due to changes in the modelled outputs which are unlikely to occur in practice, and the location experiences very little airport-related traffic.

18.8.299 While there would be some change in traffic composition, the percentage of HGVs (number of HGVs divided by total vehicle number) on the road link which experiences the highest increase in traffic flows is around 12% on Northgate Road (Link ID: NT3) and 6% on Longbridge Way (Link ID: NT2), which **ES Chapter 12: Traffic and Transport** (Doc Ref. 5.1) identifies as a minor adverse effect. Effects elsewhere are rated as negligible adverse.

Accidents and Safety

18.8.300 There is no material difference from the **ES Chapter 12: Traffic and Transport** (Doc Ref. 5.1) assessment conclusions described for 2032, (see paragraph 18.8.288). Chapter 12: Traffic and Transport rates any effect as minor beneficial where highway improvements are proposed and negligible to minor adverse on all other roads.

Effects on Public Transport Amenity

18.8.301 There is no material difference from the **ES Chapter 12: Traffic and Transport** (Doc Ref. 5.1) assessment conclusions described for 2029, (see paragraph 18.8.267). Chapter 12: Traffic and Transport rates any effect as minor adverse.

Conclusion

18.8.302 It is concluded that the magnitude of the change due to the Project is **low** for the same reasons as set out in paragraph 18.8.258 (see 2024-2029 assessment).

18.8.303 It is concluded that the significance of any adverse effect for population health is **minor adverse** (not significant) for the same reasons as set out in paragraph 18.8.259 (see 2024-2029 assessment).

18.8.304 In addition, there is an expected benefit to public health from a greater modal share of public transport being delivered. The effect relates to **ES Appendix 5.4.1: Surface Access Commitments** (Doc Ref. 5.3) and the achieving of GAL's mode share commitments and is captured with the assessment conclusion for 2029 (see paragraph 18.8.270).

18.8.305 Furthermore, benefits would also accrue from the highway improvements, which include important active travel enhancements. Such improvement in pedestrian and cycle routes are likely to promote positive behavioural change. To avoid double counting, these benefits are discussed under the 'Lifestyle Factors' determinant of health.

Conclusion

18.8.306 Overall, **minor adverse** transport scores reflect that, whilst the increase in traffic volumes results in a very slight reduction in road safety, slight increase in journey times and slight reduction in active travel amenity, and this is considered detrimental to some degree for public health, ie not negligible, the change due to the Project is not significant for population health in EIA Regulation terms. The embedded mitigating role of highway improvements are taken into account and the active travel infrastructure improvements are discussed in the 'Lifestyle Factors' determinant of health to avoid double counting.

18.8.307 The differences between the Central Case and the Slow Transition Case have been considered and they are not considered to materially affect the conclusions as to the significance of the population health effects.

Further Mitigation and Future Monitoring

18.8.308 No further mitigation or monitoring measures are proposed. Appropriate monitoring is set out as part of the **OCTMP** (ES Appendix 5.3.2: CoCP Annex 3 (Doc Ref. 5.3)) and the **ES Appendix 5.4.1: Surface Access Commitments** (Doc Ref. 5.3).

Significance of Effects

18.8.309 The residual significance of effects would remain unchanged, ie **minor adverse** (not significant) effects for population health.

Health and Wellbeing Effects from Changes in Lifestyle Factors

General

Approach

18.8.310 This section of the ES presents findings on the population health implications of changes in availability of public areas of open space and active travel walking and cycling routes.

18.8.311 This section has been informed by **ES Chapter 19: Agricultural Land Use and Recreation** (Doc Ref. 5.1). The Chapter 19: Agricultural Land Use and Recreation conclusions use DMRB methodology (LA109 and LA112, Highways England *et al.,* (2019; 2020)) that has specific thresholds relating to the change in overall distance of routes. For public health, determining significance uses different methods (IEMA, see (Pyper, et al., 2022a)), with context being more important than absolute active travel routes distance changes.

18.8.312 Consistent with the analysis discussed in **ES Chapter 19: Agricultural Land Use and Recreation** (Doc Ref. 5.1), this qualitative health assessment is based on a comparison between the with and without the Project scenarios for the assessment periods of 2024-2029, 2030-2032, 2033-2038, 2038 and 2047. Consideration has also been given to the Central Case and Slow Fleet Transition Case for ATMs.

18.8.313 The significance of the population health effect has had regard to the following evidence sources:

- Scientific literature summarised in paragraphs 18.8.315 to 18.8.317 indicates the strength of relationship between changes in active travel or public open space access and changes in physical and mental health outcomes.

- Baseline population health indicators relevant to active travel and outdoor space are set out in Table 18.8.32. Further details are set out in **ES Appendix 18.5.2: Health and Wellbeing Baseline Data Tables** (Doc Ref. 5.3).
- Health priorities that have been taken into account from a review of local JSNAs and HWSs are set out in **ES Appendix 18.5.1: Health Baseline Trends, Priorities and Vulnerable Groups** (Doc Ref. 5.3).
- Health policy on the consideration of health in planning decisions and reference to promoting healthy lifestyles, opportunities for cycling and walking, the use of open space for recreation and physical activity, as set out in Section 18.2 and **ES Appendix 18.2.1: Summary of Local Planning Policy – Health and Wellbeing** (Doc Ref. 5.3).
- Consultation responses from health stakeholders and the public, as set out in Section 18.3 and **ES Appendix 18.3.1: Summary of Stakeholder Scoping Responses – Health and Wellbeing** (Doc Ref. 5.3) and the Project **Consultation Report** (Doc Ref. 6.1).
- Statutory standards and regulatory thresholds for health protection are not relevant to this determinant of health.

Health outcomes

18.8.314 The scientific literature identifies the following general points relevant to potential effects and health outcomes. The main health outcomes are likely to relate to the health benefits of accessing areas of public open space including physical activity, as well as general wellbeing benefits from social interactions, recreation, leisure and play. Health outcomes span physical health (eg cardiovascular health) and mental health (eg stress, anxiety or depression).

18.8.315 The availability of a natural environment and attractive views of nature within an individual's living environment are important contributors to physical activity. People's experiences in using the natural environment can enhance attitudes toward physical activity and perceived behavioural control via positive psychological states and stress-relieving effects, which lead to firmer intentions to engage in physical activity (Calogiuri & Chroni, 2014). Improvements in health behaviour influence health outcomes like mortality, chronic diseases, mental and obesity disorders (Salgado, et al., 2020). Physical activity can improve cognitive and mental health, particularly improvements in physical self-perceptions, which accompany enhanced self-esteem (Lubans, et al., 2016). Access to greenspace has beneficial associations with all-cause and stroke-specific mortality, cardiovascular disease morbidity, cardiometabolic factors, mental health, low birth weight, physical activity and sleep quality (Yang, et al., 2021).

18.8.316 There is evidence of an inverse association between surrounding greenness and all-cause mortality. Physical activity may explain only 2% of the association between green spaces and mortality. Other pathways include: attenuation of air pollution, noise, and heat-island effects; and stress reduction and improved relaxation and restoration (Rojas-Rueda, et al., 2019).

18.8.317 Transportation noise has the potential to affect health through various pathways. Because noise is a psychosocial stressor it is linked to physical activity, use of green spaces and social interactions. Greenness, having access to quiet areas, and covering noise sources either visually or acoustically with natural features seems to decrease people's negative responses to noise (Peris & Fenech , 2020).

Indicators

Table 18.8.32: Baseline – summary indicators relevant to lifestyle health outcomes

Indicator Name	Units	Nine ward (mean)	HLSA (mean)	Six Authority Area (mean)	South East	England
Violent crime - violence offences	per 1,000 population	NA	22.8	29.8	32.3	34.9
Reception: Prevalence of overweight (including obesity) (4-5 years)	%	NA	17.3	19.8	20.3	22.3
Year 6: Prevalence of overweight (including obesity) (10-11 years)	%	NA	28.1	33.7	34.0	37.8
Percentage of adults (aged 18+) classified as overweight or obese (18+ years)	%	NA	61.2	62.0	62.4	63.5
Percentage of physically active children and young people (5-16 years)	%	NA	32.4	47.1	48.1	47.2
Percentage of physically active adults (19+ years)	%	NA	72.2	68.8	69.2	65.9
Emergency hospital admissions for coronary heart disease	SAR	83.0	76.5	76.2	78.0	100.0
Emergency hospital admissions for stroke	SAR	78.6	77.0	89.4	90.2	100.0
Emergency hospital admissions for Myocardial Infarction (heart attack)	SAR	75.2	76.2	76.8	85.1	100.0
Emergency hospital admissions for intentional self harm	SAR	127.3	99.6	104.4	108.3	100.0

18.8.318 Table 18.8.32 shows that on most lifestyle related health outcomes the HLSA population perform better than the national and regional averages. This includes violent crime being well below the national average, which may influence outdoor leisure and physical activity behaviour. Rates of obesity amongst children in the HLSA are relatively low, though still a measure for improvement. This is despite the percentage of physically active children and young people being notably lower than the national average. For adults in the HLSA, there is both below average obesity and an above average percentage that are physically active. For the nine ward area there are fewer small area statistics available. For the nine ward area, physical health outcomes linked to lifestyle behaviours are better than average (ie emergency hospital admissions for coronary heart disease, stroke and heart attack). In contrast, emergency hospital admission for intentional self harm, as a general small area data indicator of mental health, are above the regional and national averages. It is noted that for both physical and mental health, lifestyle related behaviour is only one of multiple influences on such outcomes. Overall the data suggests particular sensitivity for mental health outcomes and in relation to opportunities for children to be physically active.

Likelihood

18.8.319 A potential population health effect is considered likely because there is a plausible source-pathway-receptor relationship:

- The source is changes in availability of public areas of open space and active travel walking and cycling routes, as well as noise generated by airport activities, notably aircraft movements.
- The pathway is behavioural change in levels of use of public open space, affecting physical activity and wellbeing outcomes.
- Receptors are residents in the local communities near the Airport and its flightpaths.

18.8.320 Furthermore, the potential effect is probable as no highly unusual conditions are required for the source-pathway-receptor linkage.

Populations

18.8.321 The population groups relevant to this assessment are:

- The 'site-specific' geographic population of communities likely to make regular use of active travel and recreational routes or amenities within the **ES Chapter 19: Agricultural Land Use and Recreation** (Doc Ref. 5.1) study, the health sensitivity of which is indicatively based on representative wards close to the Airport, (see paragraph 18.4.12). The Chapter 19: Agricultural Land Use and Recreation study area relates to the Project site boundary, which takes account of resources that lie immediately adjacent to the site or link to it, together with any areas that may be required for mitigation.
- Regard has also been had for the 'site-specific' geographic population in the **ES Chapter 14: Noise and Vibration** (Doc Ref. 5.1) zone of influence (see paragraph 18.8.107), in relation to the effect of noise on use of active travel routes and open spaces. For example, **ES Appendix 14.9.4: Road Traffic Noise Modelling** (Doc Ref. 5.3) discusses road transport effects at a range of receptor locations in Riverside Garden Park.
- The sub-population vulnerable due to:
  - Young age vulnerability (children and young people for access to play).
  - Old age vulnerability (older people for access to social interactions, recreation, active travel and leisure).
  - Low-income vulnerability (people living in deprivation, including those on low incomes for whom travel costs to alternative active travel routes and public open space may be limiting).
  - Poor health vulnerability (people with existing poor physical and mental health who particularly benefit from accessing active travel routes and public open space).
  - Access and geographical vulnerability (people who experience existing access barriers to alternative active travel routes and public open spaces).

18.8.322 Type-2-diabetes is a growing public health concern in children, adolescents and adults, which for adults can double the risk of depression and mental health comorbidity (McVoy, et al., 2022). Leisure-time physical activity is significantly associated with decreased risk of diabetes (Huai, et al., 2016). Engaging in leisure activities promotes wellbeing, particularly in those who are retired, with frequency and diversity of leisure opportunity being more important than time spent on leisure (Kuykendall, et al., 2015).

Sensitivity of the population

18.8.323 The sensitivity of the population has had regard to the baseline, including JSNA findings, set out in Section 18.5, Table 18.8.32 and Appendices 18.5.1 and 18.5.2. Common factors that differentiate the sensitivity of the general population and the vulnerable group population have been taken into account and are listed in paragraph 18.4.29.

18.8.324 The sensitivity of the general population is **low**. This reflects that most people in the study area would only make occasional use of the affected open spaces, eg because they live distant from them. It also includes those with access to many alternative public open spaces that are not affected. The general population comprise those members of the community with a high capacity to adapt to changes, for example due to greater resources and good physical and mental health.

18.8.325 The sensitivity of the vulnerable group population is **high**. Vulnerability in this case is linked to age and health status, as well as having fewer resources and less capacity to adapt to changes. The population may therefore be more reliant on the affected active travel routes or public open spaces, with greater likelihood of sustained behavioural change in how these assets are used.

18.8.326 These conclusions on sensitivity are common to all assessment years and are not repeated to avoid duplication.

Summary of measures taken into account

18.8.327 The measures set out in **ES Chapter 19: Agricultural Land Use and Recreation** (Doc Ref. 5.1) have been taken into account within the residual effects that have informed the health assessment. Further details are provided in **ES Chapter 19: Agricultural Land Use and Recreation** Section 19.8, including Table 19.8.1, which describes: provision of replacement open space; changes to a section of the Sussex Border Path (346_2sy) and a section of footpath 367Sy; a shared pedestrian and cyclist ramp into Riverside Garden Park; a pedestrian route linking Riverside Garden Park to replacement open space; temporary diversions and management measures; and new/improved recreational routes.

18.8.328 The proposed diversions are identified in **ES Appendix 19.8.1: Public Rights of Way Management Strategy** (Doc Ref. 5.3). This includes measures to avoid severance, safely maintain public access and provide monitoring. **ES Appendix 8.8.1: Outline Landscape and Ecology Management Plan** (Doc Ref. 5.3) also provides information on new routes and open spaces.

Initial Construction Period: 2024-2029

18.8.329 As stated in **ES Chapter 19: Agricultural Land Use and Recreation** (Doc Ref. 5.1), during the initial construction period there is the potential for disruption to access along public rights of way and national cycle route (NCR) 21:

- NCR 21 (12 weeks diversion)
- West Sussex footpath 355-1Sy (3 weeks diversion)
- Surrey footpath 355a (3 weeks diversion)
- Sussex Border Path (Surrey section) footpath 367 (8 weeks diversion)
- West Sussex footpaths 360Sy and Surrey 360 (27 weeks & 3 weeks diversions)
- West Sussex footpath 359Sy (some disruption but existing route maintained)

18.8.330 Permanent diversions, with access maintained throughout:

- West Sussex footpath 367 Sy to an alignment slightly south of its current location
- West Sussex Border Path section 346-2Sy to the north of Car Park Y close to its current alignment (with some temporary closure and diversion of a section prior to this)

18.8.331 Permanent technical closures, though route remains:

- Footpath 346-2Sy eastwards from North Terminal Roundabout changes to being the promoted route of the Sussex Border Path as part of the active travel improvements for both pedestrians and cyclists within Gatwick Airport.

18.8.332 New routes:

- An alternative Sussex Border Path lit segregated cyclist and pedestrian route option between the bridge over the River Mole located south of the Travelodge Hotel and North Terminal Roundabout.
- An additional shared pedestrian and cyclist ramp within Riverside Garden Park from the A23 footway near to the Longbridge Roundabout.
- A circular route around the flood compensation area in Museum Field.
- An additional pedestrian route linking Riverside Garden Park to Car Park B and to the Sussex Border Path.

18.8.333 Areas of public open space permanently lost:

- Approximately 1.03 hectares on the southern fringe of Riverside Garden Park (0.34 hectares of which is land within the park, the remainder relates to the highway embankment).
- Approximately 0.13 hectares on the southern part of areas of public open space at Church Meadows.

18.8.334 New permanent areas of public open space:

- Approximately 1.43 hectares of Car Park B to the north and south of the A23.
- Approximately 0.52 hectares of land west of the River Mole, linked to the existing Church Meadows by a pedestrian bridge over the River Mole.

18.8.335 The construction works in this period relate to changes at: Airport Way; the M23 Spur and South Terminal Roundabout; North Terminal Roundabout and A23 London Road (including Riverside Garden Park); and Longbridge Roundabout and A23 Brighton Road (including Church Meadow). There would also be spoil deposition on Pentagon Field, flood compensation in Museum Field and the wider area of environmental mitigation at Brook Farm.

18.8.336 The locations of diversions are shown on **ES Figures 19.9.1 a-d** (Doc Ref. 5.2) and the measures to safely maintain appropriate access are set out in **ES Appendix 19.8.2: Public Rights of Way Management Strategy** (Doc Ref. 5.3).

18.8.337 For Airport Way works there is the potential to reduce physical activity, including changes to established behavioural patterns, from the temporary closure of: the National Cycle Route 21 through the underpass between Riverside Garden Park and Gatwick Airport; public footpath 360-360Sy to the east of the railway; and West Sussex footpath 355-1Sy and Surrey footpath 355a. To avoid such an outcome the Project would include suitable diversions. These would be advertised in advance, clearly signposted and comparable in access related considerations. These diversions could increase journey times by around 10 to 15 minutes for walkers and a few

minutes for cyclists. The professional judgment of this assessment, including based on a site visit of these routes, is that this is considered acceptable in the context of them being long-distance routes and constrained alternatives. The temporary effects are unlikely to deter local population use or change patterns of physical activity behaviour.

18.8.338 For M23 Spur and South Terminal Roundabout works, the temporary closure of the Sussex Border Path (Surrey section) footpath 367 and the removal of mature trees and vegetation has the potential for behavioural change affecting population physical activity. However, a diversion that maintains appropriate access of the Sussex Border Path is provided. This diversion would be advertised in advance, clearly signposted and comparable in access related considerations. The diversion is part of a long-distance walking route and could add around 15 to 20 minutes walking journey time. This is not considered onerous in this context and contributes to the level of physical activity. The loss of screening would reduce amenity. The change may have a slight adverse effect on community identity drivers of quality of life and mental wellbeing. Whilst the amenity of the affected route sections is affected, the route connectivity is maintained, and visual amenity effects are of a transitory nature for users passing through this area. Effects would reduce over time with the maturing of new planting.

18.8.339 For Airport Way works and the M23 Spur and South Terminal Roundabout works the temporary diversions provide levels of access similar to those of the current routes. The opportunities to enhance access for vulnerable groups, including for those with additional sensory and mobility needs have been considered. Such measures are reflected within new permanent routes, such as the new section of the West Sussex Border Path section 346-2Sy to the north of Car Park Y.

18.8.340 For North Terminal Roundabout and A23 London Road works the new section of the West Sussex Border Path section 346-2Sy to the north of Car Park Y that would be created in advance of losing the existing route section is expected to be an improved experience for users. The additional shared pedestrian and cyclist ramp linking the A23 footway near to the Longbridge Roundabout with Riverside Garden Park provides an alternative walking route within the park. This is considered to be an improved pedestrian experience due to greater separation from close proximity to dual-carriageway traffic. The new park route would initially be in an area cleared of vegetation but would increase in amenity as the new planting matures. The new route may encourage increased active travel along this stretch. The Sussex Border Path would also have a new link to a circular route around the flood compensation area in Museum Field. This is considered an enhanced opportunity for access to open space and physical activity.

18.8.341 As set out in **ES Chapter 19: Agricultural Land Use and Recreation** (Doc Ref. 5.1), there would be some temporary (0.48 hectares) and permanent (1.03 hectares) land lost along the southern fringe of Riverside Garden Park associated with the widening of the A23 London Road. New open space (1.43 hectares) would be re-provided from areas of Car Park B to the north and south of the A23. Car Park B is adjacent to the east of Riverside Garden Park; the final implementation of this new land, including planting, would include a contiguous connection to Riverside Garden Park. This is considered appropriate open space reprovision to maintain community health and wellbeing benefits, albeit time would be required for planting to mature.

18.8.342 Longbridge Roundabout and A23 Brighton Road works would require a permanent loss of public open space associated with works to the Longbridge Roundabout. However, this would be re-provided with a larger area of new open space adjacent to Church Meadow. This includes a contiguous connection to Church Meadow via a new footbridge over the River Mole. This

reprovision, including its wider connectivity to Riverside Garden Park, St Bartholomew's Church and the former Anderson Centre and Playing Fields is considered positive and suitable mitigation. The segment of land adjacent to Longbridge Roundabout (east) along the River Mole that is accessed and partially cleared to allow the bridge construction adjoins Riverside Garden Park but is not publicly accessible. The change is neither expected to affect the open space related health benefits of the park, nor be a sufficient change in visual impact to affect population health.

18.8.343 **ES Chapter 19: Agricultural Land Use and Recreation** (Doc Ref. 5.1) concludes that there would be minor beneficial effects associated with the enchantments to open space and active travel routes, as well as some moderate adverse effects associated with temporary diversions, disruption and reduced amenity of affected open space until planting matures. For the public rights of way and national cycle route, the Chapter 19: Agricultural Land Use and Recreation conclusions relate to a DMRB methodology (LA109 and LA112, Highways England *et al.,* (2019; 2020)) that has specific thresholds relating to the change in overall distance of routes. For public health, determining significance uses different methods (IEMA, see (Pyper, et al., 2022a)), with context being more important than absolute active travel routes distance changes. The IEMA 2022 guidance does not set thresholds based on route length change. For public health, increases in route length may be beneficial for physical activity in a context of routes that are long-distance in any case, as is the case here.

18.8.344 **ES Chapter 8: Landscape, Townscape and Visual Resources** (Doc Ref. 5.1) conclusions in relation to moderate or major visual impacts for users of affected public open spaces and active travel routes are noted and taken into account. Those findings reflect there would inevitably be a high level of visual change during construction in some locations. For the health assessment this may contribute to decisions to use open space and active travel routes. However, it is noted that these views are for parts of areas or routes only. The professional judgement reached is that for most people the visual change would not be a reason to forgo use of these assets in their entirety. Consequently, the visual changes are unlikely to result in sustained behavioural change on a level that could significantly affect public health. Construction management measures contribute to reducing reductions in open space and route amenity, including those set out in **ES Appendix 5.3.2: Code of Construction Practice** (Doc Ref. 5.3), **ES Appendix 13.8.1: Air Quality Construction Phase Mitigation** (Doc Ref. 5.3) and **ES Appendix 19.8.2: Public Rights of Way Management Strategy** (Doc Ref. 5.3).

Conclusion

18.8.345 For adverse health effects, the magnitude of change due to the Project is **low**. This reflects that the changes in relatively short sections of some active travel routes affected by diversions are *short-term.* For these routes the scale of change is considered *small* given that appropriate diversions are provided, and that the diversion lengths and quality are appropriate to the context of these routes. The score also takes into account *short- to medium-term* reductions in the quantity and quality of available public open space. This includes due to land take, as well as due to construction noise and visual impacts associated with the works and construction compounds; the location of the latter are described in **ES Chapter 5: Project Description** (Doc Ref. 5.1). The reprovision of new open space is noted as an appropriate embedded mitigation, with its value realised once it was fully implemented and accessible to the public. Prior to such there would be some temporary *small*-scale reduction in public open space quantity and/or quality. During the periods of diversions or reduced open space availability, the changes would be *continuous*, however any effects to health behaviours would be expected to *rapidly reverse* once diversions

ended, and new amenities were in place. Given the embedded measures, including signposting in **ES Appendix 19.8.2: Public Rights of Way Management Strategy** (Doc Ref. 5.3) and updates on the changes, sustained behavioural change in active travel or use of public open space is unlikely. Any behavioural change would relate to *minor* changes in quality-of-life and physical and mental health morbidity for a *small minority* of the population, ie the proportion of the population making less frequent use of affected public open spaces and active travel routes. The scale of such change is *not* expected to have implications for healthcare service planning.

18.8.346 For beneficial health effects, the magnitude of change due to the Project is also **low**. This reflects the *long-term* availability of improved active travel routes and public open spaces that are expected to be used *frequently*. However, as they largely offset other losses, the new provisions represent a *small* scale of change compared to the baseline provision. These benefits are expected to be realised by a *large minority* of the people who make regular use of these route and areas of open space, eg communities in Horley, users of the NCR 21 and Sussex Border Path long-distance routes. The enhancements are likely to contribute to a *minor* risk reduction in cardiovascular and mental wellbeing morbidity where more regular active travel behavioural change is sustained.

18.8.347 The effect is characterised as being beneficial and adverse in direction, relating to both temporary and permanent changes and due to direct and indirect health pathways. The significance of the population health effect is up to **minor beneficial** (not significant) in relation to the discussed enhancements and **minor adverse** (not significant) in relation to the discussed disruptions. The conclusion reflects that that whilst the use of active travel routes and public open spaces is important for public health, as confirmed by *clear* causal associations in the scientific literature, *specific* local health priorities and health policy; the changes due to the Project are likely to have only *slight* influences (beneficial and adverse) on the population health baseline. Such changes would at most have a *marginal* effect on health inequalities and delivery of public health policy, eg on physical activity, mental health and obesity. The active travel routes and public open spaces are in a context of existing aviation and other urban noise, and this is unchanged with or without the Project, albeit with some overall improvements in the quality or routes and the quantity of public open space. Weight is given to the package of embedded mitigation described in: **ES Chapter 19: Agricultural Land Use and Recreation** (Doc Ref. 5.1) to provide comparable and accessible alternatives; **ES Chapter 14: Noise and Vibration** (Doc Ref. 5.1) in reducing levels of noise disruption; and **ES Chapter 8: Landscape, Townscape and Visual Resources** (Doc Ref. 5.1) for vegetation planting proposals that would enhance the quality of spaces and routes over time.

2030-2032

18.8.348 **ES Chapter 19: Agricultural Land Use and Recreation** (Doc Ref. 5.1) describes ongoing effects to a subset of the same active travel routes and public open spaces. For health, there are no material differences from the considerations and conclusions described for 2024-2029, see paragraphs 18.8.345 and 18.8.346 in relation to the magnitude of effects. The amenity of affected and new open spaces would increase in this time as planting matures. For the same reasons as set out in paragraph 18.8.347, there would be **minor adverse** (not significant) and **minor beneficial** (not significant) effects for population health.

2033-2038

18.8.349 By 2032 surface access works are anticipated to have been completed, so there would be no further associated disruption of active travel routes. The permanent effects of the Project on Riverside Garden Park are assessed following the establishment of the landscape planting.

18.8.350 **ES Chapter 19: Agricultural Land Use and Recreation** (Doc Ref. 5.1) finds that as the landscaped planting, including in the Car Park B replacement open space, would be maturing, the **ES Chapter 19: Agricultural Land Use and Recreation** temporary moderate adverse effects on Riverside Garden Park are no longer assessed to be present by 2038.

18.8.351 Any adverse effect during this period relates to reduced quality of routes and public open spaces due to acoustic and visual impacts. Visual effects are expected to reduce over time as planting matures (see **ES Chapter 8: Landscape, Townscape and Visual Resources** (Doc Ref. 5.1)). As noted in paragraph 18.8.188, levels of noise at Riverside Garden Park during this period are likely to increase in some locations and reduce in others, but not affect overall use of the park.

18.8.352 Such conclusions are considered representative of the overall influence of the Project on active travel routes and public open spaces. Consequently, for health, there are no material differences from the considerations and conclusions described for 2024-2029. See paragraphs 18.8.345 and 18.8.346 in relation to the magnitude of effects. For the same reasons as set out in paragraph 18.8.347, there would be **minor adverse** (not significant) and **minor beneficial** (not significant) effects for population health.

Design Year 2038

18.8.353 **ES Chapter 19: Agricultural Land Use and Recreation** (Doc Ref. 5.1) states that no further effects on recreational resources are anticipated as a result of the operation of the Project in the Design Year 2038.

18.8.354 For health, the same points as made for the 2033-2038 assessment period apply, albeit the adverse effects are likely to be declining, as visual and auditory disturbance reduces; and the beneficial effects are likely to be increasing, as quality of routes and spaces improve as planting matures. Conservatively, the effects are considered to be the same as set out in paragraph 18.8.347, ie **minor adverse** (not significant) and **minor beneficial** (not significant) effects for population health.

Year 2047

18.8.355 **ES Chapter 19: Agricultural Land Use and Recreation** (Doc Ref. 5.1) states that no further effects on recreational resources are anticipated as a result of the operation of the Project in the Design Year 2047.

18.8.356 For health the same points as made for the 2033-2038 assessment period apply, albeit the adverse effects are likely to be declining, as visual and auditory disturbance reduces; and the beneficial effects are likely to be increasing, as quality of routes and spaces improve as planting matures. Conservatively, the effects are considered to be the same as set out in paragraph 18.8.347, ie **minor adverse** (not significant) and **minor beneficial** (not significant) effects for population health.

Conclusion

18.8.357 Overall, **minor adverse** and **minor beneficial** lifestyle scores reflect that, whilst there would be some temporary reductions in active travel opportunity and temporary and permanent reductions in open space, there would also be diversions that maintain access and new open spaces are created. The embedded active travel enhancements, including as part of highway improvements, and the planting and amenity enhancements of new community open spaces are considered proportionate and beneficial. Whilst the disruption caused by the Project is considered detrimental to some degree for public health, ie not negligible, a sustained widespread reduction in active travel or use of outdoor spaces is not expected, including for vulnerable groups. The benefits for public health from the permanent improvements to active travel routes and greater areas of public open space created would be expected to support behavioural change for modest improvement in active travel and use of outdoor spaces, including for vulnerable groups. Consequently, changes, beneficial and adverse, due to the Project are not considered significant for population health in EIA Regulation terms.

18.8.358 The differences between the Central Case and the Slow Transition case have been considered and they are not considered to materially affect the conclusions as to the significance of the population health effects.

Further Mitigation and Future Monitoring

18.8.359 No further mitigation measures are proposed. Appropriate construction period monitoring is set out as part of the **Public Rights of Way Management Strategy** (ES Appendix 19.8.2) (Doc Ref. 5.3). The monitoring of the establishment of the landscaping proposals within the replacement areas of open space would be undertaken in accordance with the **Outline Landscape and Ecology Management Plan** (ES Appendix 8.8.1) (Doc Ref. 5.3).

Significance of Effects

18.8.360 The residual significance of effects would remain unchanged, ie **minor adverse** and **minor beneficial** (not significant) effects for population health.

Health and Wellbeing Effects from Changes in Socio-economic Factors

General

Approach

18.8.361 This section of the ES presents findings on the population health implications of increased employment and economic impacts. The implications of additional upskilling and educational support are also considered.

18.8.362 This section has been informed by **ES Chapter 17: Socio-economic Effects** (Doc Ref. 5.1).

18.8.363 Consistent with the quantitative analysis discussed in **ES Chapter 17: Socio-economic Effects** (Doc Ref. 5.1), this qualitative health assessment is based on a comparison between the with and without the Project scenarios for the assessment years of 2024-2029, 2029, 2032, 2038 and 2047. Consideration has also been given to the Central Case and Slow Fleet Transition Case for ATMs.

18.8.364 The significance of the population health effect has had regard to the following evidence sources:

- Scientific literature summarised in paragraphs 18.8.365 to 18.8.369 that indicates the strength of relationship between changes in employment and changes in health outcomes. Regard has also been given to issues of uncertainty reported in the literature and to the particular benefits of avoiding long-term unemployment.
- Baseline population health indicators relevant to employment are set out in Table 18.8.33. Further details are set out in **ES Appendix 18.5.2: Health and Wellbeing Baseline Data Tables** (Doc Ref. 5.3).
- Health priorities that have been taken into account from a review of local JSNAs and HWSs are set out in **ES Appendix 18.5.1: Health Baseline Trends, Priorities and Vulnerable Groups** (Doc Ref. 5.3).
- Health policy on the consideration of health in planning decisions and reference to use of national limit values as a refence point, as set out in Section 18.2 and **ES Appendix 18.2.1: Summary of Local Planning Policy – Health and Wellbeing** (Doc Ref. 5.3).
- Consultation responses from health stakeholders and the public, as set out in Section 18.3 and **ES Appendix 18.3.1: Summary of Stakeholder Scoping Responses – Health and Wellbeing** (Doc Ref. 5.3) and the Project **Consultation Report** (Doc Ref. 6.1).
- Statutory standards and regulatory thresholds for health protection are not relevant to this determinant of health.

Health outcomes

18.8.365 The scientific literature identifies the following general points relevant to potential effects and health outcomes. Employment is an important determinant of health and well-being both directly and indirectly by making health-promoting resources available to an employee and any dependants. The socio-economic benefits associated with employment are improved living conditions and the potential to make healthier choices, eg eating a healthier diet and undertaking more physical activity. If members of the community are employed, this can also generate indirect economic activity.

18.8.366 There is strong evidence for a protective effect of employment on depression and general mental health. Pooled effect sizes showed favourable effects on depression (OR=0.52; 95% CI 0.33 to 0.83) and psychological distress (OR=0.79; 95% CI 0.72 to 0.86) (van der Noordt, et al., 2014). Unemployment is associated with poor health outcomes, with more negative health effects linked to lower socio-economic status and unemployment due to health reasons, whilst a strong social network is beneficial in reducing the health effects of unemployment (Norström, et al., 2014).

18.8.367 The long-term unemployed carry a markedly higher burden of disease, particularly mental illness, than employed persons and those who are unemployed only for a short time. The burden of disease increases with the duration of unemployment (Herbig, et al., 2013). Job insecurity likely has an adverse effect on mental health (Rönnblad, et al., 2019). Job insecurity can pose a comparable threat to health as unemployment (Kim & von dem Knesebeck, 2015).

18.8.368 Increased educational attainment is associated with better health outcomes and delayed mortality. Education is an important indicator of socio-economic status and is associated with subsequent income, employment, social networks, and behaviours (Byhoff, et al., 2017).

18.8.369 Schooling improves the likelihood of good earnings (Lindeboom, et al., 2009) and is generally associated with better health (Behrman, et al., 2011).

Indicators

Table 18.8.33: Baseline – summary indicators relevant to socio-economic health outcomes

Indicator Name	Units	Nine ward (mean)	HLSA (mean)	Six Authority Area (mean)	South East	England
Inequality in life expectancy at birth (Male)	Years	NA	5.7	7.9	7.9	9.7
Inequality in life expectancy at birth (Female)	Years	NA	4.0	6.0	6.0	7.9
Children in absolute low income families (under 16s)	%	NA	9.6	12.0	11.6	15.1
16 to 17 year old's not in education, employment or training (NEET) or whose activity is not known	%	NA	NA	5.4	5.4	4.7
19-24 year old's not in education, employment or training	%	NA	NA	NA	11.8	NA
Percentage of people in employment (16-64 years)	%	NA	82.5	76.9	78.1	75.4
Average Attainment 8 score (15-16+ years)	Mean score	NA	53.1	52.0	52.1	50.9
Population who cannot speak English well or at all	%	2.0	0.8	1.3	0.9	1.7
Child poverty, income deprivation affecting children	%	13.9	9.2	14.2	12.4	17.1
Older people in poverty, income deprivation affecting older people	%	11.5	8.0	12.4	10.2	14.2

18.8.370 Table 18.8.33 shows that inequalities in life expectancy and children in absolute poverty are lower in the HLSA compared to regional and national averages. Data for these indicators for the nine ward area is not available. For the nine ward area increased sensitivity is assumed, including because the child and older people poverty income deprivation measures are both higher in comparison with the HLSA, though still below the national average. The percentage of NEETs in the Six Authority Area is similar to the regional average and below the national average. Employment and average attainment 8 scores in the HLSA are better than the regional and national averages. A higher proportion of people in the nine ward area compared to all comparators cannot speak English well or at all, which may be a relevant factor in improving access to employment and training opportunities.

Likelihood

18.8.371 A potential population health effect is considered likely because there is a plausible source-pathway-receptor relationship:

- The source is direct and indirect job creation and economic activity, as well as educational opportunities and support.
- The pathway is good quality employment providing more health supporting resources and protecting against adverse mental health effects, eg of long-term unemployment, as well as good quality education supporting socio-economic status and future employment benefits.
- Receptors are people of working age (and their dependants), particularly young adults commencing employment or engaging in training.

18.8.372 Furthermore, the potential effect is probable as no highly unusual conditions are required for the source-pathway-receptor linkage.

Populations

18.8.373 The population groups relevant to this assessment are:

- The 'local' population of areas defined by **ES Chapter 17: Socio-economic Effects** (Doc Ref. 5.1) (LSA, FEMA, LMA and Six Authorities Area); the health sensitivity of which is indicatively based on the Six Authorities Area, see paragraph 18.4.14.
- The 'regional' population of the South East.
- The sub-population vulnerable due to:
  - Young age vulnerability (children and young people as dependants).
  - Old age vulnerability (older people as dependants).
  - Low-income vulnerability (people for whom better quality employment may be particularly beneficial, including those who are living in deprivation, on low incomes, unemployed, in insecure jobs or shift workers, as well as people for whom training and upskilling would support progression to employment, or better quality employment).
  - Poor health vulnerability (people with existing poor physical or mental health, including as dependants).

18.8.374 For direct operational employment this population health analysis frames the assessment based on where the worker lives; and **ES Chapter 17: Socio-economic Effects** (Doc Ref. 5.1) frames their assessment based on where the worker works, ie in the LSA.

18.8.375 The evidence that large income differences have damaging health and social consequences is strong and in most countries inequality is increasing. Narrowing the gap will improve the health and wellbeing of populations (Pickett & Wilkinson, 2015). Socio-economically disadvantaged children are at higher risk of consuming poor diets, in particular less fruits and vegetables and more non-core foods and sweetened beverages (Zarnowiecki, et al., 2014). Socio-economically disadvantaged children and adolescents are two to three times more likely to develop mental health problems. Low socio-economic status that persisted over time is strongly related to higher rates of mental health problems. A decrease in socio-economic status is associated with increasing mental health problems (Reiss, 2013). Improvements in socio-economic determinants positively impact population health. Improvements in indicators like income, education, employment status and ethnic inclusion, are likely to result in a reduction in mortality and

morbidity outcomes, improving overall population health (Salgado, et al., 2020). Children from more socially and economically deprived families tend to have more difficulty in school (Gerhardstein, et al., 2012).

Sensitivity of the population

18.8.376 The sensitivity of the population has had regard to the baseline, including JSNA findings, set out in Section 18.5, Table 18.8.33 and Appendices 18.5.1 and 18.5.2. Common factors that differentiate the sensitivity of the general population and the vulnerable group population have been taken into account and are listed in paragraph 18.4.29.

18.8.377 The sensitivity of the general population is **low**. This reflects that most people would already be within stable employment that would be unaffected by the Project (or being a dependant of such a person). It also reflects that most people in the local area would make use of alterative educational or training opportunities or have existing educational attainment appropriate to their vocation and career progression.

18.8.378 The sensitivity of the vulnerable group population is **high**. Vulnerability in this case relates to people and their dependants who are on low incomes, have poor job security, poor working conditions or who are unemployed. Future young or older people may also come to rely on those employed. Vulnerability is also linked to young adults, in relation to apprenticeship opportunities, and children or young people, in relation to educational support initiatives. For both these groups those who are from disadvantaged backgrounds would be particularly sensitive to educational interventions that provide knowledge, new skills or personal development. Young people leaving education or early in their careers may have the most to gain from an increase in training opportunities as a pathway into good quality local employment.

18.8.379 These conclusions on sensitivity are common to all assessment years and are not repeated to avoid duplication.

Summary of measures taken into account

18.8.380 The measures set out in **ES Chapter 17: Socio-economic Effects** (Doc Ref. 5.1) have been taken into account within the residual effects that have informed the health assessment. Further details are provided in **ES Chapter 17: Socio-economic Effects** Section 17.8, including Table 17.8.1, which describes: construction compound welfare facilities; construction workforce and travel management; and economic opportunities for communities and business.

18.8.381 A key document is **ES Appendix 17.8.1: Employment, Skills and Business Strategy (ESBS)** (Doc Ref. 5.3), which sets out the strategy for how Gatwick will seek to enhance the skills, employment and training opportunities for both existing and new members of the labour market during construction and operation.

18.8.382 Furthermore, the **CoCP** (ES Appendix 5.3.2 (Doc Ref. 5.3)), includes additional measures including for a construction worker code of conduct and on community engagement.

Initial Construction Period: 2024-2029

18.8.383 Having a consistent income and being in long-term employment are two of the most important wider determinants of health. The construction period of the Project would offer a number of medium-term job opportunities. While job opportunities would vary in type, the majority of jobs available would be for construction workers.

18.8.384 As stated in **ES Chapter 17: Socio-economic Effects** (Doc Ref. 5.1), the directly employed construction workforce is anticipated to peak in February 2027 when the expected average daily figure is 1,350 workers (workforce numbers are rounded consistent with ES Chapter 17: Socio-economic Effects). This is the estimated peak maximum numbers of construction workers required for completing this period of the Project. Up to 205 construction workers are expected to be drawn from the LSA, 260 workers from the FEMA, 640 workers from the LMA and 810 workers from the Six Authorities Area. For 2024-2029, Chapter 17: Socio-economic Effects concludes there would be moderate beneficial effects for construction business and activity from direct employment in the LSA, FEMA and LMA, with a minor beneficial effect in the Six Authorities Area.

18.8.385 Regarding indirect employment opportunities generated within the supply chain, while the construction period is temporary in nature, it is still expected that there would be a sizeable impact on the construction supply chain due to the large scale nature of the Project. However, due to the specialist nature of some of the construction services required for the Project and on the basis that the number of enterprises in the area which could potentially benefit is small, it is unlikely that indirect employment opportunities generated would be captured locally, with leakage of associated health and wellbeing benefits to areas beyond the study area.

18.8.386 For direct beneficial employment and training opportunity related health effects, the magnitude of change due to the Project is **low**. This reflects a *small* scale of change within the context of the Six Authorities Study Area employment market. The employment would be *medium-term* and on a *continuous* basis, whether full-time or part-time. Such jobs and upskilling are likely to be associated with *minor* changes in *morbidity and quality of life* for a *small minority* of the population due to improved socio-economic status and increased spend on health supporting resources and activities (including through indirect benefits to dependants).

18.8.387 The roles are predominantly expected to be filled by existing residents (rather than an influx of new residents taking up these roles). The population effects are expected at the Six Authorities Study Area local level, but benefits would also extend both more broadly at the regional South East level and more locally at the LSA, FEMA and LMA levels.

18.8.388 The effect is characterised as being beneficial in direction, temporary and due to direct and indirect health pathways. The significance of the population health effect for this determinant of health is **minor beneficial** (not significant). The professional judgment is that there would be a *slight* beneficial change in the health baseline for the local population. This conclusion reflects that the scientific literature establishes a *clear* relationship between good quality employment and factors that promote health or are protective against poor health, particularly mental health. The scale and nature of employment is expected be *marginal* in narrowing health inequalities locally, and more generally supporting delivery of health policy to improve local population health.

First Full Year of Opening: 2029

Construction Related Employment

18.8.389 As stated in **ES Chapter 17: Socio-economic Effects** (Doc Ref. 5.1), the construction workforce peak for the 2030-2032 period is 1, 320 workers. This is the estimated peak maximum numbers of construction workers required for completing this period of the Project. Up to 290 workers are expected to be drawn from the LSA, 320 from the FEMA, 740 from the LMA and 880 from the Six

Authorities Area[18]. For 2030-2032, Chapter 17: Socio-economic Effects concludes there would be moderate beneficial effects for construction business and activity from direct employment in the LSA, FEMA and LMA, with a minor beneficial effect in the Six Authorities Area.

18.8.390 It is concluded that the magnitude of the change due to the Project is **low** for the same reasons as set out in paragraph 18.8.386.

18.8.391 It is concluded that the significance of the effect for population health is **minor beneficial** (not significant) for the same reasons as set out in paragraph 18.8.388.

Operational Related Employment

18.8.392 As stated in Annex 4 of **ES Appendix 17.9.2: Local Economic Impact Assessment** (Doc Ref. 5.3) in 2029, the Project would lead to an increase of 987 direct jobs nationally over the base case. Annex 4 reports that 293 of these direct jobs would be filled by workers from within the LSA, 408 in the FEMA, 690 in the LMA and 776 the Six Authorities Area. For 2029, **ES Chapter 17: Socio-economic Effects** (Doc Ref. 5.1) concludes there would be minor beneficial business, commercial activity and labour market effects associated with operational activity from direct employment activity in the LSA. There would also be indirect, induced and catalytic moderate beneficial effects in the FEMA and LMA, with minor benefits in the LSA and a negligible effect in the Six Authorities Area.

18.8.393 For direct operational employment and training opportunity related health effects, the magnitude of change due to the Project is **low**. The reasoning is similar to construction related magnitude set out in paragraph 18.8.386, albeit the effects of operational employment are more permanent and therefore longer-term. The operational jobs would provide a small minority of the population with minor benefits to physical and mental health *morbidity and quality of life*. The benefits would extend indirectly to dependants, including children, older adults and those in poor health requiring care.

18.8.394 The effect is characterised as being beneficial in direction, permanent and due to direct and indirect health pathways. The significance of the population health effect is **minor beneficial** (not significant). The professional judgment is that there would be a *slight* beneficial change in the health baseline for the local population. This conclusion reflects that the scientific literature establishes a *clear* relationship between good quality employment and factors that promote health or are protective against poor health, particularly mental health. The scale and nature of employment is expected to be *marginal* in narrowing health inequalities locally, and more generally supporting delivery of health policy to improve local population health.

Interim Assessment Year: 2032

Construction Related Employment

18.8.395 As stated in **ES Chapter 17: Socio-economic Effects** (Doc Ref. 5.1), the construction workforce peak for the 2033-2038 period is 450 workers. This is the estimated peak maximum numbers of construction workers required for completing this period of the Project. Around 100 workers will come from the LSA, 110 from the FEMA, 250 from the LMA and 300 from the Six Authorities

[18] The smaller geographic areas represent parts of the larger study areas and some workers are expected from beyond the Six Authorities Area.

Area. For 2033-2038, Chapter 17: Socio-economic Effects concludes there would be minor beneficial effects for construction business and activity from direct employment in the LSA, FEMA and LMA, with a negligible effect in the Six Authorities Area.

18.8.396 It is concluded that the magnitude of the change due to the Project is **negligible**. The scale of construction employment would be *very small* within the context of the local labour market, providing a *very small* minority of the population with employment and training opportunities that would have *minor* benefits for socio-economic related morbidity and quality of life outcomes.

18.8.397 It is concluded that the significance of the effect for population health is **negligible beneficial** (not significant). This reflects very limited change in the population health baseline from these levels of employment and training and limited potential to narrow inequalities or deliver socio-economic related health policy.

Operational Related Employment

18.8.398 As stated in Annex 4 of **ES Appendix 17.9.2: Local Economic Impact Assessment** (Doc Ref. 5.3), in 2032, the Project would lead to an increase of 3,122 direct jobs nationally over the base case. Annex 4 calculates that 942 of these direct jobs would be filled by people from within the LSA, 1,312 from the FEMA, 2,219 from the LMA and 2,461 from the Six Authorities Area. For 2032, **ES Chapter 17: Socio-economic Effects** (Doc Ref. 5.1) concludes there would be major beneficial business and commercial activity effects associated with operational direct employment in the LSA. There would also be indirect, induced and catalytic moderate beneficial effects in the LSA, FEMA and LMA, with minor benefits in the Six Authorities Area.

18.8.399 For direct operational employment and training opportunity related health effects, the magnitude of change due to the Project is **medium**. This reflects long-term continuous operational employment and upskilling opportunities. The change is considered to be medium scale within the local employment market. The operational jobs would provide a *small minority* of the population with minor benefits to physical and mental health *morbidity and quality of life*. The benefits would extend indirectly to dependants, including children, older adults and those in poor health requiring care.

18.8.400 The effect is characterised as being beneficial in direction, permanent and due to direct and indirect health pathways. The significance of the population health effect is **moderate beneficial** (significant). The professional judgment is that there would be a *small* beneficial change in the health baseline for the local population. This conclusion reflects that the scientific literature establishes a *clear* relationship between good quality employment and factors that promote health or are protective against poor health, particularly mental health. The scale and nature of employment is expected be *influential* in narrowing health inequalities locally, and more generally supporting delivery of health policy to improve local population health.

Design Year 2038

18.8.401 As stated in Annex 4 of **ES Appendix 17.9.2: Local Economic Impact Assessment** (Doc Ref. 5.3), in 2038, the Project would lead to an increase of 3,215 direct jobs nationally over the base case, which is the highest across the entire assessment period. Annex 4 calculates that 955 of these direct jobs would be filled by people from within the LSA, 1,330 from the FEMA, 2,249 from the LMA and 2,494 from the Six Authorities Area. For 2038, **ES Chapter 17: Socio-economic Effects** (Doc Ref. 5.1) concludes there would be major beneficial business and commercial

activity effects associated with operational direct employment in the LSA. There would also be indirect, induced and catalytic moderate beneficial effects in the LSA, FEMA and LMA, with minor benefits in the Six Authorities Area.

18.8.402 It is concluded that the magnitude of the change due to the Project is **medium** for the same reasons as set out in paragraph 18.8.399.

18.8.403 It is concluded that the significance of the effect for population health is **moderate beneficial** (significant) for the same reasons as set out in paragraph 18.8.400.

Year 2047

18.8.404 As stated in Annex 4 of **ES Appendix 17.9.2: Local Economic Impact Assessment** (Doc Ref. 5.3), in 2047, the Project would lead to an increase of 3,101 direct jobs nationally over the base case, which is lower compared to both the design year (2038) and the interim assessment year (2032) albeit at a marginal basis. It has been estimated that 921 of these direct jobs would be filled by people from within the LSA, 1,283 from the FEMA, 2,169 from the LMA and 2,405 from the Six Authorities Area. For 2047, **ES Chapter 17: Socio-economic Effects** (Doc Ref. 5.1) concludes there would be major beneficial business and commercial activity effects associated with operational direct employment in the LSA. There would also be indirect, induced and catalytic moderate beneficial effects in the LSA, FEMA and LMA, with minor benefits in the Six Authorities Area.

18.8.405 It is concluded that the magnitude of the change due to the Project is **medium** for the same reasons as set out in paragraph 18.8.399.

18.8.406 It is concluded that the significance of the effect for population health is **moderate beneficial** (significant) for the same reasons as set out in paragraph 18.8.400.

Conclusion

18.8.407 Overall, the **minor** to **moderate beneficial** socio-economic scores reflect that the Project would provide construction and operational employment and training opportunities that would benefit public health directly and indirectly. The moderate beneficial effects relate to a level of operational employment due to the Project that would be significant for population health in EIA Regulation terms.

Further Mitigation and Future Monitoring

18.8.408 The following measures that support good health are considered necessary as part of reducing adverse population health effects for vulnerable groups, particularly locally in areas such as Crawley, that have a baseline of poorer health outcomes. The Project would commit through **ES Appendix 17.8.1: ESBS** (Doc Ref. 5.3), to advertising and interviewing for jobs within the LSA and promoting the opportunities through channels accessible to vulnerable groups. Specifically, the Project would:

- As far as reasonably practicable (eg subject to standards and security checks) provide a targeted scheme of access to operational Airport training schemes and apprenticeships for young people in the local and regional area who are Not in Education, Employment, or Training (NEET).

- Work with local education and training providers to support opportunities to provide local adult learning linked to operational Airport related (or wider supply chain) job opportunities relevant to disadvantaged adults facing skills barriers to employment opportunities.

18.8.409 Monitoring of the proportion of local people (particularly the LSA) who are NEET, unemployed, have high job instability or low-income characteristics who enter good quality stable employment with the Project would support this measure. Monitoring would allow both the benefit to be confirmed and further tailoring to target local vulnerable groups if required.

Significance of Effects

18.8.410 With these additional measures, inequalities for vulnerable groups could be influentially improved. Where there is a successful and sustained intervention targeting those with existing disadvantage in the LSA, particularly young adults NEET and those in long-term unemployment, the following residual effect conclusions may be reached:

- In 2032, 2038 and 2047 the operational benefits could be improved up to **major beneficial** (significant).

18.8.411 These residual population health effect scores reflect the public health benefits of targeting project opportunities to vulnerable groups, even where the total number of jobs and apprenticeships is modest within the wider labour markets.

Health and Wellbeing Effects from Changes in Exposure to Light

General

Approach

18.8.412 This section of the ES presents findings on the population health implications of construction and operational lighting impacts.

18.8.413 This section has been informed by **ES Chapter 8: Landscape, Townscape and Visual Resources** (Doc Ref. 5.1).

18.8.414 Consistent with the analysis discussed in **ES Chapter 8: Landscape, Townscape and Visual Resources** (Doc Ref. 5.1), this health assessment is based on a comparison between the with and without the Project scenarios for the assessment periods of 2024-2029, 2030-2032, 2033-2038 and 2038. Consideration has also been given to the Central Case and Slow Fleet Transition Case for ATMs.

18.8.415 The significance of the population health effect has had regard to the following evidence sources:

- Scientific literature summarised in paragraph 18.8.417 that indicates the strength of relationship between changes in lighting and changes in health outcomes. Regard has been given to issues of uncertainty reported in the literature.
- Baseline population health indicators specifically relevant to light exposure are set out in Table 18.8.34. Further details are set out in **ES Appendix 18.5.2: Health and Wellbeing Baseline Data Tables** (Doc Ref. 5.3).
- Health priorities that have been taken into account from a review of local JSNAs and HWSs are set out in **ES Appendix 18.5.1: Health Baseline Trends, Priorities and Vulnerable Groups** (Doc Ref. 5.3). Specific health priorities relating to lighting have not been identified.

- Health policy on the consideration of health in planning decisions, including references to light pollution are set out in Section 18.2 and **ES Appendix 18.2.1: Summary of Local Planning Policy – Health and Wellbeing** (Doc Ref. 5.3).
- Consultation responses from health stakeholders and the public, as set out in Section 18.3 and **ES Appendix 18.3.1: Summary of Stakeholder Scoping Responses – Health and Wellbeing** (Doc Ref. 5.3) and the Project **Consultation Report** (Doc Ref. 6.1).
- Statutory standards and regulatory thresholds for health protection are not relevant to this determinant of health.

Health outcomes

18.8.416 The scientific literature identifies the following general points relevant to potential exposures and health outcomes. The main health outcomes are likely to relate to sleep disturbance, with tentative evidence of melatonin disruption effects on cancer risk and circadian rhythm disruption on cardiovascular risks. Changes in community identity due to visual impacts may also affect mental health outcomes.

18.8.417 Exposure to light at night has the potential to cause circadian disruption (He, et al., 2015). There is not strong evidence on health outcomes associated with night-time lighting. There is some evidence that high exposure to artificial light at night is associated with an increased risk for breast cancer (Urbano, et al., 2021). The main explanation for the increased risk of breast cancer is the impact of artificial light on reducing sleep duration and melatonin release. Melatonin is suggested as a carcinogenesis inhibitor; thus, low melatonin concentrations could contribute to breast cancer development (Rojas-Rueda, et al., 2021). Bright light exposure at night may also increase obesity risk by disrupting circadian rhythms and macronutrient metabolism (Choi, et al., 2022). Besides urban artificial light pollution, other sources of non-natural light at night are electronic devices (TVs, smartphones, tablets, computers, etc) or lights turned on during night at home or at the workplace. The correlation of night-time light with adverse health outcomes has not yet been able to rule out other potential causes (Urbano, et al., 2021).

Indicators

Table 18.8.34: Baseline – summary indicators relevant to light exposure health outcomes

Indicator Name	Units	Nine ward (mean)	HLSA (mean)	Six Authority Area (mean)	South East	England
Incidence of breast cancer (standardised incidence ratio per 100)	SIR	108.60	110.46	86.79	NA	100.00
Percentage of adults (aged 18+) classified as overweight or obese (18+ years)	%	NA	61.21	61.95	62.35	63.45

18.8.418 Table 18.8.34 references metrics referred to in the scientific literature as being associated with high exposures to artificial light at night. Such levels of exposure are not anticipated to occur outside of an occupational context. The metrics presented are therefore not indicative of increased sensitivity within the local community on this issue.

Likelihood

18.8.419 Potential effects on population health are considered likely because there is a plausible source-pathway-receptor relationship:

- The source is new temporary or permanent Project external lighting that provides a high degree of change in illumination.
- The pathway is changes in lighting levels at night affecting sleep or causing physiological or psychological changes in health outcomes.
- Receptors are residents and long-term occupiers of nearby properties and community buildings.

18.8.420 Furthermore, the potential effect is probable as no highly unusual conditions are required for the source-pathway-receptor linkage.

Populations

18.8.421 The population groups relevant to this assessment are:

- The 'site-specific' geographic population of communities is covered within the **ES Chapter 8: Landscape, Townscape and Visual Resources** (Doc Ref. 5.1) 5km radius zone of theoretical visibility, the health sensitivity of which is indicatively based on representative wards close to the Airport, (see paragraph 18.4.12). In practice, most relevant exposures are highly localised close to the airport and highways improvements.
- The sub-population vulnerable due to:
  - Young age vulnerability (children and young people for sleep disturbance).
  - Old age vulnerability (older people for sleep disturbance).
  - Low-income vulnerability (people on low incomes who may be less able to adapt to changes, as well as shift workers who may have greater sensitivity to disruption of melatonin levels and circadian rhythm).
  - Poor health vulnerability (people with existing poor physical and mental health who may be more sensitive to sleep disruption).
  - Access and geographical vulnerability (people for whom close proximity to project change increases sensitivity).

Sensitivity of the population

18.8.422 The sensitivity of the population has had regard to the baseline, including JSNA findings, set out in Section 18.5, Table 18.8.34 and Appendices 18.5.1 and 18.5.2. Common factors that differentiate the sensitivity of the general population and the vulnerable group population have been taken into account and are listed in paragraph 18.4.29.

18.8.423 The sensitivity of the general population is considered to be **low**. This reflects that most people in the site-specific area live at a distance from the Airport, Project construction compounds and areas of highway improvements that would not experience a change in lighting levels that could affect health outcomes. The reasons include distance from source as well as intervening shielding by other buildings, barriers or vegetation. This conclusion also reflects those members of the population with a high capacity to adapt, eg new or existing blackout blinds.

18.8.424 The sensitivity of vulnerable groups is considered **high**. This reflects the presence of populations (residents or workers) who (while at work or at home) are likely to spend extended periods exposed to a high level of lighting change. It also reflects the potentially higher sensitivity of some groups to light related sleep disturbance. The tentative relationships in the scientific literature for groups, such as shift workers, who may be affected by sustained melatonin or circadian rhythm disruption are acknowledged. However, such reasons for sensitivity are unlikely to be widespread, as the nature of the Project exposures in question are light-spill into community areas, not changes in occupational lighting exposures. The latter fall within occupational health and safety considerations that are beyond the scope of this assessment but would be appropriately managed by the contractor.

18.8.425 These conclusions on sensitivity are common to all assessment years and are not repeated to avoid duplication.

18.8.426 **ES Chapter 8: Landscape, Townscape and Visual Resources** (Doc Ref. 5.1) notes a range of lighting effects, including to landscape character areas, users of public rights of way and road or rail users. However, the health assessment focuses on the Chapter 8: Landscape, Townscape and Visual Resources discussion of effects to occupiers of residential and commercial buildings, Gatwick employees and users of public open spaces, such as Riverside Garden Park. Only these effects are considered to have the potential for population health effects relating to lighting exposures. Wider distant visual impacts, including but not limited to lighting, that may affect mental health and wellbeing through changes in community identity are discussed in the section of this assessment on changes to lifestyle factors, (see paragraph 18.8.310 onwards).

Summary of measures taken into account

18.8.427 The measures set out in **ES Chapter 8: Landscape, Townscape and Visual Resources** (Doc Ref. 5.1) have been taken into account within the residual effects that have informed the health assessment. Further details are provided in **ES Chapter 8: Landscape, Townscape and Visual Resources** Section 8.8, including Table 8.8.1, which describes: the vegetation retention strategy; planting, including woodland and trees; earth shaping, embankments, and cuttings or bunds; fences, walls or barriers; and enhancing existing green infrastructure. Further detail on these measures is set out in **ES Appendix 8.8.1: Outline Landscape and Ecology Management Plan** (Doc Ref. 5.3).

18.8.428 Construction lighting is discussed in Section 4.9 of the **CoCP** (ES Appendix 5.3.2 (Doc Ref. 5.3) and there is an **Operational Lighting Framework** (ES Appendix 5.2.2 (Doc Ref. 5.3)), which takes into account the Guidance Notes for the Reduction of Obtrusive Light (Institute of Lighting Professionals, 2011).

Initial Construction Period: 2024-2029

18.8.429 Temporary lighting during construction would be required to provide a safe and appropriate working environment. As stated in **ES Chapter 8: Landscape, Townscape and Visual Resources** (Doc Ref. 5.1), lighting changes are also associated with activities including the replacement purple parking at Car Park X, the replacement of the Central Airfield Maintenance and Recycling (CARE) and the replacement fire training ground.

18.8.430 As described in **ES Chapter 8: Landscape, Townscape and Visual Resources** (Doc Ref. 5.1), the night-time lighting effects contribute to the following findings for occupiers of residential properties with private views:

- 2 dwellings would have views of the Longbridge roundabout contractors compound and construction activities, with short-term minor to moderate effects (rated as not-significant in Chapter 8: Landscape, Townscape and Visual Resources).
- 18 dwellings would have filtered views of construction activities, the temporary River Mole bridge and clearer views of the petrol station on Brighton Road, with short-term minor to moderate effects (rated as not-significant in Chapter 8: Landscape, Townscape and Visual Resources).
- 4 dwellings would have views of the A23 and traffic and views of the Holiday Inn and Airport Inn Gatwick would be more open, with short-term minor to moderate effects (rated as not-significant in Chapter 8: Landscape, Townscape and Visual Resources).
- 1 dwelling would have partially visible views of traffic using the M23 Spur, with a short-term minor effect (rated as not-significant in Chapter 8: Landscape, Townscape and Visual Resources).

18.8.431 There would be some lighting effects to occupiers of commercial properties and hotels, specifically the office building at Meadowcroft House. The location is adjacent to the contractor compound for the South Terminal roundabout improvements. During the winter there would be views of the construction compound lighting. **ES Chapter 8: Landscape, Townscape and Visual Resources** (Doc Ref. 5.1) identifies this as a minor adverse effect. However, occupiers of an office building with views of external lighting is not considered a relevant exposure that could result in population health effects, ie is unlikely to cause melatonin or circadian rhythm disruption.

18.8.432 The magnitude of change due to the Project is **negligible**. This reflects that the scale of change in lighting that could affect public health is *small* and is within the context of areas with existing residential, commercial, airport and highway lighting. There is *very low*, exposure to residential locations that could cause sleep disturbance, public open space that could affect behavioural change, or occupational settings that could materially affect melatonin or circadian rhythm disruption. Effects at a given location would be *short to medium-term* and *frequent to occasional* depending on night-working requirements. However, the severity of impact is likely to be limited to a *minor* change in *quality of life* for a *very few* people. The effects would *immediately* reverse on removal of light sources, with *no* implications for healthcare services.

18.8.433 The effect is characterised as being adverse in direction, temporary and due to direct and indirect health pathways. The significance of the population health effect is **negligible adverse** (not significant). There is *very limited* potential for a change in the population health baseline due to the Project's lighting requirements. The scientific literature shows *clear* associations with the potential for sleep disturbance and *suggestive* association for other outcomes. For all health outcomes the Project lighting strategy and embedded design provides appropriate mitigation. Lighting changes would have *no* effect on the delivery of health policy, including in relation to inequalities.

Initial Construction Period: 2030-2032 (Interim Assessment in ES Chapter 8: Landscape, Townscape and Visual Resources (Doc Ref. 5.1))

18.8.434 Temporary lighting during construction would be required to provide a safe and appropriate working environment. As stated in **ES Chapter 8: Landscape, Townscape and Visual**

Resources (Doc Ref. 5.1), lighting changes are also associated with activities including: mast lighting for aircraft Pier and Stand amendments; lighting columns associated with surface access improvements; and red aviation obstruction lights on the top of the CARE facility flue.

18.8.435 Highway improvement construction works would require lighting for night work. This is likely to have some amenity impact at the fringe of Riverside Garden Park. Wider lighting effects within the park are not expected. A change in level of use of the park due to temporary construction lighting for night working is not expected to be on a scale which could affect health outcomes. Construction lighting associated with the highway improvements would be managed in accordance with the lighting strategy to avoid excessive light spill to surrounding residential properties. No population level effect on sleep disturbance is expected.

18.8.436 As described in **ES Chapter 8: Landscape, Townscape and Visual Resources** (Doc Ref. 5.1), the night-time lighting effects contribute to the following findings for occupiers of residential properties with private views:

- 2 dwellings would continue to have views of the Longbridge roundabout contractors compound and construction activities, with short-term minor to moderate effects (rated as not-significant in Chapter 8: Landscape, Townscape and Visual Resources).
- 18 dwellings would have filtered views of construction activities, the temporary River Mole bridge and clearer views of the petrol station on Brighton Road, with short-term minor to moderate effects (rated as not-significant in Chapter 8: Landscape, Townscape and Visual Resources).
- 4 dwellings would have views of the construction activities at the A23, with short-term minor to moderate effects (rated as not-significant in Chapter 8: Landscape, Townscape and Visual Resources).
- 87 dwellings at the Horley Residential Edge would have some filtered views of the A23 North Terminal and South Terminal roundabouts construction activities (including a lit corridor of works visible at night filtered through vegetation against a backdrop of skyglow from the airport), with medium-term minor effects (rated as not-significant in Chapter 8: Landscape, Townscape and Visual Resources).
- 1 dwelling would have views of construction activities at the A23 and Balcombe Road overbridge, with a short-term minor effect (rated as not-significant in Chapter 8: Landscape, Townscape and Visual Resources).

18.8.437 Construction related effects to public open space are as described in paragraph 18.8.435 for the 2024-2029 assessment period. There would be some lighting effects to occupiers of commercial properties, specifically:

- members of the public using the McDonalds and KFC at South Terminal; and
- occupants of the office building at Meadowcroft House, with continuing minor adverse effects due to views of lighting associated with the adjacent contractor compound for the South Terminal roundabout improvements.

18.8.438 For health the same conclusions on magnitude that were made for the 2024-2029 assessment period apply, ie the level of change has **negligible** implications for population heath. The reasons are set out in paragraph 18.8.432. This takes into account the additional very limited exposures at the 87 dwellings at the Horley Residential Edge. Whilst some views that include night-time lighting are likely, an effect on sleep disturbance or other light related health outcomes is unlikely.

18.8.439 Similarly, the same conclusions reached for the 2024-2029 assessment period apply, ie a **negligible adverse** (not significant) effect to population health due to Project lighting changes for the reasons set out in paragraph 18.8.433.

Initial Construction Period: 2033-2038 (Interim Assessment in ES Chapter 8: Landscape, Townscape and Visual Resources (Doc Ref. 5.1))

18.8.440 Temporary lighting during construction would be required to provide a safe and appropriate working environment. As stated in **ES Chapter 8: Landscape, Townscape and Visual Resources** (Doc Ref. 5.1), lighting changes are also associated with filtered views through trees and shrubs of moving traffic on completed sections of the highway improvements. People using public open space, specifically Riverside Garden Park, would also have views of lighting from passing vehicles, which would be more visible due to reduced vegetation until new planting matured.

18.8.441 There would be some lighting effects to occupiers of commercial properties. Members of the public using the McDonalds and KFC at the South Terminal, as well as occupants of the office building at Meadowcroft House, would have views of lighting from lighting columns and passing vehicles on the South Terminal roundabout and flyover. Such transitory views of external lighting are not considered a relevant exposure that could result in population health effects, ie are unlikely to cause melatonin or circadian rhythm disruption and are not associated with sleep disturbance.

18.8.442 As described **ES Chapter 8: Landscape, Townscape and Visual Resources** (Doc Ref. 5.1), the night-time lighting effects contribute to the following findings for occupiers of residential properties with private views:

- 2 dwellings would have views of the completed Longbridge roundabout, including due to traffic, signage and lighting, with long-term minor to moderate effects (rated as not-significant in Chapter 8: Landscape, Townscape and Visual Resources).
- 18 dwellings would have heavily filtered views of the Longbridge roundabout, traffic, hotels and petrol station, with long-term minor to moderate effects (rated as not-significant in Chapter 8).
- 4 dwellings would have views of the A23, traffic, lighting, widened River Mole overbridge and the footpath ramp, with the Holiday Inn and Airport Inn Gatwick beyond, with long-term minor to moderate effects (rated as not-significant in Chapter 8: Landscape, Townscape and Visual Resources) for three of the dwellings and a major effect at one dwellings (rated as significant in Chapter 8: Landscape, Townscape and Visual Resources).
- 87 dwellings at the Horley Residential Edge would have some filtered views of the A23 North Terminal and South Terminal junctions including flyovers, moving traffic and lighting, as well as a general intensification of infrastructure within views, with long-term negligible effects (rated as not-significant in Chapter 8: Landscape, Townscape and Visual Resources).
- 1 dwelling would have views of traffic, lighting and the Balcombe Road overbridge, with a long-term minor effect (rated as not-significant in Chapter 8: Landscape, Townscape and Visual Resources).

18.8.443 The magnitude of change due to the Project is **low**. This reflects a *small* scale of change in views of traffic and of light spill (by highway lighting and by other vehicles) at Riverside Garden Park and a small number of residential locations. It is noted that lighting changes are in the context of areas with existing residential, commercial, airport and highway lighting. The changes have some

limited potential to cause sleep disturbance or behavioural change in the use of public open space (Riverside Garden Park) but are unlikely to result in melatonin or circadian rhythm disruption. Effects at a given location would be *medium- to long-term* (reflecting the time for vegetation screening to mature) and *frequent* in terms of passing traffic at night. The severity of impact is likely to be limited to a *minor* change in *quality of life,* or a *very minor* change in physical activity, mental wellbeing or sleep related *morbidity* outcomes. Such effects would, at most, be experienced by a *small minority* of the population. This reflects that very few residential properties are affected and the small scale of increase in evening and night-time filtered views of illuminated traffic in parts of Riverside Garden Park is not expected to strongly influence overall use of the park. The effects would *gradually* reverse as vegetation matures, with *no* implications for healthcare services.

18.8.444 The effect is characterised as being adverse in direction, temporary and due to direct and indirect health pathways. The significance of the population health effect is **minor adverse** (not significant). There is potential for, at most, a *slight* change in the population health baseline due to a sustained increase in filtered views of moving traffic. The effect is driven by changes in the amenity of parts of Riverside Garden Park, particularly in winter. At the level of lighting change expected, there is very limited potential for effects on sleep disturbance or other outcomes described in the scientific literature. Any effect would at most have a *marginal* effect on inequalities and delivery of health policy.

Design Year 2038 and Beyond

18.8.445 As stated in **ES Chapter 8: Landscape, Townscape and Visual Resources** (Doc Ref. 5.1), lighting changes are associated with operation of the North and South Terminal roundabouts, flyovers and A23 improvements, including vehicle lights and lighting columns.

18.8.446 People using public open space, specifically Riverside Garden Park would have views of lighting from passing vehicles, which would be more visible due to reduced vegetation until new planting matured. Effects are expected to be greater in winter months due to shorter daylight hours and less vegetative screening by deciduous species. Effects would however reduce over time as vegetation matures.

18.8.447 There would be some lighting effects to occupiers of commercial properties. Occupants of the office building at Meadowcroft House, as well as the Amadeus Building and Schlumberger House Commercial Properties at South Terminal, would have views of lighting from lighting columns and passing vehicles on the South Terminal roundabout and flyover. For Gatwick staff, at night, lighting columns would be slightly more apparent in some locations, creating a slight intensification of effects in a well-lit context. Such views of external lighting are unlikely to affect public health, as described for other assessment years.

18.8.448 As set out for the 2033-2038 assessment period, occupiers of a small number of residential properties with private views of areas of Project highway improvements would continue to experience lighting from lighting columns or passing vehicles, which would be more visible due to reduced vegetation until new planting matured.

18.8.449 For health the same conclusions on magnitude that were made for the 2033-2038 assessment period apply, ie a **low** magnitude as set out in paragraph 18.8.443, albeit the adverse effects are likely to be declining, as planting matures.

18.8.450 Similarly, the same conclusions reached for the 2033-2038 assessment period apply, ie a **minor adverse** (not significant) effect to population health due to Project lighting changes for the reasons set out in paragraph 18.8.444. Conservatively, the effects are considered to be the same as for the 2033-2038 assessment period, though likely to become negligible over the longer-term as planting matures.

Conclusion

18.8.451 Overall, the **minor adverse** lighting effect scores reflect that, whilst increases in night-time light exposure may be considered detrimental to some degree for public health, ie not negligible, the change due to the Project is not significant for population health in EIA Regulation terms.

18.8.452 The differences between the Central Case and the Slow Transition case have been considered and they are not considered to materially affect the conclusions as to the significance of the population health effects.

Further Mitigation and Future Monitoring

18.8.453 The following measure is necessary to reduce localised individual level adverse effects on sleep disturbance, avoiding the potential for population level effects. The community fund to provide discretionary support for owners of dwellings specified in the **ES Chapter 8: Landscape, Townscape and Visual Resources** (Doc Ref. 5.1) assessment with bedrooms newly exposed to significant night-time direct or filtered near views of traffic or construction compounds. This would be on a case-by-case basis as a response to specific complaints about chronic lighting related sleep disturbance.

Significance of Effects

18.8.454 The residual significance of effects would remain unchanged, ie up to **minor adverse** (not significant) effects for population health.

Health and Wellbeing Effects from Changes to Water Quality, Flood Risk and Ground Conditions

General

Approach

18.8.455 This section of the ES presents findings on population health implications of potential pollution releases and flood risk.

18.8.456 This section has been informed by **ES Chapter 10: Geology and Ground Conditions** (Doc Ref. 5.1) and **ES Chapter 11: Water Environment** (Doc Ref. 5.1).

18.8.457 Sources of contaminants may include runway de-icer contaminated runoff, new spills or leaks of hazardous substances and/or historical land uses. Occupational soil contamination exposures are governed by statutory health and safety requirements, appropriately avoiding or reducing risks to the construction workforce, including through working practices, management plans and personal protective equipment. For the community, the potential for exposures may either be via water, as discussed in this section, or via construction dusts as discussed from paragraph 18.8.1. Given restricted access to Project construction areas, including due to fencing, it is unlikely that there is the potential for the community to have direct contact with contaminated soils to an extent that

could affect public health. Similarly, due to the measures in the **CoCP** (ES Appendix 5.3.2 (Doc Ref. 5.3)), including the Construction Dust Management Plan, and level of effect described in **ES Chapter 13: Air Quality** (Doc Ref. 5.1), it is unlikely that there would be community exposures due to airborne contaminant pathways. The focus of this assessment is therefore the mobilisation of any contaminants identified in **ES Chapter 10: Geology and Ground Conditions** (Doc Ref. 5.1), through waterborne pathways to human receptors described in **ES Chapter 11: Water Environment** (Doc Ref. 5.1). It is noted that this pathway is limited due to the presence of impermeable geology indicated to directly underlie the majority of the site.

18.8.458 Consistent with the analyses discussed in **ES Chapter 10: Geology and Ground Conditions** (Doc Ref. 5.1) and **ES Chapter 11: Water Environment** (Doc Ref. 5.1), this qualitative health assessment is based on a comparison between the with and without the Project scenarios for the assessment periods of 2024-2029, 2029-2032 (2030-2032 assessed in Chapter 10: Geology and Ground Conditions and 2029-2032 assessed in Chapter 11: Water Environment), 2032-2038 (2033-2038 assessed in Chapter 10: Geology and Ground Conditions and 2032-2037 assessed in Chapter 11: Water Environment), 2038, 2047. Consideration has also been given to the Central Case and Slow Fleet Transition Case for ATMs.

18.8.459 The significance of the population health effect has had regard to the following evidence sources:

- Scientific literature summarised in paragraphs 18.8.460 and 18.8.462 indicate the strength of relationship between changes in exposure to pollutants or toxins and changes in health outcomes.
- Baseline population health indicators specifically relevant to water quality have not been identified.
- Health priorities that have been taken into account from a review of local JSNAs and HWSs are set out in **ES Appendix 18.5.1: Health Baseline Trends, Priorities and Vulnerable Groups** (Doc Ref. 5.3).
- Health policy on the consideration of health in planning decisions, including that pollution control regimes should be assumed to operate effectively, as set out in Section 18.2 and **ES Appendix 18.2.1: Summary of Local Planning Policy – Health and Wellbeing** (Doc Ref. 5.3).
- Consultation responses from health stakeholders and the public, as set out in Section 18.3 and **ES Appendix 18.3.1: Summary of Stakeholder Scoping Responses – Health and Wellbeing** (Doc Ref. 5.3) and the Project **Consultation Report** (Doc Ref. 6.1).
- Regulatory thresholds for controlled waters health protection considered under **ES Chapter 10: Geology and Ground Conditions** (Doc Ref. 5.1) and **ES Chapter 11: Water Environment** (Doc Ref. 5.1), eg as set out in the Water Supply (Water Quality) Regulations 2016.

Health outcomes

18.8.460 The key health outcomes potentially relevant to this determinant of health arise from exposure to contaminated drinking water. It is less likely that adverse community health effects would be associated with surface water bathing given the local context.

18.8.461 The scientific literature identifies the following general points relevant to potential exposures and health outcomes. Recreational exposure to natural toxins by skin contact, accidental swallowing of water or inhalation can cause a wide range of acute or chronic illnesses (Koreivienė, et al., 2014). Climate change is likely to affect the infectious disease burden from exposure to

pathogens in water used for drinking and recreation (Sterk, et al., 2013). Drinking water supplies from both surface water and groundwater sources may be contaminated during flooding events (Andrade, et al., 2018). Use of spray irrigation with contaminated water is a risk factor for microbial contamination in fruits and vegetables. Avoiding microbial contamination of irrigation water and soil is effective for the prevention and control of produce contamination (Park, et al., 2012).

18.8.462 The safety of water supplies is of paramount public health importance. Good hydration is vital for good health and well-being. There is increasing evidence of the links between water intake and physical disease and cognitive performance (Gandy, 2015). Although microbiological contamination is the largest contribution to waterborne disease and mortality at a global scale, chemical contaminants in water supplies also can cause disease, sometimes after long periods of exposure. Water supplies often include mixtures of chemical contaminants at negligible concentrations that vary in time and space. However, drinking-water quality is regulated and monitoring is conducted routinely (Villanueva, et al., 2014). This ensures that drinking water guidelines are not exceeded.

Likelihood

18.8.463 A potential population health effect is considered likely because there is a plausible source-pathway-receptor relationship:

- The source is runway de-icer contaminated runoff, new spills or leaks of hazardous substances and/or historical land uses.
- The pathway is transmission through surface and/or groundwater, including flooding. Exposure is primarily related to potential ingestion, but also has regard to dermal contact of surface and groundwater. Flood risk in itself as a pathway to physical and mental health outcomes is also considered.
- Receptors are residents in the local communities near the Airport and users of relevant public water supplies.

18.8.464 Furthermore, the potential effect is probable as no highly unusual conditions are required for the source-pathway-receptor linkage.

Populations

18.8.465 The population groups relevant to this assessment are:

- The ‘site-specific’ geographic population of communities is covered within **the ES Chapter 10: Geology and Ground Conditions** (Doc Ref. 5.1) 500m buffer zone around the Project site and the **ES Chapter 11: Water Environment** (Doc Ref. 5.1) 2km radius beyond the Project site boundary. For both, the health sensitivity is indicatively based on representative wards close to the Airport, (see paragraph 18.4.12). Consideration is also given to the population that could potentially be affected by any effect to public water supplies of Southern Water or Sutton and East Surrey Water (SES Water).
- The sub-population vulnerable due to:
  - Young age vulnerability (children and young people as more sensitive to contaminants).
  - Old age vulnerability (older people as more sensitive to contaminants).
  - Poor health vulnerability (people with existing poor physical or mental health, as more sensitive to contaminants).

18.8.466 In general, the scientific literature indicates that communities where polluting human activities are sited often show disadvantage in terms of social and economic variables. The majority of associations support an increased burden on vulnerable categories, especially ethnic minorities and unemployed. However, several relationships are found in the opposite direction or in both ways, particularly with wealth and education, reflecting a mixed reality where potential discrimination in siting decisions coexists with socio-economic benefits for nearby communities due to industrial development (Davide, et al., 2022).

Thresholds and non-threshold effects

18.8.467 The assessment of risk from ingestion of surface and groundwater is based on UK statutory standards for water quality (Water Supply (Water Quality) Regulations 2016) (HM Government, 2016) but has also been informed by WHO targets (WHO, 2022c). The Water Supply Regulations set out measures to protect the quality of water intended for human consumption.

Sensitivity of the population

18.8.468 The sensitivity of the population has had regard to the baseline, including JSNA findings, set out in Section 18.5 and Appendices 18.5.1 and 18.5.2. Common factors that differentiate the sensitivity of the general population and the vulnerable group population have been taken into account and are listed in paragraph 18.4.29.

18.8.469 The sensitivity of the general population is **low**. This reflects many people would make limited use of areas where exposures to ground contaminants or flood risks are anticipated to occur and do not make regular use of waters (for drinking or bathing) that could experience contamination due to the Project. The general population also includes those who are in good health and less likely to be adversely affected by contaminants.

18.8.470 The sensitivity of the vulnerable group population is **high**. Vulnerability in this case relates to people more sensitive due to life stage or health status. For example, children and young people may spend more time outdoors and due to developmental stage or relative body size have increased risks from a given toxin exposure. Increased sensitivity to exposure may also apply to older people and those with existing poor health (eg long-term illness). These groups would be more sensitive to accidental short-term exposure to any ground or waterborne pollutants, eg playing along the River Mole, fishing in Riverside Garden Park pond or potable supplies being affected by run-off during high precipitation or flooding events. Children, older people, people with existing poor health and people on low incomes are also more sensitive to health outcomes associated with flooding. These include not only direct risks to safety from flood waters but also secondary economic and mental health effects from property damage. There may also be secondary infection risks if water, including wastewater, damage is not appropriately remediated.

18.8.471 These conclusions on sensitivity are common to all assessment years and are not repeated to avoid duplication.

Summary of measures taken into account

18.8.472 The measures set out in **ES Chapter 10: Geology and Ground Conditions** (Doc Ref. 5.1) have been taken into account within the residual effects that have informed the health assessment. Further details are provided in **ES Chapter 10: Geology and Ground Conditions** Section 10.8, including Table 10.8.1. This includes measures applicable to the construction phase which would

be implemented as part of the **CoCP** (ES Appendix 5.3.2 (Doc Ref. 5.3) secured as a **DCO requirement in Schedule 2** (Doc Ref. 2.1), and these include:

- Ground contamination discovery and remediation strategies
- Materials Management Plan
- Measures to prevent and control spillage of oil, chemicals and other potentially harmful liquids, including appropriate storage and handling of materials and products in accordance with the Control of Pollution (Oil Storage) (England) Regulations 2001
- Groundwater protection measures, including good environmental practices based on legal responsibilities and guidance on good environmental management in: CIRIA C532 Control of Water Pollution from Construction Sites – Guidance for Consultants and Contractors (CIRIA, 2001)
- Implementation of control measures, use of appropriate personal protective equipment and adoption of high levels of personal hygiene by construction workers, including health and safety risk assessments to be completed prior to construction workers in line with Construction (Design and Management) Regulations 2015.

18.8.473 Measures applicable to the operational phase have also been taken into account within the residual effects that have informed the health assessment. These include (further details in **ES Chapter 11: Water Environment** (Doc Ref. 5.1) Table 11.8.1):

- Provision of compensatory flood storage
- Additional attenuation storage within the existing airfield surface water drainage network
- Provision for new airfield syphons
- Surface access improvements drainage strategy
- Additional de-icer treatment from Long Term Storage Lagoons
- Wastewater System Capacity Upgrades
- Geomorphological mitigation for River Mole renaturalised channel and valley
- Groundwater mitigation, including detailed design considerations to minimise risk to groundwater quality, groundwater impedance and groundwater flooding.

Initial Construction Period: 2024-2029

Ground Conditions (2024-2029)

18.8.474 Construction activities that involve breaking the ground surface and disturbing soil and perched groundwater have the potential to influence human health as a result of exposure to contaminants via a range of exposure pathways (dermal contact, ingestion and inhalation).

18.8.475 As stated in **ES Chapter 10: Geology and Ground Conditions** (Doc Ref. 5.1), potential areas of concern (PAOC) exist within the Project site, where elevated concentrations of contaminants could exist. Chapter 10: Geology and Ground Conditions lists PAOC locations associated with initial construction period ground works. In these circumstances, remediation strategies as part of the **CoCP** (ES Appendix 5.3.2 (Doc Ref. 5.3) would ensure minimal risk to human health upon completion of the development. In addition, construction workers would be provided with appropriate protective equipment to limit any temporary exposure, as set out in the **CoCP** (ES Appendix 5.3.2 (Doc Ref. 5.3)).

18.8.476 **ES Chapter 10: Geology and Ground Conditions** (Doc Ref. 5.1) concludes there is the potential for minor adverse effects. These risks predominantly relate to potential occupational

exposures for construction workers, not community exposures. Occupational exposures would be managed through statutory health and safety requirements. The Chapter 10: Geology and Ground Conditions conclusion includes potential for minor adverse contamination effects to River Terrace Deposits (a Secondary A aquifer) and surface waters. These are discussed further in relation to **ES Chapter 11: Water Environment** (Doc Ref. 5.1) findings.

Water Quality and Flood Risk (2024-2029)

18.8.477 The initial construction works include building flood mitigation measures, the establishment of construction compounds and highways improvements. Relevant surface water features include the Gatwick Stream, the River Mole, Crawter's Brook, Burstow Stream and Burstow Stream tributary. There are also GAL managed surface water ponds and flood compensation areas. Potential health pathways relevant to water amenity and water quality include increased risk of sediment mobilisation and harmful pollution affecting surface or ground waters. Vegetation removal, topsoil stripping and excavation works have the potential to mobilise historical contaminants. Activities such as re-fuelling, concrete batch mixing and storage of polluting substances at construction site compounds have the potential to produce new contaminants. Flooding events pose a risk in themselves and could exacerbate mobilisation of both historical and new contaminants.

18.8.478 **ES Chapter 11: Water Environment** (Doc Ref. 5.1) works through the potential pathways and references best practice measures secured and implemented through the **CoCP** (ES Appendix 5.3.2 (Doc Ref. 5.3)) that mean that residual risks are greatly reduced (for example, appropriate storage/removal of excavated materials and the provision of appropriate storage for potentially polluting substances). At most Chapter 11: Water Environment identifies potential for a range of minor adverse effects across surface water, ground water (including aquifers) and flood risk pathways. Chapter 11: Water Environment notes that due to embedded design measures overall flood risk is reduced by the Project despite loss of existing floodplain.

18.8.479 **ES Chapter 11: Water Environment** (Doc Ref. 5.1) also assesses the effect of the increased use of de-icer due to the increase in ATMs and find the new de-icer treatment system would significantly reduce the risk of runoff contaminated with de-icer to the River Mole, providing an improvement from the baseline situation.

18.8.480 In terms of wastewater and drinking water infrastructures, **ES Chapter 11: Water Environment** (Doc Ref. 5.1) identifies that there is sufficient capacity for both with at most minor adverse effects.

Conclusion

18.8.481 **ES Chapter 10: Geology and Ground Conditions** (Doc Ref. 5.1) and **ES Chapter 11: Water Environment** (Doc Ref. 5.1) conclude that no residual significant effects for ground quality or water quality are anticipated in relation to human receptors. Conclusions in both chapters give weight to secured mitigation measures that break pollution linkage pathways, as well as embedded design measures that provide improvements.

18.8.482 For health it is concluded that the magnitude of the change due to the Project is **low.** Both ground and water contaminants pose a *very low* exposure risk to the community, whether by direct contact, waterborne or airborne pathways. The use of standard good practice mitigations described in **ES Chapter 10: Geology and Ground Conditions** (Doc Ref. 5.1) and **ES Chapter**

11: Water Environment (Doc Ref. 5.1) mean that any exposure would be *very short-term* and *occasional*. Flood risk is expected to be reduced rather than increased. Any localised changes in flood risk, eg ground water flooding, would relate to a *very few* people. Mitigation to respond to such individual level effects is set out in the **CoCP** (ES Appendix 5.3.2 (Doc Ref. 5.3) but would not constitute a population health effect. Additional population level exposure to ground or water contaminants due to the Project, if any, would represent a *very minor* change in *morbidity* related population health risk, eg associated with very low dose temporary toxicological exposures. Any health effect from a pollution incident would likely be limited to a *small minority* of the study area population, with at most a *slight* effect on routine health service planning.

18.8.483 The professional judgement is that the significance of the population health effect would be up to **minor adverse** (not significant). The conclusion reflects minimal risk to public drinking water supplies, with water quality expected to be maintained *well within* regulatory thresholds. Water utilities diversions would avoid interruptions in supplies and water sources, including groundwater aquifers are not at risk due to the Project. Although the scientific literature establishes causal pathways by which health outcomes could plausibly be affected, in practice standard mitigation and design measures means there are very limited potential pathways by which any contaminants released by the Project could affect population health to a meaningful degree. Any change in the health baseline due to the Project is likely to be *very limited*, with at most a *marginal* effect on health inequalities and delivery of health policy. The minor adverse (rather than negligible) score represents a conservative assessment finding.

2029-2032 (2030-2032 assessed in ES Chapter 10: Geology and Ground Conditions (Doc Ref. 5.1) and 2029-2032 assessed in ES Chapter 11: Water Environment (Doc Ref. 5.1))

Ground Conditions (2030-2032)

18.8.484 As stated in **ES Chapter 10: Geology and Ground Conditions** (Doc Ref. 5.1), construction within PAOCs is proposed to be ongoing during this period and therefore, the effects remain as described during the initial construction period (2024-2029). Chapter 10: Geology and Ground Conditions concludes that following completion of remediation activities the level of effect to airport users and site workers would be negligible. Effects to aquifers and surface water, which could have wider community implications, remain up to minor adverse and are discussed further in relation to **ES Chapter 11: Water Environment** (Doc Ref. 5.1) findings.

Water Quality and Flood Risk (2029-2032)

18.8.485 As stated in **ES Chapter 11: Water Environment** (Doc Ref. 5.1), all of the proposed flood mitigation measures (except for the Gatwick Stream flood compensation area) would have been completed by the first full year of opening (2029). After 2029, the main works that could impact fluvial flood risk would be the proposed highway improvement works and contractor compounds. Highway improvement works for the Longbridge Roundabout, South Terminal Roundabout and North Terminal Roundabout are expected to conclude in 2031. Construction impacts on water quality associated with these works are anticipated to be the same as those outlined in the 2024 to 2029 assessment years, with some minor adverse effects. Water quality benefits from de-icer treatment works are expected, as described for the 2024 to 2029 assessment.

18.8.486 **ES Chapter 11: Water Environment** (Doc Ref. 5.1) concludes that in relation to increased passenger numbers in this period, there would be a negligible effect on wastewater infrastructure

and a minor adverse effect on drinking water capacity, with capacity able to meet the airport and local population's water needs.

Conclusion

18.8.487 It is concluded that the magnitude of the change due to the Project is **low** for the same reasons as set out in paragraph 18.8.482.

18.8.488 It is concluded that the significance of the effect for population health is **minor adverse** (not significant) for the same reasons as set out in paragraph 18.8.483.

2032-2038 (2033-2038 assessed in ES Chapter 10: Geology and Ground Conditions (Doc Ref. 5.1) and 2032-2037 assessed in ES Chapter 11: Water Environment (Doc Ref. 5.1))

Ground Conditions (2033-2038)

18.8.489 The majority of construction activity would be complete by this stage with some ongoing final construction activities taking place. As stated in **ES Chapter 10: Geology and Ground Conditions** (Doc Ref. 5.1), remediation may be required for the remaining construction areas. However, the requirement for remediation is likely to be localised in its extent, with no remediation required in the majority of areas. Chapter 10: Geology and Ground Conditions concludes there remains the potential for minor adverse effects, which as for other construction periods, predominantly relates to occupational rather than community risk. Chapter 10: Geology and Ground Conditions notes that for aquifers and surface waters, the effects would remain up to minor adverse as described for previous assessment years, albeit with potentially reduced risks due to reduced levels of construction activity. These effects are discussed further in relation to the findings of **ES Chapter 11: Water Environment** (Doc Ref. 5.1).

Water Quality and Flood Risk (2032-2037)

18.8.490 As stated in **ES Chapter 11: Water Environment** (Doc Ref. 5.1), changes to watercourses would have stabilised by this stage. Best practice measures to mitigate construction impacts would continue to control the impacts to surface waters, with potential for up to minor adverse effects to Gatwick Stream, River Mole and Crawter's Brook. Similarly, potential for groundwater effects, including to aquifers, would continue to be mitigated against, with the residual effect remaining up to minor adverse, as reported for the 2024 to 2029 assessment years.

18.8.491 Water quality benefits from de-icer treatment works are expected, as described for the 2024 to 2029 assessment.

18.8.492 All primary works that could affect current flood risk would have been completed by this time, whereby the measures implemented by this stage would be adequate to ensure that no further increase in flood risk are anticipated to occur. **ES Chapter 11: Water Environment** (Doc Ref. 5.1) notes that any changes in flood risk during this period would continue to be mitigated by measures set out in the **CoCP** (ES Appendix 5.3.2 (Doc Ref. 5.3) and would be as described for the 2024 to 2029 assessment.

18.8.493 Operational impacts of the highway improvements are reported for design year 2047, as this represents the realistic worst case.

Conclusion

18.8.494 It is concluded that the magnitude of the change due to the Project is **low** for the same reasons as set out in paragraph 18.8.482.

18.8.495 It is concluded that the significance of the effect for population health is **minor adverse** (not significant) for the same reasons as set out in paragraph 18.8.483.

Design Year 2038

Ground Conditions (2038)

18.8.496 The development would be fully operational by this stage. As stated in **ES Chapter 10: Geology and Ground Conditions** (Doc Ref. 5.1), remediation activities would be completed by 2038, so any effect to airport users and site workers would be negligible. Taking into account the proposed drainage strategy, pollution control measures and existing measures in place to control airport operations, Chapter 10: Geology and Ground Conditions concludes that there would be no change in effects to surface water or groundwater.

Water Quality and Flood Risk (2038)

18.8.497 **ES Chapter 11: Water Environment** (Doc Ref. 5.1) discusses the operational changes of surface water feature in 2038. These include realignments of water courses, including improvements to the River Mole and other works such as stretches of culverts and changes in floodplain area. Chapter 11: Water Environment notes a range of moderate beneficial and minor adverse effects. These have limited implications for human health.

18.8.498 **ES Chapter 11: Water Environment** (Doc Ref. 5.1) describes how a long-term change in flood compensation areas and the amount of hardstanding compared to the baseline (eg additional hardstanding for runways, taxiways and aprons) has the potential for up to minor adverse effects to ground water quality.

18.8.499 The Project changes also have a range of beneficial and adverse implications for flood risk. For surface water flood risk, **ES Chapter 11: Water Environment** (Doc Ref. 5.1) concludes are up to minor adverse for offsite receptors including residential properties. In relation to fluvial flood risk, the improvements in the Project design provide a moderate to major beneficial reduction in flood risk for offsite residential dwellings.

18.8.500 **ES Chapter 11: Water Environment** (Doc Ref. 5.1) concludes that in relation to increased passenger numbers in this period, there would be up to a minor adverse effect on wastewater infrastructure and drinking water capacity, with capacity able to meet the airport and local population's water needs.

Conclusion

18.8.501 For health it is concluded that the magnitude of the change due to the Project is **low.** Both ground and water contaminants pose a *very low* exposure risk to the community, whether by direct contact, waterborne or airborne pathways. The use of standard good practice mitigations described in **ES Chapter 10: Geology and Ground Conditions** (Doc Ref. 5.1) and **ES Chapter 11: Water Environment** (Doc Ref. 5.1) mean that any exposure would be *very short-term* and *occasional*. Flood risk is expected to be reduced rather than increased, driven by a *medium* scale of reductions in the risk of *occasional* fluvial flooding for a *small minority* of the population. Any

localised changes in flood risk, eg surface water flooding, constitute a *small* scale of change to *occasional* events for, at most, a *small minority* of the population. Additional population level exposure to ground or water contaminates due to the Project, if any, would represent a *very minor* change in *morbidity* related population health risk, eg associated with very low dose temporary toxicological exposures. Any health effect from a pollution incident would likely be limited to a *small minority* of the study area population, with at most a slight effect on routine health service planning.

18.8.502 The professional judgement is that the significance of the population health effect would be up to **minor adverse** (not significant) in relation to any contamination, water capacity or increased surface water flood risk. The conclusion reflects minimal risk to public drinking water supplies, with water quality expected to be maintained *well within* regulatory thresholds. Although the scientific literature establishes causal pathways by which health outcomes could plausibly be affected, in practice standard mitigation and design measures set out in the **ES Chapter 5: Project Description** (Doc Ref. 5.1) and as part of the **CoCP** (ES Appendix 5.3.2 (Doc Ref. 5.3)) means there are very limited potential pathways by which any contaminants released by the Project could affect population health to a meaningful degree. Any change in the health baseline due to the Project is likely to be *slight*, with at most a *marginal* effect on health inequalities and delivery of health policy. The minor adverse (rather than negligible) score represents a conservative assessment finding.

18.8.503 A **negligible beneficial** (not significant) effect due to reduced fluvial flood risk is also noted. This reflects *clear* associations in the scientific literature between flooding events and both physical and mental health outcomes. Whilst the protective effect from avoiding such outcomes is welcomed, at the population level the level of change in the health baseline is likely to be *very limited*. No effect on health policy delivery is expected.

Year 2047

Ground Conditions (2047)

18.8.504 **ES Chapter 10: Geology and Ground Conditions** (Doc Ref. 5.1) states that no further impacts are considered relevant, and effects remain as assessed for 2038.

Water Quality and Flood Risk (2047)

18.8.505 **ES Chapter 11: Water Environment** (Doc Ref. 5.1) considers the operational effects of the highway improvements on surface water quality, including through assessment of routine runoff as well as spillage risk assessments. Chapter 11: Water Environment identifies the potential for minor adverse effects. The de-icer treatment impartments are noted as continuing to provide benefits during this period. Groundwater and flood risk effects are as assessed in 2038, with no new impacts. Wastewater infrastructure and drinking water capacity in 2047 is assessed, with sufficient capacity identified and at most a minor adverse effect. Chapter 11: Water Environment notes that water supply capacity will continue to be reviewed by SESW through their own impact assessment.

Conclusion

18.8.506 For health it is concluded that the magnitude of the change due to the Project is **low.** Operation of the highway improvements and other operational activities that could affect ground and water quality pose a *very low* exposure risk to the community, whether by direct contact, waterborne or

airborne pathways. The use of standard good practice mitigations described in **ES Chapter 10: Geology and Ground Conditions** (Doc Ref. 5.1) and **ES Chapter 11: Water Environment** (Doc Ref. 5.1) mean that any exposure would be *very short-term* and *occasional*. Flood risk is expected to be reduced overall rather than increased, see conclusion for 2038. Additional population level exposure to ground or water contaminants due to the Project, if any, would represent a *very minor* change in *morbidity* related population health risk, eg associated with very low dose temporary toxicological exposures. Any health effect from a pollution incident would likely be limited to a *small minority* of the study area population, with at most a slight effect on routine health service planning.

18.8.507 The professional judgement is that the significance of the population health effect would be up to **minor adverse** (not significant). The conclusion reflects minimal risk to public drinking water supplies, with water quality expected to be maintained *well within* regulatory thresholds. Although the scientific literature establishes causal pathways by which health outcomes could plausibly be affected, in practice, standard mitigation and design measures means there are very limited potential pathways by which any contaminants released by the Project could affect population health to a meaningful degree. Any change in the health baseline due to the Project is likely to be *very limited*, with *no* effect on health inequalities or the delivery of health policy. The minor adverse (rather than negligible) score represents a conservative assessment finding.

Conclusion

18.8.508 Overall, the **minor adverse** effect in relation to potential pollution releases reflects that, whilst slight increases in exposure risk related to water quality, flood risks and ground conditions may be considered detrimental to some degree for public health, ie not negligible, the change due to the Project is not significant for population health in EIA Regulation terms.

18.8.509 The differences between the Central Case and the Slow Transition case have been considered and they are not considered to materially affect the conclusions as to the significance of the population health effects.

Further Mitigation and Future Monitoring

18.8.510 No further mitigation or monitoring measures are proposed. Appropriate measures are set out in **CoCP** (ES Appendix 5.3.2 (Doc Ref. 5.3)).

Significance of Effects

18.8.511 The residual significance of effects would remain unchanged, ie up to **minor adverse** (not significant) effects for population health.

Health and Wellbeing Effects from Changes to Local Healthcare Capacity

General

Approach

18.8.512 This section of the ES presents findings on the potential implications for NHS routine service planning, and any consequent population health effect, of changes in numbers of passengers arriving at the Airport (inbound or outbound), as well as demand associated with the Project's workforces.

18.8.513 Health service capacity may be affected by a non-permanent UK population in the area. These are people who are not usually resident in the area (so not registered with local NHS services). This group includes some airport employees (eg aircrews), passengers and other airport visitors (eg dropping off or collecting passengers).

18.8.514 The health assessment considers the current level of demand, eg ambulance callouts from the Airport, and the expected change due to the proposed uplift in passengers, visitors and workers.

18.8.515 This section has been informed by a review of medical events and ambulance callout data, as well as discussion with the West Sussex ICB about improving access to healthcare for Airport workers.

18.8.516 This section has regard to the potential for impacts to ambulance services, accident and emergency (A&E), primary care, secondary care and the broader integrated care system (ICS).

18.8.517 The assessment distinguishes two main issues:

- the impact of airport passengers on ambulance and A&E services; and
- the impact of airport workforces (construction and operation) on primary care and the broader ICS capacity.

18.8.518 That there is some overlap between these issues and populations is acknowledged. This has been taken into account and does not change the assessment findings. This reflects that project workforces would not be a main driver of ambulance and A&E usage due to high occupational health standards, including as described in the **CoCP** (ES Appendix 5.3.2 (Doc Ref. 5.3)). Furthermore, passengers are not a main driver of primary care and wider ICS demand as they are a transitory population for whom routine access to such services is provided close to their usual place of residence. As noted in **ES Chapter 17: Socio-economic Effects** (Doc Ref. 5.1), additional passengers travelling to the airport are not expected to typically access community facilities and services.

18.8.519 Regarding the operational workforce, as set out in its Annual Report 2022 (GAL, 2022), GAL manages its health and safety risk through Health, Safety and Environment management systems. GAL has a strong Health and Safety culture, with a clear Environmental Health and Safety (EHS) policy (GAL, 2021) focusing on key risks including Safety, Occupational Health and Wellbeing, Environment, Fire and Performance Improvement. GAL's leaders understand their roles and responsibilities in delivering a strong, just EHS culture through their behaviours (attitudes, values and beliefs), and through visibility and engagement with employees, contractors and passengers. GAL's people receive the health, safety and security training required to ensure they are able to identify, understand and manage risks associated with their roles. GAL promote a just and fair culture by undertaking investigations for the purpose of implementing improvements and responding to positive and negative behaviours appropriately. GAL has a comprehensive occupational health and wellbeing service in place to promote and support the wellbeing of its people. They have a confidential reporting line through which concerns about wrongdoing in respect of health, safety and security can be reported.

18.8.520 The health assessment is based on a comparison between the with and without the Project scenarios for the assessment years of 2024-2029, 2029, 2032, 2038 and 2047. Consideration has also been given to the Central Case and Slow Fleet Transition Case for ATMs.

18.8.521 The significance of the population health effect has had regard to the following evidence sources:

- Scientific literature summarised in paragraphs 18.8.523 to 18.8.529 that indicates the strength of relationship between changes in access to healthcare and changes in health outcomes. Regard has also been given to issues of uncertainty reported in the literature and to the relationship between occupational health and hygiene provision, shift worker access to services and levels of NHS demand. This includes acknowledging the importance of reducing inappropriate attendance at A&E and promoting early use of preventative screening programmes.
- Baseline population health indicators relevant to healthcare access are set out in Table 18.8.35. Further details are set out in **ES Appendix 18.5.2: Health and Wellbeing Baseline Data Tables** (Doc Ref. 5.3). East Surrey Hospital is the major acute hospital for east Surrey and north-east West Sussex, providing an emergency department (A&E) and acute services for the whole catchment area of the Surrey and Sussex Healthcare NHS Trust, including Gatwick Airport. An urgent treatment centre for non-life-threatening injuries and illnesses is run by Sussex Community NHS Trust at Crawley hospital. Further details on healthcare and emergency services are set out in **ES Chapter 17: Socio-economic Effects** (Doc Ref. 5.1).
- Health priorities that have been taken into account from a review of local JSNAs and HWSs are set out in **ES Appendix 18.5.1: Health Baseline Trends, Priorities and Vulnerable Groups** (Doc Ref. 5.3).
- Health policy on the consideration of health in planning decisions. As well as reference in planning guidance to supporting the NHS with their strategies to meet the health needs of the existing population and needs arising as a result of new and future development as set out in Section 18.2 and **ES Appendix 18.2.1: Summary of Local Planning Policy – Health and Wellbeing** (Doc Ref. 5.3).
- Consultation responses from health stakeholders and the public, as set out in Section 18.3 and **ES Appendix 18.3.1: Summary of Stakeholder Scoping Responses – Health and Wellbeing** (Doc Ref. 5.3) and the Project **Consultation Report** (Doc Ref. 6.1).
- Statutory standards and regulatory thresholds for health protection are not relevant to this determinant of health.

Health outcomes

18.8.522 The scientific literature identifies the following general points relevant to potential effects and health outcomes. The main health outcomes are likely to relate to unplanned need for NHS attendance whilst at, or travelling to or from, the Airport, ie suffering a medical emergency as an airport passenger or visitor. Having suitable access to healthcare services, including by workforces, affects early diagnosis, treatment outcomes and preventative measures.

18.8.523 In general terms, emergency department crowding in England is a major patient safety concern associated with poor patient outcomes (Carter, et al., 2014). Inappropriate attendances may account for up to 40% of presentations at accident and emergency (A&E) departments (Ismail, et al., 2013). Healthcare professionals with poor wellbeing and moderate to high levels of burnout are associated with poor patient safety outcomes such as medical errors (Hall, et al., 2016). Accessibility of primary health care, mostly measured through the availability of GPs in a given area and the entitlement of patients to access to GP visits, reduces avoidable hospitalisation (Rosano, et al., 2013).

18.8.524 Work environment factors are highly correlated with employees' health and well-being, affecting absenteeism and associated business and healthcare service costs (Pieper, et al., 2019). Cross-sectional studies demonstrate significant and salient correlations between health culture and the health and safety of employees (Flynn, et al., 2018). Workplace interventions targeting workplace culture can achieve beneficial health and well-being outcomes (Quigley, et al., 2022).

Indicators

Table 18.8.35: Baseline – summary indicators relevant to health care health outcomes

Indicator Name	Units	Nine ward (mean)	HLSA (mean)	Six Authority Area (mean)	South East	England
Access to NHS dental services - successfully obtained a dental appointment (18+ years)	%	NA	NA	78.5	77.3	77.0
Percentage of people who said they had good experience when making a GP appointment (18+ years)	%	NA	NA	73.0	NA	70.7
Emergency hospital admissions for all causes (SAR)	%	90.0	90.9	88.9	92.0	100.0

18.8.525 Table 18.8.35 shows that the rate of emergency hospital admissions for all causes is lower in the nine ward area, HLSA and Six Authority Area compared to the regional and national averages. Primary care experience data is not available for the nine ward area or HLSA, but for the Six Authority Area the rates of successfully obtaining a dental appointment and of a good experience when making a GP appointment are both higher than the national average.

Likelihood

18.8.526 A potential population health effect is considered likely because there is a plausible source-pathway-receptor relationship:

- Source: changes in demand for medical and healthcare facilities as a result of unplanned need for NHS attendance whilst at, or travelling to or from, the Airport (as a worker, passenger or visitor).
- Pathway: a change in capacity, staffing and resources of the local NHS.
- Receptors: local community populations accessing these services or facilities. This may include healthcare staff should they experience resource pressures.

18.8.527 Furthermore, the potential effect is probable as no highly unusual conditions are required for the source-pathway-receptor linkage.

Populations

18.8.528 The population groups relevant to this assessment are:

- The 'site-specific' geographic population of communities near the Airport, see paragraph 18.4.12, in relation to primary care and ICS effects. In this regard there has been discussion with West Sussex ICB on the Crawley Programme.
- The 'local' population relates to the wider community effects in relation to the South East Coast Ambulance Service NHS Foundation Trust activities and A&E capacity, eg at East Surrey Hospital.
- The sub-population vulnerable due to:
  - Young age vulnerability (including children, young people and pregnant mothers as higher users of healthcare).
  - Old age vulnerability (including older people as higher users of healthcare).
  - Poor health vulnerability (people with existing poor physical and mental health as higher users of healthcare).
  - Access and geographical vulnerability (people who experience existing access barriers to healthcare).

18.8.529 An ageing population and high levels of multi-morbidity increase rates of GP and specialist consultations (Price, et al., 2014). Adolescence is the period of highest risk for the development of mental illness, but also the age group least likely to seek help from mental health services (Plaistow, et al., 2014). For the elderly general population, health care use and costs significantly increase with each additional chronic condition (Lehnert, et al., 2011).

Medical Calls and Ambulance Attendances at the Airport

18.8.530 Gatwick Airport has on-site personnel trained as first responders in the event of a medical emergency at the Airport. The Gatwick Control Centre is the point of coordination for medical events at the Airport and has a direct line to the South East Coast Ambulance Trust. Gatwick's first responders have a high level of training to allow them to assess and commence stabilisation in the event of a medical emergency. The first responders are supported by 105 staff members who are trained to provide first aid. This figure excludes first aiders, who are also located in every commercial outlet. In addition, there is a total of 80 Automated External Defibrillators (AEDs) located within the airport. The coordination between the Gatwick Control Centre, first responders, first aiders and South East Coast Ambulance Trust provides timely treatment and reduced unnecessary ambulance callouts. As such, the airport is well prepared to respond, treat, and, if required, call for emergency assistance from the South East Coast Ambulance Trust. An example of the existing effectiveness of port health treatment is that AED treatment success rate is more than six times greater than the national average.

18.8.531 Table 18.8.36 sets out data provide by GAL in relation to passengers and medical callouts whilst at the Airport. This updates data provided in the PEIR with additional data from January 2019 to June 2022. The data supports GAL in scaling onsite first responder capacity, as well as first aid training and defibrillator availability. Such scaling of existing onsite healthcare support is expected to continue to manage the majority of medical calls to the Gatwick Control Centre.

Table 18.8.36: Airport health calls and hospital transfer statistics

Year	Type of Call and Outcome					
	C1 - Life threatening calls	C3 & First Aid - Non life threatening medical calls	Total medical calls to Gatwick Control Centre	Passengers who continued journey	Passengers transferred to Hospital	Total Passenger numbers (Arr + Dep)
2015	160	4,245	4,405	3,146	1,118	40,010,000
2016	164	4,727	4,847	3,777	1,070	42,670,000
2017	177	5,116	5,295	4,173	1,121	44,176,000
2018	123	5,256	5,369	4,271	1,098	44,786,000
2019	105	5,102	5,266	4,102	1,004	46,500,000
2020	17	952	969	746	203	10,200,000
2021	35	1,049	1,086	852	218	6,300,000
2022[35]	67	1,287	1,346	1,115	222	13,140,000

Notes:

[35] Data for 01 January to 31 June 2022.

18.8.532 Table 18.8.37 summarises some key statistics from the data. The data shows that since 2016 where a medical incident occurs at the airport, consistently over 75% of people continue their journey rather than being transferred to hospital. Typically, only 20.7% of medical calls to Gatwick Control Centre result in a transfer to hospital. This equates to 0.002% of passengers per year. For passengers transferred to hospital, the data supports the NHS with routine service planning.

Table 18.8.37: Airport hospital transfer statistics – selected data as percentages

Year	Passengers who continued journey as a percentage of total medical calls to Gatwick Control Centre	Passengers transferred to Hospital as a percentage of total medical calls to Gatwick Control Centre	Passengers transferred to Hospital as a percentage of total passenger numbers
2015	71.4%	25.4%	0.003%
2016	77.9%	22.1%	0.003%
2017	78.8%	21.2%	0.003%
2018	79.5%	20.5%	0.002%
2019	77.9%	19.1%	0.002%
2020	77.0%	20.9%	0.002%
2021	78.5%	20.1%	0.003%
2022	82.8%	16.5%	0.002%
Average (mean)	78.0%	20.7%	0.002%

Notes: 2022 data for 01 January to 31 June 2022.

18.8.533 Table 18.8.38 further considers the number of passengers who were transferred to hospital relative to total passenger numbers. Table 18.8.38 uses this data to calculate the rate of transfers to hospital per 100,000 passengers. The average rate is around 2.45 transfers per 100,000 passengers. As a sensitivity test, the worst-case individual year of 3.46 transfers per 100,000 has also been used when projecting future assessment year demand. It is however noted that this sensitivity test rate is likely to be affected by COVID-19 so not representative of the normal rate. The most recent data available (January to June 2022) is less than half this rate.

Table 18.8.38: Calculation of historic passenger transfer rates to hospital from the airport

Year	Passengers transferred to Hospital	Total Passenger numbers (Arr + Dep)	Rate of transfers to hospital per 100,000 passengers
2015	1,118	40,010,000	2.79
2016	1,070	42,670,000	2.51
2017	1,121	44,176,000	2.54
2018	1,098	44,786,000	2.45
2019	1,004	46,500,000	2.16
2020	203	10,200,000	1.99
2021	218	6,300,000	**3.46**
2022	222	13,140,000	1.69
Average (mean)			**2.45**

Notes: 2022 data for 01 January to 31 June 2022.

18.8.534 As set out in Environmental Statement **Appendix 4.3.1: Forecast Data Book** (Doc Ref. 5.3), Table 18.8.39 summarises the total passenger number forecasts. These inform the projection of ambulance callouts in each assessment year.

Table 18.8.39: Gatwick Passenger forecasts

Assessment year	Base Case (passengers per year)	Northern Runway Case (passengers per year)	Change in passenger numbers per year
2029	57,300,000	61,300,000	4,000,000
2032	59,400,000	72,300,000	12,900,000
2038	62,400,000	75,600,000	13,200,000
2047	67,200,000	80,200,000	13,000,000

18.8.535 Table 18.8.40 estimates the number of additional transfers expected in each assessment year. This informs the assessment of magnitude later in this section. The calculation uses a rate of transfers to hospital per 100,000 passengers of 2.45, which is the average rate for 01 January 2015 to 31 June 2022 (the full data range available). The data show that the change due to the Project in all assessment years equates to less than one additional ambulance callout per day.

18.8.536 Table 18.8.41 provides a sensitivity test calculated using a rate of transfers to hospital per 100,000 passengers of 3.46, which is the worst case 2021 data (likely affected by COVID-19).

Even on that basis the increase in ambulance callouts is still only just above one per day on average.

18.8.537 Conditions at the Airport, eg resulting in an accidental trip or fall, are one factor that could result in a transfer to hospital. However, although not quantifiable from the data, it is reasonable to assume that the immediate or underlying reason for transfer to hospital would in many cases not relate to conditions at the Airport. Rather a sizable proportion of the additional transfers are likely to reflect a redistribution of demand for emergency care that would have arisen in any case, eg due to underlying health conditions, rather than new demand. That these medical events occurred at the airport rather than at another location does not change the level of NHS demand.

18.8.538 In this regard it is relevant that there is a large overlap in the catchment area of the South East Coast Ambulance Service and the Airport passenger catchment. Around 38% of passengers (excluding transfers) originating from the South East, see **ES Appendix 4.3.1: Forecast Data Book** (Doc Ref. 5.3). Ambulance demand in the South East region is broadly split between the South East Coast Ambulance Service and the South Central Ambulance Service NHS Foundation Trust.

Table 18.8.40: Additional transfers to hospital forecast in each assessment year, expected rate

Assessment year	Base Case number of transfers to hospital using average rate (Jan 2015- Jun 2022)	Northern Runway Case number of transfers to hospital using average rate (Jan 2015- Jun 2022)	Change in transfers to hospital per year	Change in transfers to hospital per day
2029	1,403	1,501	98	0.3
2032	1,455	1,770	316	0.9
2038	1,528	1,851	323	0.9
2047	1,646	1,964	318	0.9

Table 18.8.41: Additional transfers to hospital forecast in each assessment year, sensitivity test

Assessment year	Base Case number of transfers to hospital using worst case rate (2021 data)	Northern Runway Case number of transfers to hospital using worst case rate (2021 data)	Change in transfers to hospital per year	Change in transfers to hospital per day
2029	1,983	2,121	138	0.4
2032	2,055	2,502	446	1.2
2038	2,159	2,616	457	1.3
2047	2,325	2,775	450	1.2

Demand on primary care and wider ICS

18.8.539 Both local context and the scientific literature (Santos, et al., 2017) are informative in determining appropriate distances over which to assess primary healthcare capacity. The 2017 study by Santos et al., based in the East Midlands of England, found that the average (mean) distance to a patient's chosen practice was 1.877 km (1.2 mile), which was further than the average of the

nearest GP practice, 1.197 km (0.74 mile). The difference reflected patient choices and preferences, including driven by clinical quality. Santos et al. note that 91.5% of those in urban areas choose a GP practice within 3 km (1.9 mile) and 91.9% of residents in rural areas choose a practice within 7 km (4.3 mile).

18.8.540 For Gatwick airport there are three GP practices within 1.2 miles (NHS, Online): Birchwood Medical Practice and Wayside Medical Practice (co-located in Horley to the north of the airport) and Clerklands Surgery in Horley (with a further site in Crawley, Woodlands Surgery, with which data is combined).

18.8.541 The NHS Digital General Practice Workforce March 2023 (NHS Digital, 2023) data release provides information on existing capacity. The three GP practices with 1.2 miles of the airport[19] (Table 18-47) are currently accepting new patients. Collectively these practices serve 40,811 patients with 24.3 full time equivalent (FTE) GPs. This is a collective ratio of 1,681 patients per GP which is within the recommended patient to GP ratio of 1,800 patients per FTE GP (a commonly applied benchmark that is indicative but often exceeded in practice[20]) (HUDU, 2009). It is noted that Wayside Medical Practice is above this ratio and that GP to patient ratios may not always reflect particular local context in terms of capacity. The data does however give a broad indication of sensitivity to any changes in demand. Whilst the Project does not rely on local primary care capacity, it is noted that the data suggests that 2,900 additional patients could be registered before reaching the 1,800 patients per GP ratio benchmark, a number in excess of the maximum construction workforce of 1,350.

Table 18.8.42: GP primary care capacity close to the airport – March 2023 data release

GP Practice	Patients	GP FTE	GP Patient ratio	Distance (miles)	Accepting new patients?
Birchwood Medical Practice (H81037)	18,755	12.46	1,505.15	0.8	Yes
Wayside Medical Practice (H81046)	5,783	1.13	5,117.10	0.9	Yes
Woodlands & Clerklands Partnership (H82025)	16,273	10.69	1,521.79	0.9	Yes
Total	**40,811**	**24.3**	**1,680.57**		

18.8.542 As with the general population, workforces have healthcare service needs that are met through a range of occupational services and NHS functions. Later in this section Table 18.8.45 illustrates this range, including considering effects to secondary care. Where people move to an area with their families and dependants there can also be implications for additional services, including health visitors, school nurses, midwifery, district nursing and child and adolescent mental health services.

[19] Using NHS service search website for postcode RH6 OGQ.

[20] London's Healthy Urban Development Unit (HUDU) uses the 1,800 people per GP as a default benchmark, based on guidance from the Royal College of GPs.

18.8.543 Whilst there is the potential for a broad range of services to be affected, the assessment distinguishes between:

- demand that is identified and met through routine NHS service planning, which is funded through general taxation; and
- demand that is in addition to this.

18.8.544 There is the potential for additional healthcare demand from some members of the construction and operational workforces, however the scale is expected to be within normal health service planning margins and not a step-change in demand. **The ES Chapter 17: Socio-economic Effects** (Doc Ref. 5.1) model assumes that 80% of construction workers are anticipated to be home-based (HB) (ie permanently resident), and a maximum of 20% are anticipated to be non-home-based (NHB) and living temporarily in the area. It is assumed that 100% of the directly employed operational workforce in the study areas are anticipated to be HB. In general, it can be assumed that HB workers will continue to make use of community facilities, including healthcare, at their home location, and it will therefore only be NHB workers that may generate regular additional demand for community facilities, including healthcare, in the area. The assessment considers numbers of NHB workers in each assessment year.

18.8.545 The assumed construction workforce profile is set out in Table 18.8.43.

Table 18.8.43: Construction workforce profile

Assessment year	Number of workers	Assumed percentage with NHS entitlement or medical insurance	Percentage home based
Initial Construction Period: 2024-2029	The construction workforce is expected to peak in February 2027 when the expected average daily figure is 1,350 workers.	100%	80%
First Full Year of Opening: 2029 (construction effects 2030-2032)	The construction workforce is expected to peak at 1,320 workers in July and August 2030.	100%	80%
Interim Assessment Year: 2032 (construction effects 2033-2038)	The construction workforce is expected to peak at around 450 workers between January 2033 and April 2033. This will subsequently reduce.	100%	80%
Design Year: 2038	None	N/A	N/A
The Long-term Forecast Year: 2047	None	N/A	N/A

18.8.546 The assumed operational workforce profile is set out in Table 18.8.44.

Table 18.8.44: Operational workforce profile

Assessment year	Number of workers	Assumed percentage with NHS entitlement or medical insurance	Percentage home based
Initial Construction Period: 2024-2029	None	N/A	N/A
First Full Year of Opening: 2029	Direct, indirect, induced and catalytic employment is expected to increase by 990, 860, 1,070 and 2,470 jobs respectively within the UK. The total incremental impact is expected to be 5,400 jobs in the UK.	100%	100%
Interim Assessment Year: 2032	Direct, indirect, induced and catalytic employment is expected to increase by 3,120, 2,730, 3,390 and 7,600 jobs respectively within the UK. The total incremental impact is expected to be 16,840 jobs in the UK.	100%	100%
Design Year: 2038	Direct, indirect, induced and catalytic employment is expected to increase by 3,220, 2,810, 3,500 and 7,150 jobs respectively within the UK. The total incremental impact is expected to be 16,670 jobs in the UK.	100%	100%
The Long-term Forecast Year: 2047	Direct, indirect, induced and catalytic employment is expected to increase by 3,100, 2,710, 3,370 and 6,490 jobs respectively within the UK. The total incremental impact is expected to be 15,680 jobs in the UK.	100%	100%

18.8.547 The profile of the Project, which does not directly affect the size of the permanent local population (ie no new housing), as well as the profiles of both the construction and operational workforces, being predominantly home based with existing NHS entitlements or medical insurances, indicates that routine NHS service planning is the main mechanism for responding to any Project related change in demand. This is supported through provision of appropriate data to the NHS and by providing occupational healthcare to the construction and operational workforces.

18.8.548 As stated at PEIR, the level of occupational healthcare provisions for the construction workforce is anticipated to avoid any significant adverse impact on the local health care system.

18.8.549 Table 18.8.45 sets out illustrative occupational health services and Table 18.8.46 sets out illustrative occupational health roles involved in their delivery. Table 18.8.46 sets out illustrative occupational health roles involved in their delivery. This demonstrates the types of services that the Principal Contractor is anticipated to commission and implement, the detail for which would be developed post-determination once a Principal Contractor is appointed, as is usual. The commitment within the **CoCP** (ES Appendix 5.3.2 (Doc Ref. 5.3)), to be secured through **a DCO requirement in Schedule 2** (Doc Ref. 2.1), to provide appropriate occupational on-site health care for construction workers, including implementing a protocol to manage the first point of contact for health queries from construction workers, as well as subsequent avenues for further healthcare support, is a sufficient and proportionate basis for assessment. Many of the occupational care provisions relate to statutory requirements under the Health and Safety at Work Act 1974, guidance for which is provided by the Health and Safety Executive (HSE) including specifically for the construction industry (HSE, 2006).

Table 18.8.45: Illustrative health services that may be required by the workforce

Occupational health	Primary care and ICB services	Secondary care/ hospital care
Promoting positive mental health	General dental services	A&E (walk-in and emergency)
Drugs and alcohol prevention	General medical services	Inpatients (elective or emergency)
Musculoskeletal (Physio)	Minor injuries and dressings	Outpatients (elective or emergency)
Immunisation	Radiation, confined space and IR medical	Prescribing
Navigation	Out-of-hours GP	Imaging
Well-women clinic	Immunisation	Pathology
Well-men clinic	Musculoskeletal (Physio)	
Counselling	Sexual health	
Health surveillance (reporting injuries, diseases and dangerous occurrences)	Pharmacy services	
First aid, minor injuries and dressings	Prescribing	
A health care practitioner for construction workers to consult	Imaging	
Welfare facilities	Pathology	
Emergency procedures	Outpatients	
Preventative practices and protective equipment	Primary care mental health	

Table 18.8.46: Illustrative roles in occupational health service provision (Construction Industry Advisory Committee, 2015)

Title	Description
Appointed doctor	Doctor approved by the Health and Safety Executive (HSE) to undertake statutory health checks under certain regulations, eg for asbestos and lead.
Occupational health physician or occupational health nurse	Medical professional, with specific occupational health qualifications, who provides health surveillance, eg for noise and hand–arm vibration.
Occupational hygienist	Professional trained to recognise, evaluate and control risks associated with hazardous substances, such as asbestos, cement and silica.
Occupational health technician	Professional trained and qualified in specific areas, such as spirometry and audiometry. Technicians should be under the supervision of qualified occupational health physicians or nurses.
Responsible person	Someone given responsibility to help deliver a system of occupational health surveillance, eg administering screening questionnaires for hand–arm vibration, asthma and skin inspections for dermatitis. The role will be clearly defined. It will be a person trusted by the workforce, with good communication and interpersonal skills. If ill health is observed, an appropriately qualified doctor or nurse is consulted.

Port health activities at the Airport

18.8.550 Port health is a statutory function defined in the Public Health (Control of Disease) Act 1984, with further relevant notification provisions set out in the Public Health (Aircraft) Regulations 1979 (as amended). Port health authorities carry out a range of health controls at the UK borders. These include checks on imported food, inspecting aircraft for food safety and infectious disease control, as well as general public and environmental health checks (HM Government, 2012b).

18.8.551 A number of different organisations are responsible for different aspects of port health controls at Gatwick Airport:

- UKHSA have responsibility for sick passengers and infectious disease.
- Crawley Borough Council deal with products arriving at the airport such as imported food.
- GAL facilitate port health activities through access and onsite facilities as required.

18.8.552 The potential for infectious diseases risk to increase directly due to passengers arriving with communicable illnesses is noted and has been taken into account. This is a known risk with all national and international travel. Existing measures at the Airport to monitor and respond to this risk are in line with Government guidance. Such measures would be scaled with the increase in passenger growth, continuing to manage this risk appropriately in line with Government guidance of the day. Consequently, the level of risk is unlikely to change with the Project.

18.8.553 The potential for infectious diseases risk to increase indirectly due to the establishment of foreign vectors, such as non-endemic mosquito species, close to the Airport is also a port health issue. This is responded to with regular surveillance activities by Crawley Borough Council in and around the Airport. The potential for vectors to establish is partially probabilistic, ie a function of

aircraft numbers, but is more strongly linked to favourable habitat availability. The driver for increased risk is therefore habitat and climate change related, rather than due to additional aircraft movements associated with the Project. GAL would continue to support Crawley Borough Council in their statutory port heath duties in this regard, including reviewing any changes in the frequency and location of mosquito monitoring (eg the removal of Pond A and inclusion of new underground storage at car park Y for surface water drainage would change the habitat availability). Due to the appropriate scaling of such activities, there is unlikely to be a change in the level of indirect infectious disease risk due to the Project.

18.8.554 GAL will scale support for port health activities as required in relation to the Project to ensure continued compliance with relevant statutory requirements.

Sensitivity of the population

18.8.555 The sensitivity of the population has had regard to the baseline, including JSNA findings, set out in Section 18.5, Table 18.8.35 and Appendices 18.5.1 and 18.5.2. Common factors that differentiate the sensitivity of the general population and the vulnerable group population have been taken into account and are listed in paragraph 18.4.29.

18.8.556 The sensitivity of the general population is considered to be **low**. There are a suitable range of existing primary, secondary and emergency healthcare services located in proximity to the Airport. The great majority of passengers (circa 99.998%) would have no implications for local ambulance and A&E capacity (see Table 18.8.37). The majority of construction and operational workers would have existing NHS entitlements and access healthcare services as usual close to their usual place of residence, without implications for healthcare capacity changes. Any implication would be reduced by the Project's commitment to occupational health services, as well as by reimbursement procedures for workers with medical insurance. The great majority of demand on the NHS in the local area that is above that based on the resident population or patient list size, is likely unrelated to the Project and reflects normal unplanned NHS local service use by a non-permanent population in the area for business, education, leisure or other reasons unconnected with the airport.

18.8.557 The sensitivity of vulnerable groups is considered **high**. This reflects the presence of people who require regular health care, eg older people with multiple long-term conditions. Those requiring transfer from the Airport to hospital are included within this sub-population, as are members of the workforce, or their dependants, with particular health needs, eg chronic long-term conditions. Health professionals who are facing increased demand are also considered to be highly sensitive.

18.8.558 These conclusions on sensitivity are common to all assessment years and are not repeated to avoid duplication.

Summary of measures taken into account

18.8.559 The following measures have been taken into account. Further details are provided in Table 18.7.1.

- In relation to construction workers, occupational health provision scaled with worker numbers to maintain compliance with relevant statutory requirements, as well as implementing a protocol to manage the first point of contact for health queries from construction workers and subsequent avenues for further healthcare support. The objective of the protocol is to minimise use of local NHS primary healthcare providers and

inappropriate use of A&E services by construction workers. Secured through the **CoCP** (ES Appendix 5.3.2 (Doc Ref. 5.3)).
- In relation to operational workers, occupational health provision scaled with worker numbers to maintain compliance with relevant statutory requirements.
- In relation to port health, support scaled with passenger number increases to maintain compliance with relevant statutory requirements.
- In relation to airport passengers, onsite first responders, first aid training and AEDs scaled with passenger number increases, as well as information sharing to support routine NHS strategic service planning. Secured through Section 106 agreement.

Initial Construction Period: 2024-2029

Construction Workforce

18.8.560 The construction workforce is anticipated to peak in February 2027 when the expected average daily figure is 1,350 workers (reducing back to below 1,000 by April). **ES Chapter 17: Socio-economic Effects** (Doc Ref. 5.1) estimates 20% would be NHB, equivalent to 271 of the 1,357 workers.

18.8.561 As stated in **ES Chapter 17: Socio-economic Effects** (Doc Ref. 5.1), the 270 NHB workers would equate to an increase in the local population of around 0.3% against the average future baseline population between 2024 and 2029. The impact in the wider geographies is anticipated to be even smaller as these have a much larger population base (ie 0.3% in the FEMA and 0.1% in the LMA).

18.8.562 Furthermore, the total peak number of construction workers (1,350) is lower than the suggested 1,800 registered patients per full-time equivalent GP (based on guidance from the Royal College of GPs (NHS London HUDU, 2009)). This suggests that the hypothetical maximum increase in population would not be sufficient to create demand for an additional GP across the entire labour market area.

18.8.563 While the maximum population increase is anticipated to be very low and lower than that required to create demand for an additional GP, on-site health care would be provided for construction workers.

18.8.564 It is concluded that the magnitude of the change due to the Project is **low.** Due to the occupational health commitments, there would be a *negligible* to *very small* scale of change in NHS demand due to the presence of the construction workforce. There is likely to be some residual *occasional* access of services over the *medium-term*. Any impact on healthcare capacity is likely to equate to a *very minor* change in *morbidity* related outcomes for a *small minority* of the study area community populations. The effect on routine health service planning is likely *negligible*.

18.8.565 The professional judgement is that the significance of the population health effect would be up to **minor adverse** (not significant). The score reflects a clear association in the scientific literature as to the importance of appropriate health care access, but also that there is some uncertainty as to the efficacy of occupational health interventions in avoiding inappropriate A&E attendance and other healthcare service usage. Notwithstanding this, the commitments on occupational healthcare for the workforce mean that the level of change in the study area's health baseline due

to the Project is likely to be *very limited*, with at most a *marginal* effect on the delivery of health policy and inequalities.

First Full Year of Opening: 2029

Construction Workforce

18.8.566 The size of the construction workforce in the first full year of opening (2029) would be less than in the peak year of construction (occurring during the initial construction period). As set out in **ES Chapter 17: Socio-economic Effects** (Doc Ref. 5.1), informing the 2029 assessment year, the peak construction workforce between 2030-2032 is 1,320 workers in July and August 2030. As with the 2024-2029 assessment year, Chapter 17: Socio-economic Effects assumes 20% would be NHB, equivalent to 264 workers.

18.8.567 As stated in **ES Chapter 17: Socio-economic Effects** (Doc Ref. 5.1), the 265 NHB workers would equate to an increase in the local population of c.0.3% against the future baseline population projection for this period. The equivalent for the FEMA and LMA is anticipated to be 0.3% and 0.1%.

18.8.568 It is concluded that the magnitude of the change due to the Project is **low** for the same reasons as set out in paragraph 18.8.564.

18.8.569 The professional judgement is that the significance of the population health effect would be up to **minor adverse** (not significant) for the same reasons as set out in paragraph 18.8.565.

Operational Workforce

18.8.570 In 2029, the Project would lead to an increase of 987 direct jobs nationally over the base case. Annex 4 of **ES Appendix 17.9.2: Local Economic Impact Assessment** (Doc Ref. 5.3) calculates that 293 of these direct jobs would be filled by workers from within the LSA, 408 in the FEMA, 690 in the LMA and 766 in the Six Authorities Area.

18.8.571 GAL will continue to provide appropriate occupational healthcare to its employees. Provisions would continue to be aligned to statutory requirements and would be scaled proportionately to the increase in the workforce. Provisions include health promotion and support, including musculoskeletal and mental health conditions. Occupational healthcare would be provided to the operational workforce in line with statutory requirements under the Health and Safety at Work Act 1974.

18.8.572 GAL have been in discussion with West Sussex ICB with regard to supporting improved NHS access to services as part of the Crawley Programme. This collaboration is relevant to both the business-as-usual activities of GAL and the Project. Both current and future Airport workers, particularly shift workers, would benefit from enhanced access to preventative screening programmes provided by the NHS and increased opportunity to access GP services with which they are already registered. Ongoing collaboration is planned, including on data sharing and gathering activities, as well as exploring the feasibility of on-site NHS outreach services. The project does not rely on such activities as mitigation but notes the positive relationship as illustrative of an ongoing commitment to employee health and wellbeing.

18.8.573 GAL is constructively engaging with the NHS Sussex ICB, including considering localised effects in Crawley. GAL will continue to share information with the ICB and explore collaboration, eg in facilitating access to NHS services for shift workers at the Airport, to support better NHS and

public health outcomes for GAL workers. For example, GAL could provide annual reporting to West Sussex ICB on monitoring of operational employee occupation health statistics and referrals.

18.8.574 It is concluded that the magnitude of the change due to the Project is **low.** Due to the occupational health commitments, there would be a *negligible* to *very small* scale of change in NHS demand due to additional operational workers, as most would be locally resident with NHS entitlements. There is likely to be some residual *occasional* access of services over the *medium-term* by staff not directly employed by GAL, such as aircrews. The great majority of residual access is expected to be covered by health insurance or existing NHS out of area reimbursement mechanisms. Any impact on healthcare capacity is likely to equate to a *very minor* change in *morbidity* related outcomes for a *small minority* of the study area community populations. This is likely to include a negative effect from slightly increased demand and a positive element of change where access to the NHS is enhanced through collaboration on the Crawley Programme. The effect on routine health service planning is likely *negligible*.

18.8.575 The professional judgement is that the significance of the population health effect would be up to **minor adverse** (not significant) for the same reasons as set out in paragraph 18.8.565.

Passengers requiring emergency healthcare

18.8.576 As discussed, the rates of transfers to hospital are reduced by effective onsite first responder and first aid activities, with over 75% of health related calls to the Gatwick Control Centre resulting in the passenger continuing their journey. The rates of additional hospital transfers have been projected based on the Project increases in air traffic movements. For 2029 this equates to a further 98 transfers per year, which is on average 0.3 transfers per day. As noted, this is likely to be partially a redistribution of transfers from the South East Coast Ambulance Service area, linked to underlying health reasons, rather than wholly new demand attributable to incidents at the airport, see paragraphs 18.8.537 and 18.8.538.

18.8.577 It is concluded that the magnitude of the change due to the Project is **low.** The scaling of onsite first responder and first aid provision would continue to reduce unnecessary demands on ambulance and A&E services. Notwithstanding this, hospital transfers would continue to be a *frequent* occurrence given context of a busy transport hub, though the scale of change in demand due to the Project is *small*. Any impact on healthcare capacity is likely to equate to a *very minor* change in *morbidity and mortality* risk for a *very few* people. Such outcomes are related to the potential for slightly increased response times, which are a function of ambulance availability and number of callouts. The effect on routine health service planning is likely *slight*.

18.8.578 The professional judgement is that the significance of the population health effect would be up to **minor adverse** (not significant). The score reflects a clear association between ambulance and A&E capacity and treatment outcomes. This acknowledges the importance of emergency services and their sensitivity to capacity changes. However, the level of change would have a *very limited* effect on the population health baseline of the study area, with at most a *marginal* effect on the delivery of health policy and inequalities.

Port Health

18.8.579 Port health activities are a statutory requirement and would be scaled with passenger growth. GAL will continue to support Port health activities undertaken by relevant statutory duty holders at

the Airport. Such activities are protective of public health, eg communicable illness surveillance activities, and GAL support for such activities would be scaled appropriately.

18.8.580 The magnitude of the change due to the Project is **negligible.** This reflects that whilst activities would be *continuous* in terms of health surveillance, there would be a *negligible* scale of change due to the Project as port health activities would be scaled as a statutory requirement independent of the Project. Consequently, at most, there would be a *very minor* change in *morbidity and mortality* risk, inherent to increased national and international travel probabilistically increasing communicable disease and vector transmission. This has the potential to affect a majority of the population, a risk that is greatly reduced and controlled through the port health measures. The effect on routine port health service planning is likely *small* and is supported by the data set out in this chapter and elsewhere in the application.

18.8.581 The professional judgement is that the significance of the population health effect would be **negligible adverse** (not significant). This acknowledges the clear association between port health activities in safeguarding population health outcomes but gives weight to the existing statutory duties that would scale such measures without the need for further DCO commitments. Consequently, there would be *no,* or *very limited*, expected change in the population health baseline and *no* effect on the delivery of health policy and inequalities.

18.8.582 Requirements for additional port health space being provide by GAL would be agreed with relevant parties through post determination discussions as part of business-as-usual reviews and planning of port heath activities at the Airport in line with statutory obligations.

Interim Assessment Year: 2032

Construction Workforce

18.8.583 The size of the construction workforce in the interim assessment year (2032) would be less than in the peak year of construction (occurring during the initial construction period). As set out **in ES Chapter 17: Socio-economic Effects** (Doc Ref. 5.1), informing the 2032 assessment year, the peak construction workforce between 2033 and 2038 is estimated to be around 450 workers in January to June 2033. As with the 2024-2029 assessment year Chapter 17: Socio-economic Effects assumes 20% would be NHB, equivalent to 90 workers.

18.8.584 It is concluded that the magnitude of the change due to the Project is **low** for the same reasons as set out in paragraph 18.8.564.

18.8.585 The professional judgement is that the significance of the population health effect would be up to **minor adverse** (not significant) for the same reasons as set out in paragraph 18.8.565.

Operational Workforce

18.8.586 In 2032, the Project would lead to an increase of 3,122 direct jobs nationally over the base case. It has been calculated that 942 of these direct jobs would be filled by people from within the LSA, 1,312 the FEMA, 2,219 the LMA and 2,461 the Six Authorities Area.

18.8.587 Occupational healthcare would be provided to the operational workforce in line with statutory requirements under the Health and Safety at Work Act 1974.

18.8.588 It is concluded that the magnitude of the change due to the Project is **low** for the same reasons as set out in paragraph 18.8.574.

18.8.589 The professional judgement is that the significance of the population health effect would be up to **minor adverse** (not significant) for the same reasons as set out in paragraph 18.8.565.

Passengers requiring emergency healthcare

18.8.590 For 2032, projections estimate a further 316 transfers to hospital per year, which is on average 0.9 transfers per day. As noted, this is likely to be partially a redistribution of transfers from the South East Coast Ambulance Service area, linked to underlying health reasons, rather than wholly new demand attributable to incidents at the airport.

18.8.591 It is concluded that the magnitude of the change due to the Project is **low.** The scaling of onsite first responder and first aid provision would continue to reduce unnecessary demands on ambulance and A&E services. Notwithstanding this, hospital transfers would continue to be a *frequent* occurrence given context of a busy transport hub. Although the scale of change in demand due to the Project is *medium*, it is anticipated that there would be a commensurate increase in ambulance service capacity through routine service planning functions, including as informed by the analysis presented in this chapter. Any impact on healthcare capacity is likely to therefore equate to a *very minor* change in *morbidity and mortality* risk for a *very few* people. The effect on routine health service planning is likely *small* but necessary to avoid a medium magnitude effect.

18.8.592 The professional judgement is that the significance of the population health effect would be up to **minor adverse** (not significant). The score reflects a clear association between ambulance and A&E capacity and treatment outcomes. The assessment assumes adequate routine service planning, including by South East Coast Ambulance Service NHS Foundation Trust and Surrey and Sussex Healthcare NHS Trust, to accommodate the increase in additional hospital transfers. On this basis, the level of change would have a *very limited* effect on the population health baseline of the study area, with at most a *marginal* effect on the delivery of health policy and inequalities.

Port Health

18.8.593 Port health activities are a statutory requirement and would be scaled with passenger growth.

18.8.594 The magnitude of the change due to the Project is **negligible** for the same reasons as set out in paragraph 18.8.580.

18.8.595 The professional judgement is that the significance of the population health effect would be **negligible adverse** (not significant) for the same reasons as set out in paragraph 18.8.581.

Design Year 2038

Operational Workforce

18.8.596 In 2038, the Project would lead to an increase of 3,215 direct jobs over the base case, which is the highest across the entire assessment period. It has been estimated that 955 of these direct jobs would be filled by people from within the LSA, 1,330 the FEMA, 2,249 the LMA and 2,494 the Six Authorities Area.

18.8.597 Occupational healthcare would be provided to the operational workforce in line with statutory requirements under the Health and Safety at Work Act 1974.

18.8.598 It is concluded that the magnitude of the change due to the Project is **low** for the same reasons as set out in paragraph 18.8.574.

18.8.599 The professional judgement is that the significance of the population health effect would be up to **minor adverse** (not significant) for the same reasons as set out in paragraph 18.8.565.

Passengers requiring emergency healthcare

18.8.600 For 2038, projections estimate a further 323 transfers to hospital per year, which is on average 0.9 transfers per day. As noted, this is likely to be partially a redistribution of transfers from the South East Coast Ambulance Service area, linked to underlying health reasons, rather than wholly new demand attributable to incidents at the airport.

18.8.601 It is concluded that the magnitude of the change due to the Project is **low** for the same reasons as set out in paragraph 18.8.591.

18.8.602 The professional judgement is that the significance of the population health effect would be up to **minor adverse** (not significant) for the same reasons as set out in paragraph 18.8.592.

Port Health

18.8.603 Port health activities are a statutory requirement and would be scaled with passenger growth.

18.8.604 The magnitude of the change due to the Project is **negligible** for the same reasons as set out in paragraph 18.8.580.

18.8.605 The professional judgement is that the significance of the population health effect would be **negligible adverse** (not significant) for the same reasons as set out in paragraph 18.8.581.

Year 2047

Operational Workforce

18.8.606 In 2047, the Project would lead to an increase of 3,101 direct jobs nationally over the base case, which is lower compared to both the design year (2038) and the interim assessment year (2032) albeit at a marginal basis. It has been estimated that 921 of these direct jobs would be filled by people from within the LSA, 1,283 the FEMA, 2,169 the LMA and 2,405 the Six Authorities Area.

18.8.607 Occupational healthcare would be provided to the operational workforce in line with statutory requirements under the Health and Safety at Work Act 1974.

18.8.608 It is concluded that the magnitude of the change due to the Project is **low** for the same reasons as set out in paragraph 18.8.574.

18.8.609 The professional judgement is that the significance of the population health effect would be up to **minor adverse** (not significant) for the same reasons as set out in paragraph 18.8.565.

Passengers requiring emergency healthcare

18.8.610 For 2047, projections estimate a further 318 transfers to hospital per year, which is on average 0.9 transfers per day. As noted, this is likely to be partially a redistribution of transfers from the South East Coast Ambulance Service area, linked to underlying health reasons, rather than wholly new demand attributable to incidents at the airport.

18.8.611 It is concluded that the magnitude of the change due to the Project is **low** for the same reasons as set out in paragraph 18.8.591.

18.8.612 The professional judgement is that the significance of the population health effect would be up to **minor adverse** (not significant) for the same reasons as set out in paragraph 18.8.592.

Port Health

18.8.613 Port health activities are a statutory requirement and would be scaled with passenger growth.

18.8.614 The magnitude of the change due to the Project is **negligible** for the same reasons as set out in paragraph 18.8.580.

18.8.615 The professional judgement is that the significance of the population health effect would be **negligible adverse** (not significant) for the same reasons as set out in paragraph 18.8.581.

Conclusion

18.8.616 Overall, the **minor adverse** local healthcare capacity scores reflect that, whilst a slight increase in NHS demand may be considered detrimental to some degree for public health, ie not negligible, the change due to the Project is not significant for population health in EIA Regulation terms.

Further Mitigation and Future Monitoring

18.8.617 No further mitigation measures are proposed. Regarding monitoring, the total medical calls to Gatwick Control Centre and the number of passengers subsequently transferred to hospital will be shared with GATCOM annually. The measure is secured through Section 106 agreement. With such information sharing there can be a high degree of confidence in the effectiveness of routine NHS service planning.

Significance of Effects

18.8.618 The residual significance of effects would remain unchanged, ie **minor adverse** (not significant) effects for population health.

Health and Wellbeing Effects from Understanding of Risk (Risk Perception)

General

Approach

18.8.619 This section of the ES presents findings on a group of issues where the common factor is the potential for a population health effect related to concern about an issue, affecting mental health and wellbeing, rather than the likelihood of an actual level risk to public health. The issues discussed are electromagnetic fields (EMF), extended operational hazards and pests. These are discussed together due to the common pathway of effect and the common approach to reducing effects through good communication.

18.8.620 Project features and expectations about a project can be understood in different ways by different people. This assessment considers these views, ways that health and well-being might be affected and a course of action. The aim is to find a way to address and allay concerns that people might have, inform communications and consultation elements of the Project and contribute towards reducing anxiety.

18.8.621 The term 'understanding' is used in preference to 'perception'. An understanding of a topic or an issue is something that can develop and that can be debated and shared. The term 'perception' can imply views that do not align with scientific analysis and are given less credence.

18.8.622 This section has been informed by **ES Appendix 5.3.4: Major Accidents and Disasters** (Doc Ref. 5.3) in relation to the actual risks of extended operational hazards and the **CoCP** (ES Appendix 5.3.2 (Doc Ref. 5.3)) in relation to measures that mitigate against actual risks of pests, such as avoidance and control of vermin or flies.

18.8.623 Baseline population health indicators relevant to understanding of risk are set out in Table 18.8.35. Further details are set out in **ES Appendix 18.5.2: Health and Wellbeing Baseline Data Tables** (Doc Ref. 5.3).

Health outcomes

18.8.624 The scientific literature identifies the following general points relevant to potential effects and health outcomes. The way risks are understood has important influences on health behaviour (Ferrer & Klein, 2015). Awareness of risk can affect mental, physical and emotional wellbeing, and can be worse when it is accompanied by uncertainty (Luria, et al., 2009).

18.8.625 The ultimate goal of dialogue between regulators and communities is to produce an informed public (Sinisi, 2004). Trust, credibility, competence, fairness and empathy are of great importance (Sinisi, 2004) and the routine monitoring and clear communication of results can greatly increase trust, empower people and reduce fear factors (WHO, 2013b).

18.8.626 The views that people hold can be associated with low-grade illnesses (eg headaches or hypertension) and can be exacerbated when there is uncertainty (Luria, et al., 2009).

Indicators

Table 18.8.47: Baseline – summary indicators relevant to understanding of risk health outcomes

Indicator Name	Units	Nine ward (mean)	HLSA (mean)	Six Authority Area (mean)	South East	England
Self reported wellbeing: people with a high anxiety score (16+ years)	%	NA	NA	24.7	22.3	22.6
Depression: QOF prevalence (18+ years)	%	NA	11.8	12.7	13.1	12.7
Population who cannot speak English well or at all	%	2.0	0.8	1.3	0.9	1.7
Emergency hospital admissions for intentional self harm	SAR	127.3	99.6	104.4	108.3	100.0
Suicide rate (10+ years)	Per 100,000	NA	11.1	11.0	10.6	10.4

18.8.627 Table 18.8.47 summarises mental health and wellbeing indicators that may be affected to varying degrees by public understanding of Project risks. The above average rates of hospital admissions

for intentional self harm in the nine ward area, compared to other comparators, suggests current heightened localised mental health pressures. At the HLSA level, the proportion of the population with a primary care depression diagnosis is lower compared to regional and national comparators. Smaller area anxiety data is not available for the nine ward area or HLSA, however a greater number of people report a high anxiety score in the Six Authority Area than the regional and national average. The above average proportion of the population who do not speak English well or at all in the nine ward area compared to other comparators is relevant to the extent to which the actual risks may be understood through information sharing.

Likelihood

18.8.628 A potential population mental health effect is considered likely because there is a plausible source-pathway-receptor relationship:

- Source: public understanding of risks can differ from the actual risks that are derived from scientific studies.
- Pathway: anxiety, stress and a sense of powerlessness can have adverse effects on health and mental well-being while a sense of control is beneficial to health and well-being.
- Receptor: people living and working close to the Airport.

18.8.629 Furthermore, the potential mental health effects are probable as no highly unusual conditions are required for the source-pathway-receptor linkage. An effect on the population's physical health associated with the actual exposures or risks is unlikely as mitigation breaks the pathway between sources and receptors.

Populations

18.8.630 The population groups relevant to this assessment are:

- The 'site-specific' geographic population of the nine wards close to the Airport, see paragraph 18.4.12; noting that this is indicative because concern on an issue is not geographically bounded in the same way as actual risk.
- The sub-population vulnerable due to:
  - Low-income vulnerability (people with fewer resources may feel less able to adapt to changes that concern them).
  - Poor health vulnerability (people with existing poor mental health may be more sensitive to changes that concern them).
  - Access and geographical vulnerability (people for whom close proximity increases sensitivity).

Sensitivity of the population

18.8.631 The sensitivity of the population has had regard to the baseline, including JSNA findings, set out in Section 18.5, Table 18.8.47 and Appendices 18.5.1 and 18.5.2. Common factors that differentiate the sensitivity of the general population and the vulnerable group population have been taken into account and are listed in paragraph 18.4.29.

18.8.632 The sensitivity of the general population is **low**. Most people in the study area live, work or travel at a separation distance from the Project's infrastructure and activities, including electrical infrastructure, fuel storage and public safety zones, where they would not be concerned about the

potential for risks. This group also includes that proportion of the population who are ambivalent or not concerned about EMF, extended operational hazards or pests as risk factors.

18.8.633 The sensitivity of the vulnerable sub-population is **high**. This reflects that the sub-population includes people who may be uncertain or concerned about EMF, extended operational hazards or pests and this may exacerbate existing mental health conditions or be a source of stress and anxiety in itself. This may particularly be the case for people with near views and/or who live in close proximity to the airport. Low incomes or existing deprivation may contribute to a limited sense of control and reduced capacity to obtain further information.

18.8.634 These conclusions on sensitivity are common to all assessment years and are not repeated to avoid duplication.

Summary of measures taken into account

18.8.635 The following measures have been taken into account.

- EMF: compliance with exposure standards set out in Department for Energy and Climate Change (DECC) Voluntary Code of Practice (DECC, 2012), including compliance with the ICNIRP public exposure guidelines (ICNIRP, 1998).
- Sharing of non-technical information with the community, for example the summary at the end of this chapter and the **EIA Non-Technical Summary** (Doc Ref. 5.4).
- **CoCP** (ES Appendix 5.3.2 (Doc Ref. 5.3)), including pest control and appropriate waste management.

Initial Construction Period: 2024-2029

18.8.636 The following sections explain how actual risks are responded to. This supports public understanding of risk, including reduced mental health effects associated with concern or anxiety.

Health Effects from EMF

18.8.637 The Project includes the reorientation and distribution of the airport substation and grid infrastructure, with the potential to modify EMF. However, as stated in the Department for Energy and Climate Change (DECC) Voluntary Code of Practice (DECC, 2012), compliance with the ICNIRP public exposure guidelines set to protect health is assumed for electricity distribution infrastructure, overhead power lines or underground cables operating at ≤132 kV, without the need for more detailed assessment. This is on the basis of evidence published by the Energy Networks Association (ENA) showing that by design, such infrastructure is not capable of causing exceedance of the public exposure guideline limits.

18.8.638 As outlined by the ENA (National Grid, n.d.), based on a worst-case hypothetical design (ie L7 pylon design with 7 m clearance, 1.4 kA per circuit and untransposed phasing), the pylon would produce 3.6 kV/m electric field and 46 μT magnetic field. Therefore, this worst-case pylon design, and all practical pylons at 132 kV and below, are compliant by design. On this basis, the 33 kV required by the Project would remain below the ICNIRP exposure guidelines set to be protective of human health.

18.8.639 Any electricity supply infrastructure included as part of the Project would operate at ≤132 kV and would therefore comply with the guideline exposure limit set to protect public health.

Extended Operational Hazards

18.8.640 Extended operational hazards include the risk from major accidents and fuel storage and the transmission of communicable diseases.

18.8.641 The risks associated with fuel storage are covered throughout **ES Appendix 5.3.4 Major Accidents and Disasters** (Doc Ref. 5.3) whereby the sources and hazards are clearly identified, and emergency responses outlined. Appendix 5.3.4 concludes operation of the Project would not result in significant increases in risk levels.

18.8.642 The potential risk from communicable disease transmission is currently managed by implementation of the International Health Regulations which place a legally binding requirement for 196 countries, including all Member States of the World Health Organization (WHO), to prevent and respond to acute public health risks that have the potential to cross trans-national boundaries and threaten people worldwide. Measures include:

- surveillance to establish any potential transboundary risk;
- informing national travel recommendations, airlines and ports of any heightened risk and acute symptoms to screen for;
- refusal for travel by airlines should symptoms be prevalent at the country of origin;
- visual screening for acute symptoms taking place during boarding and on-board flights; and
- cataloguing of any health condition mid-flight other than air sickness by airline staff, which is signed off by the pilot-in-command and relayed to the destination for instruction (eg diversion, priority landing, quarantine and/or medical assistance upon arrival).

18.8.643 The UKHSA (formally Public Health England) is the National Focal Point for the International Health Regulations, monitoring international communicable health risks to the UK, and providing regular epidemiological updates, assessing potential risk, offering travel advice and briefing health services on the symptoms, health conditions and clinical interventions to be aware of. The UKHSA also has various specialist advice and diagnostic units (eg the Imported Fever Service or Rare and Imported Pathogens Laboratory) to assist doctors with managing cases where travellers have returned to the UK with infectious diseases.

18.8.644 Overall, the Project has no influence on the approach to dealing with international communicable disease transmission and does not alter the hazard profile, international regulatory requirement, UKHSA duty, or measures in place to monitor, prevent, contain and respond to the transmission of international communicable disease. Relevant port health links, eg to passenger communicable disease surveillance, are discussed in the section 18.8 assessment of local healthcare capacity from paragraph 18.8.512.

Health Effects from Pests

18.8.645 Infrastructure projects can alter habitats and food chains that might attract opportunistic species that are typically regarded as pests. Without management, airports could provide good year-round habitats for insects, rodents, rabbits, deer, foxes and birds that could theoretically present an aircraft maintenance hazard and can pose a direct collision hazard to aircraft moving on the ground and in flight. Such species can further attract raptors presenting an associated strike hazard.

18.8.646 However, the potential hazard is well known, understood and already addressed at Gatwick Airport through existing design and management measures. Further to this, the **CoCP** (ES

Appendix 5.3.2 (Doc Ref. 5.3)) is expected to ensure the risk of pest/vermin infestation would be reduced by ensuring any putrescible waste (eg food waste) is stored appropriately and regularly collected, and effective preventative pest control measures are implemented.

18.8.647 Relevant port health links, eg to mosquito population monitoring and control, are discussed in the section 18.8 assessment of local healthcare capacity from paragraph 18.8.512.

Conclusion

18.8.648 The magnitude of change due to the Project is **low**. The level of actual risk exposure is *negligible*, however the scale of change that may contribute to community concern is *medium*, *continuous* and *long-term*. The severity of the health outcome relates predominantly to a *minor* change in mental health related *morbidity* for a *very few* people within the population. Such individual level effects are unlikely to have implications for health service capacity. For many people there is likely to be a rapid reversal of effects should their concerns be responded to and resolved to their satisfaction.

18.8.649 The significance of the population health effect is **minor adverse** (not significant). The professional judgment is that there could be a *very limited* adverse change in the health baseline for the surrounding population. This conclusion reflects scientific understanding of the impact of uncertainty or concern about environmental risks on mental health. It also reflects that the actual risks would be well within regulatory standards and that most members of the public would expect this to be the case. The context that airport infrastructure, including electrical infrastructure and fuel storage, as well as public safety zones are an existing feature of the local context would also be expected to inform population understanding of risk. At most the Project change may have a *marginal* influence on population health inequalities.

First Full Year of Opening: 2029

18.8.650 It is concluded that the magnitude of the change due to the Project is **low** for the same reasons as set out in paragraph 18.8.648.

18.8.651 The professional judgement is that the significance of the population health effect would be up to **minor adverse** (not significant) for the same reasons as set out in paragraph 18.8.649.

Interim Assessment Year: 2032

18.8.652 It is concluded that the magnitude of the change due to the Project is **low** for the same reasons as set out in paragraph 18.8.648.

18.8.653 The professional judgement is that the significance of the population health effect would be up to **minor adverse** (not significant) for the same reasons as set out in paragraph 18.8.649.

Design Year 2038

18.8.654 It is concluded that the magnitude of the change due to the Project is **low** for the same reasons as set out in paragraph 18.8.648.

18.8.655 The professional judgement is that the significance of the population health effect would be up to **minor adverse** (not significant) for the same reasons as set out in paragraph 18.8.649.

Year 2047

18.8.656 It is concluded that the magnitude of the change due to the Project is **low** for the same reasons as set out in paragraph 18.8.648.

18.8.657 The professional judgement is that the significance of the population health effect would be up to **minor adverse** (not significant) for the same reasons as set out in paragraph 18.8.649.

18.9. Potential Changes to the Assessment as a Result of Climate Change

18.9.1 The primary impacts associated with climate change include increased temperatures, increased atmospheric CO_2 and increased incidence of extreme weather events. These primary impacts affect several environmental functions (such as water availability, salinisation, varying crop yields, wildfires, ozone/PM concentrations, and migration patterns) which could plausibly alter the prevalence of a range of health and wellbeing outcomes.

18.9.2 Of particular relevance in this context is the modification of atmospheric emission dispersion, related concentration hazard exposure and consequent changes in cardiovascular/respiratory disease prevalence associated with climate change driven meteorological variations.

18.9.3 However, at this stage it is not possible to predict future changes in climate change driven meteorological variations which have the potential to influence health and wellbeing. While the effects of climate change outlined above have the potential to exacerbate existing health and wellbeing outcomes at a population level, there are clear limitations associated with predicting future meteorological variations that influence health and wellbeing. Despite this, the effects of climate change likely to be realised during the operational lifetime of the Project are not expected to materially alter the conclusions of this assessment.

18.10. Cumulative Effects

Zone of Influence

18.10.1 The zone of influence (ZoI) for health and wellbeing has been identified based on the spatial extent of likely effects. Following the same approach applied in the main assessment, the ZoI for health and wellbeing remains consistent with the inter-related technical disciplines that the health and wellbeing topic relies upon.

Screening of Other Developments and Plans

18.10.2 The Cumulative Effect Assessment (CEA) takes into account the impact associated with the Project together with other developments and plans. The projects and plans selected as relevant to the CEA presented within this chapter are based upon the results of a screening exercise undertaken as part of the 'CEA short list' of developments (see **ES Appendix 20.4.1: Cumulative Effects Assessment Long and Short Lis**t (Doc Ref. 5.3)). Each development on the CEA long list has been considered on a case by case basis for scoping in or out of this chapter's assessment based upon data confidence, effect-receptor pathways and the spatial/temporal scales involved.

18.10.3 It is noted that the cumulative effect of additional road traffic from other developments is included within the main assessment, as the traffic movements, traffic noise and traffic air quality modelling

is based on traffic forecasts that take these developments into account (see **ES Chapter 12: Traffic and Transport** (Doc Ref. 5.1)).

18.10.4 In undertaking the CEA for the Project, it is important to bear in mind that the likelihood of other developments and plans being constructed varies depending on how far along the planning process they are. For example, relevant developments and plans that are already under construction are likely to contribute to a cumulative impact with the Project (providing impact or spatial pathways exist), whereas developments and plans not yet approved or not yet submitted are less certain to contribute to such an impact, as some may not achieve approval or may not ultimately be built due to other factors. For this reason, all relevant development and plans considered cumulatively alongside the Project have been allocated into 'Tiers', reflecting their current stage within the planning and development process. Appropriate weight is therefore given to each Tier in the decision-making process when considering the potential cumulative impact associated with the Project (eg it may be considered that greater weight can be placed on the Tier 1 assessment relative to Tier 2). Further details of the screening process for the inclusion of other developments and plans in the short list and a description of the Tiers is provided in **ES Chapter 20: Cumulative Effects and Inter-relationships** (Doc Ref. 5.1).

18.10.5 The specific developments scoped into the CEA for health and wellbeing remain consistent with the inter-related technical disciplines that the health and wellbeing chapter draws from and builds upon. Full details of each of the developments is provided in **ES Appendix 20.4.1: Cumulative Effects Assessment Long and Short List** (Doc Ref. 5.3).

18.10.6 Broadly the potential for other projects to cumulatively affect site-specific populations discussed in the main assessment is relatively limited. This reflects that localised impacts require close proximity and similar timing (concurrently or consecutively) to affect the same populations.

18.10.7 Similarly at the local and regional spatial levels discussed in the main assessment, effects tend to be diffuse, ie the changes are spread over a large area. This limits the extent to which the same people experience multiple effects.

18.10.8 In both cases it is assumed that other projects will also employ standard good practice measures. This further reduces the potential for significant adverse population effects individually or in combination.

Cumulative Effects Assessment

Cumulative Health and Wellbeing Effects from Changes to Air Quality

18.10.9 As stated in **ES Chapter 13: Air Quality** (Doc Ref. 5.1), modelled data used in the main assessment includes known future developments and the assessment therefore incorporates cumulative impacts. Where there are cumulative projects, eg residential development, that are not modelled receptors in the main assessment, there are other closer receptors that have been modelled. The main assessment therefore represents the worst-case scenario.

18.10.10 No new or materially different magnitude or significance conclusions in relation to air quality and population health effects are therefore expected due to cumulative projects. This conclusion applies to all assessment years.

Cumulative Health and Wellbeing Effects from Changes in Noise Exposure

18.10.11 **ES Chapter 14: Noise and Vibration** (Doc Ref. 5.1) notes in relation to cumulative residential developments that in seeking permission to develop sites for residential use in noisy areas, in accordance with the NPPF and other policy, developers are required to consider the potential for noise impacts on future residents and to design the developments with suitable mitigation accordingly. The presumption is that any future residential development can reasonably be assumed to be built to standards that provided an appropriate noise environment. It would also be the case that residents moving to such accommodation can reasonably be assumed to be in a position to take the noise impacts of the Airport into account. Both limit the likelihood of such a future population increase being associated with levels of exposure, or subjective responses to noise changes, associated with adverse health outcomes.

18.10.12 No new or materially different magnitude or significance conclusions in relation to noise and population health effects are therefore expected due to cumulative projects. This conclusion applies to all assessment years.

Cumulative Health and Wellbeing Effects from Changes in Transport Nature and Flow Rate

18.10.13 As stated in **ES Chapter 12: Traffic and Transport** (Doc Ref. 5.1) cumulative developments have inherently been considered as part of the strategic transport modelling process.

18.10.14 There are three developments within the vicinity of Gatwick that are considered 'reasonably foreseeable'. They are not specifically included in the future baselines, other than in the sense that they form part of general population and employment growth which is addressed in growth factors used in the assessment in **ES Chapter 12: Traffic and Transport** (Doc Ref. 5.1). The three developments are:

- Horley Employment Park (83ha with 200,000 sqm office space 0.4 km from Project site boundary);
- Land West of Ifield (up to 4,000 homes and supporting infrastructure 1.5 km from Project site boundary); and
- Gatwick Green (24.1ha new industrial land, predominantly for B8 storage and distribution use 2.5 km from Project site boundary).

18.10.15 Stakeholders have requested consideration of the cumulative effects of the Project with these three developments, given their proximity to the Airport. **ES Chapter 12: Traffic and Transport** (Doc Ref. 5.1) therefore considers these projects and concludes that across the assessment years, the cumulative effects are up to:

- severance, minor adverse effects;
- driver delay, minor and moderate adverse effects;
- pedestrian and cyclist delay, negligible adverse effects;
- pedestrian and cyclist amenity, minor and moderate adverse effects;
- accidents and safety, negligible adverse effects; and
- public transport amenity, minor adverse effects.

18.10.16 The moderate adverse effects for driver delay and pedestrian and cyclist amenity are due to additional traffic arising from these developments at certain junctions during operation. However, these effects are expected to be assessed and mitigated by the proponents of those projects, such that there would not be a significant residual cumulative effect.

18.10.17 No new or materially different magnitude or significance conclusions in relation to transport nature and flows and population health effects are therefore expected due to cumulative projects. This conclusion applies to all assessment years.

Cumulative Health and Wellbeing Effects from Changes in Lifestyle Factors

18.10.18 As stated in **ES Chapter 19: Agricultural Land Use and Recreation** (Doc Ref. 5.1), Horley Business Park is noted as including (Reigate and Banstead Development Management Plan 2018-2027, Policy HOR9 'Horley Strategic Business Park'):

- at least five hectares of new high quality public open space, including parkland and outdoor sports facilities;
- retention or re-routing of public footpath 362a (Sussex Border Path); and
- upgrading and extension of pedestrian/cycle routes from the Business Park to Horley town centre and Gatwick Airport station.

18.10.19 **ES Chapter 19: Agricultural Land Use and Recreation** (Doc Ref. 5.1) does not anticipate that there would be any significant cumulative effects from such proposals or other cumulative projects.

18.10.20 No new or materially different magnitude or significance conclusions in relation to lifestyle factors and population health effects are therefore expected due to cumulative projects. This conclusion takes into account the effects on pedestrians and cyclists discussed in relation to **ES Chapter 12: Traffic and Transport** (Doc Ref. 5.1). This conclusion applies to all assessment years.

Cumulative Health and Wellbeing Effects from Changes in Socio-economic Factors

18.10.21 **ES Chapter 17: Socio-economic Effects** (Doc Ref. 5.1) identifies cumulative construction requirements that are likely to come forward and, although they would increase construction activity in the local study area, labour supply issues are not anticipated due to the general scale and mobility of the construction workforce. Chapter 17: Socio-economic Effects does not anticipate changes to construction related socio-economic effects.

18.10.22 Once operational, **ES Chapter 17: Socio-economic Effects** (Doc Ref. 5.1) expects the cumulative projects will result in the following assessment year provisions:

- 2029, c.2,100 new homes equivalent to an additional population of 5,020 new residents, and c.200 jobs across a variety of occupations.
- 2032, c.3,300 new homes, 7,900 new residents and 70 new jobs.
- 2038, 4,000 new homes and 9,600 new residents.
- 2047, c.4,600 new homes, c.20,500 new residents and c.12,400 new jobs.

18.10.23 **ES Chapter 17: Socio-economic Effects** (Doc Ref. 5.1) finds these increases to be within (ie smaller than) the increases projected within its future baselines, so are accommodated by its main assessment without changes to their conclusions.

18.10.24 No new or materially different magnitude or significance conclusions in relation to socio-economic factors and population health effects are therefore expected due to cumulative projects. This conclusion applies to all assessment years.

Cumulative Health and Wellbeing Effects from Changes in Exposure to Light

18.10.25 No cumulative effects relating specifically to exposure to light have been identified **by ES Chapter 8: Landscape, Townscape and Visual Resources** (Doc Ref. 5.1) for any assessment scenario. The Horley Business Park development is noted as having some spatial overlap with one of the Project's construction compounds. This sequential use of the site is noted as having temporary cumulative visual effects to a small number of people at their place of work.

18.10.26 No new or materially different magnitude or significance conclusions in relation to exposure to light and population health effects are therefore expected due to cumulative projects. This conclusion applies to all assessment years.

Cumulative Health and Wellbeing Effects from Changes to Water Quality, Flood Risk and Ground Conditions

18.10.27 As stated **in ES Chapter 10: Ground Conditions** (Doc Ref. 5.1) and **ES Chapter 11: Water Environment** (Doc Ref. 5.1), it is assumed that approved developments within the ZoI would include embedded and further mitigation of any effects and residual effects respectively, in order to ensure there is no deleterious impact upon the water environment or ground conditions. No cumulative effects are therefore expected.

18.10.28 No new or materially different magnitude or significance conclusions in relation to potential pollution releases and population health effects are therefore expected due to cumulative projects. This conclusion applies to all assessment years.

Cumulative Health and Wellbeing Effects from Changes in Local Healthcare Capacity

18.10.29 The cumulative residential developments have the potential to increase the local population, affecting health and social care service capacity. However, it would reasonably be expected that such developments would make an appropriate contribution, eg via their Section 106 agreements, towards any increased demand. It would also be expected that the data available on such future housing and care home developments would inform routine NHS service planning. As the Project does not itself increase the resident population size, as it does not provide any new housing, it is not expected that there would be cumulative effects.

18.10.30 The population increase implications of new residential developments are discussed in paragraph 18.10.22 based on the analysis undertaken by **ES Chapter 17: Socio-economic Effects** (Doc Ref. 5.1), which also lists the cumulative projects.

18.10.31 The non-residential cumulative projects listed in **ES Appendix 20.4.1 Cumulative Effects Assessment Long and Short List** (Doc Ref. 5.3) would contribute to the size of the non-resident population who may be in HLSA or the wider area for work, accessing services, travel or other reasons. As with the main assessment these are normal reasons for people to be out of the area where they are registered with primary care. As with travel to the Airport, there may be occasional need to access healthcare services, eg accidents or emergencies, when away from home. These are levels of healthcare demand, including ambulance and A&E, that are taken into account by routine NHS service planning. Such effects would act cumulatively with the Project but would not change the conclusions reached by the main assessment.

18.10.32 No new or materially different magnitude or significance conclusions in relation to local healthcare capacity and population health effects are therefore expected due to cumulative projects. This conclusion applies to all assessment years.

18.11. Inter-Related Effects

18.11.1 The purpose of the health and wellbeing chapter is to draw from and build upon technical outputs presented for a range of environmental and socio-economic health determinants. The resulting impacts identified and assessed in this chapter have the potential to interact with each other. The areas of potential interaction between impacts are presented in Table 18.11.1, Table 18.11.2, and Table 18.11.3.

Table 18.11.1: Key interactions where health determinants influence, or are influenced by, other health determinants

Determinant of health	Air Quality	Noise	Transport	Lifestyle Factors	Socio-economic Factors	Light	Water Quality, Flood Risk & Ground	Healthcare Capacity	Risk Perception
Air Quality			✓	✓				✓	
Noise			✓	✓				✓	
Transport	✓	✓		✓	✓	✓		✓	
Lifestyle Factors	✓	✓	✓			✓	✓	✓	✓
Socio-economic Factors			✓					✓	
Light			✓	✓				✓	
Water Quality, Flood Risk & Ground Conditions				✓				✓	
Healthcare Capacity	✓	✓	✓	✓	✓	✓	✓		✓
Risk Perception				✓				✓	

18.11.2 Table 18.11.1 illustrates key interactions between determinants of health. This captures interactions that are related to common sources of change. For example, transport influences noise, air quality and light, and also influences lifestyle factors like physical activity. It also captures that all determinants of health ultimately influence healthcare capacity. The interactions do not capture where health determinants influence common health outcomes, eg noise and air quality both influencing cardiovascular outcomes. These are discussed separately.

Inter-related effects by geographic populations

Table 18.11.2: Inter-related effects by geographic populations

Determinant of health	Site-specific	Local	Regional	National	International
Air Quality	✓				

Determinant of health	Site-specific		Local		Regional	National	International
Noise	✓						
Transport	✓	✓	✓	✓			
Lifestyle Factors	✓	✓	✓	✓			
Socio-economic Factors	✓		✓		✓		
Light	✓						
Water Quality, Flood Risk and Ground Conditions	✓						
Healthcare Capacity	✓		✓				
Risk Perception	✓		✓				

Notes: Ticks indicate effects. Green shading indicates positive effects and orange shading indicates negative effects. Ticks indicate effects.

Site- specific population

Inter-related effects by geographic populations

18.11.3 Table 18.11.2 shows that the site-specific population would experience effects from:

- Air quality (minor adverse);
- Noise (minor adverse);
- Transport (minor beneficial and minor adverse);
- Lifestyle factors (minor beneficial and minor adverse);
- Socio-economic factors (minor to moderate beneficial, and potentially up to major beneficial for the residual effect as described in Section 18.8);
- Light (negligible to minor adverse);
- Water quality (minor adverse);
- Flood risk (minor adverse to negligible beneficial);
- Ground conditions (minor adverse);
- Healthcare capacity (minor adverse); and
- Risk perception (minor adverse).

18.11.4 These effects are not expected to produce a greater population level effect in combination. This reflects that beneficial and adverse effects are unlikely to cancel each other out.

18.11.5 The beneficial effects linked to enhanced lifestyle factors (such as new and enhanced open space and active travel routes) and improved transport opportunity may affect similar people, but in-combination, these are not likely to be greater than the individual effects, ie remain minor beneficial. The benefits from socio-economic factors such as employment and training are likely to overlap, but the combined effect is not expected to be greater than the individual effects.

18.11.6 For adverse effects, the population may experience incremental negative contributions related to: noise; disincentivised physical activity and leisure (lifestyle factors); traffic volumes; and air quality including ultra-fine particulates. The extent to which these affect the same individuals will vary. However, there is anticipated to be some overlap, as well as common health outcomes affected, eg cardiovascular and mental wellbeing outcomes influenced by different pathways. Noise effects may coincide with slightly reduced air quality. These may affect similar populations to those who experience slightly disincentivised use of public open spaces and/or slightly busier road transport

routes. The combined effect has been considered. Whilst there is some increased adverse influence on health outcomes, the degree of increase is not considered to constitute a significant population health effect. The effect therefore remains minor adverse. The combined influences of committed mitigations that support the same population is noted. For example, there are likely to be overlaps in those benefiting from the enhanced NIS for homes and community buildings, as well as benefiting from local public open space and active travel enhancements to promote physical activity and community cohesion.

18.11.7 Both beneficial and adverse effects contribute to the use of NHS services (healthcare capacity), with beneficial effects tending to reduce demand, whilst adverse effects tend to increase demand. The overall effect is not considered to be worse than minor adverse.

18.11.8 At the site-specific level, minor adverse effects driven by environmental exposures and beneficial effects driven by socio-economic opportunities are both likely influences of the Project on population health. The significance conclusions of the main health and wellbeing assessment would not be greater for the affected population.

Local population

18.11.9 The local population would experience effects from:

- Transport (minor beneficial and minor adverse);
- Lifestyle factors (minor beneficial and minor adverse);
- Socio-economic factors (minor to moderate beneficial, and potentially up to major beneficial for the residual effect as described in Section 18.8);
- Flood risk (minor adverse to negligible beneficial);
- Healthcare capacity (negligible to minor adverse); and
- Risk perception (minor adverse).

18.11.10 These are similarly not expected to have greater combined effects that would change the EIA significance scoring for the reasons set out for the site-specific population. At the local level, beneficial effects driven by socio-economic opportunities are likely to be the main influence of the Project on population health.

Regional population

18.11.11 The regional population would experience effects from:

- Socio-economic factors (minor to moderate beneficial);

18.11.12 For such a wide geographic area there is very limited potential for overlap in effects experienced by the same individuals. Population level combined effects are therefore unlikely.

National and international population

18.11.13 Health effects from changes to the health determinants assessed in this chapter, are not anticipated to affect national and international populations. Inter-related effects would therefore not occur at these geographic levels.

Inter-related effects by vulnerable group sub-populations

Table 18.11.3: Inter-related effects by vulnerable group sub-populations

Determinant of health	Young age	Old age	Low-income	Poor health	Access and geographical
Air Quality	✓	✓	✓	✓	✓
Noise	✓	✓	✓	✓	✓
Transport	✓	✓	✓	✓	✓
Lifestyle Factors	✓	✓	✓	✓	✓
Socio-economic Factors	✓	✓	✓	✓	
Light	✓	✓	✓	✓	✓
Water Quality, Flood Risks and Ground Conditions	✓	✓		✓	
Healthcare Capacity	✓	✓		✓	✓
Risk Perception			✓	✓	✓

18.11.14 For all determinants of health, across geographic areas, there is likely to be a high degree of overlap in the effects experienced by vulnerable population groups, as shown by Table 18.11.3. The individual negative influences on determinants of health are negligible to minor adverse.

18.11.15 The combined effects for vulnerable groups, particularly given there is also geographic overlap between the determinants of health as shown in Table 18.11.2, is likely to be greater.

18.11.16 The greatest effects would be within those who are vulnerable for more than one reason (intersectionality), for example due to old age, poor health and low income. Particularly for these people, minor adverse effects that contribute to similar health outcomes could act in combination to produce moderate adverse effects. For example:

- noise and air quality affecting cardiovascular outcomes; or
- open space and active travel disruptions, as well as sleep disturbance and annoyance from noise, affecting mental health outcomes.

18.11.17 Such greater inter-related effects are likely at the individual level. At the population level the assessment considers if such interactions would be so widespread as to result in moderate or major, ie significant, public health effects. The professional judgment is that this would not be the case and that at the population level, be it for the site-specific or local geographic area, effects would remain minor adverse (not significant). This reflects that:

- The individual effects are small in scale with limited influence on the population health baseline, eg the quantitative cardiovascular indicators in the main health assessment for both air quality and for noise are both very small changes, together they remain unlikely to have more than a slight effect on the population health baseline.
- There would be spatial overlap between determinants of health, but this would not be complete and in many cases would be limited, eg most people who would experience air noise effects may be distant from and not regular users of open space or active travel routes affected by the Project.

- Whilst a combination of effects may be additive or even synergistic, not all people who experience the combination of determinants of health would experience a change in their risk factors for particular health outcomes, and not all those who did experience a change in their risk factors for particular health outcomes would actually experience such outcomes.

18.11.18 Vulnerable groups are also expected to benefit from the Project, including indirectly as dependants. Young adults, particularly those from low-income households, may particularly benefit directly from the Project's employment and training initiatives.

18.11.19 Whilst the assessment does not seek to reach a combined, or net effect, conclusion on population health (as positive and negative effects do not necessarily cancel each other out), it can be noted that the populations affected, including vulnerable group sub-populations, would experience both:

- negligible to minor adverse effects; and
- negligible to minor to moderate (to potentially major) beneficial effects.

18.11.20 The overall balance of individual determinants of health is that the beneficial effects from socio-economic opportunity are likely to be the most influential outcome of the Project for public health. This conclusion is not changed by the potential for adverse effects to act in combination for some people within the affected population, including those with multiple vulnerabilities.

Inter-related Further Mitigation and Future Monitoring

18.11.21 The following measure is necessary to reduce the combined adverse effects of the Project on some particularly vulnerable population groups who would face particular challenges in access or managing change due to the Project.

18.11.22 The new Community Fund can be used by GAL to provide discretionary support to individuals in local communities, particularly those falling into more than one vulnerable group, who experience particular hardship as a result of in-combination effects of the Project. The expectation is that such cases would be rare, but should they arise, a process is in place to mitigate against severe and inequitable health outcomes.

18.11.23 Illustrative uses of the fund include the offer of a finite period of temporary relocation to hotel accommodation or a finite period of extra carer support for individuals in the HLSA. The fund may also, at GAL's discretion, be used to provide targeted home improvements beyond that set out in the NIS. An illustrative example could be occupiers of a dwelling predicted to experience significant effects from the Project in **ES Chapter14: Noise and Vibration** (Doc Ref. 5.1) and significant effects due to loss of visual screening of Project lighting activities as identified in **ES Chapter 8: Landscape, Townscape and Visual Resources** (Doc Ref. 5.1), who also have multiple vulnerability, due to, for example, receipt of Universal Credit for both low income and health conditions or disability. Such cases would need to be raised to GAL by West Sussex ICB on an individual basis and reflect a clear and evidenced statement of circumstances resulting in particular hardship. Details on eligibility for, and the value of support from, the fund would be the subject of post-submission discussion between GAL and the West Sussex ICB. The measure is secured through Section 106 agreement.

18.11.24 Further information on inter-related Mitigation and Future Monitoring is provided in **ES Chapter 20: Cumulative Effects and Inter-relationships** (Doc Ref. 5.1).

18.12. Summary

Introduction

18.12.1 Chapter 18: Health and Wellbeing of the ES considers the effects of the Project on health and wellbeing and draws from other technical topic assessments, most notably: **ES Chapter 8: Townscape and Visual Resources** (Doc Ref. 5.1); **ES Chapter 10: Geology and Ground Conditions** (Doc Ref. 5.1); **ES Chapter 11: Water Environment** (Doc Ref. 5.1); **ES Chapter 12: Traffic and Transport** (Doc Ref. 5.1); **ES Chapter 13: Air Quality** (Doc Ref. 5.1); **ES Chapter 14: Noise and Vibration** (Doc Ref. 5.1); **ES Chapter 17: Socio-economic Effects** (Doc Ref. 5.1); and **ES Chapter 19: Agricultural Land Use and Recreation** (Doc Ref. 5.1).

18.12.2 Following published guidance for the coverage of human health in EIA (Pyper, et al., 2022b) and aligning with principles of public health, the conclusions of the assessment relate to the health outcomes to defined populations, not the health outcomes of individuals.

18.12.3 Population health varies, given factors such as personal choice, location, mobility and exposure. These factors that influence health are called determinants of health and they span environmental, social, behavioural, economic and institutional aspects. The Project has the potential to change determinants of health, with beneficial and adverse effects, either directly, indirectly or cumulatively.

Assessment Methodology

18.12.4 The chapter uses the World Health Organization (WHO) definition of health, which states that health is a "*state of complete physical, mental and social wellbeing and not merely the absence of disease or infirmity*" (WHO, 1948). The chapter also uses the WHO definition for mental health as a "*state in which every individual realises his or her own potential, can cope with the normal stresses of life, can work productively and fruitfully, and is able to make a contribution to her or his community*" (WHO, 2022a).

18.12.5 The health assessment methodology follows the Institute of Environmental Management and Assessment (IEMA) 2022 guidance on determining EIA health significance (Pyper, et al., 2022a). Significance is determined using an evidence-based professional judgment, drawing on consistent and transparent criteria for sensitivity and magnitude.

18.12.6 The assessment identifies any likely significant effects on population health due to the Project. Consideration is given to physical health, mental health and health inequalities, across a broad range of determinants of health. The health assessment looks at the potential effects for both the general population and for vulnerable groups. Vulnerability relates to experiencing effects differently due to age, income level, health status, degree of social disadvantage or ability to access services or resources.

18.12.7 Relevant assessment areas from other EIA chapters have informed the health assessment. In addition, a local health study area is defined focusing on environmental exposures, for the local authority districts of Crawley, Reigate and Banstead, Tandridge, Mid Sussex, Horsham and Mole Valley. Small area data is also referenced for highly localised effects.

18.12.8 A wider study area is defined and relates predominantly to socio-economic health effects. The area aligns with that in **ES Chapter 17: Socio-economic Effects** (Doc Ref. 5.1) and comprises

the County areas of East Sussex, West Sussex, Surrey, Kent, Brighton and Hove and London Borough of Croydon (the Six Authorities Area). Regional and national effects are also considered.

18.12.9 Baseline data for these areas is presented and informs the assessment of population sensitivity. Reports such as the relevant Health and Wellbeing Strategies and Joint Strategic Needs Assessments have provided additional context on local health circumstances, inequalities and public health priorities.

Current Baseline Environment

18.12.10 From analysis of baseline public health statistics, physical and mental health in the local study area and Six Authorities Area can be considered good, and trends are generally positive. In most circumstances, health status is better than the national average and more comparable to the regional average. The presence of areas of greater sensitivity are noted and taken into account.

18.12.11 The highest levels of overall deprivation in the local study area are in the south west of Crawley (Southgate and Broadfield areas), and the least deprived areas are located in the eastern half of Crawley (Pound Hill, Maidenbower) and the northern parts of Horley.

Potential Significant Effects

Air Quality

18.12.12 The health assessment considers changes in annual average concentrations of air pollutants. While there would be incremental increases in exposure to the changes predicted, the absolute level of change is low and the population levels exposures remain within statutory air quality objective thresholds set to be protective of health, including vulnerable groups. The level of change is unlikely to measurably affect population health outcomes. Quantitative analysis of health outcomes supports this conclusion.

Construction Phase

18.12.13 Assessment year 2024 is considered to be the worst case in terms of construction air quality. The professional judgement is that the significance of the population health effect would be up to **minor adverse** (not significant).

Operational Phase

18.12.14 The operational effects for all assessment years (2029, 2032, 2038 and 2047) are considered to be **minor adverse** (not significant). The conclusion reflects the view that exposures remain within acceptable levels for health protection, including for vulnerable groups. The minor adverse (rather than negligible) score represents a conservative assessment finding given scientific uncertainty (and emerging evidence) about non-threshold health effects of NO_2, and $PM_{2.5}$.

Ultrafine particulates (UFP) in all assessment years and scenarios

18.12.15 The professional judgement is that the significance of any UFP effect for population health would be up to **minor adverse** (not significant). The conclusion reflects that the literature does not support exposure-response regulatory thresholds, standards or guidelines that would define a level below which effects might be considered negligible. The minor adverse (rather than negligible) score is a conservative assessment finding on the basis of scientific uncertainty (and emerging evidence) about UFP.

18.12.16 Overall, the **minor adverse** air quality scores reflect that, whilst any reduction in air quality may be considered detrimental to some degree for public health, ie not negligible, the change due to the Project is not significant for population health in EIA Regulation terms.

Noise Exposure

18.12.17 The health assessment considers changes in noise exposure, including from air noise, ground noise and traffic noise. The assessment considers average noise levels as well as indicators relevant to maximum levels and tonal characteristics. Consideration has been given to a very small minority of the population being exposed to levels of noise above the Significant Observed Adverse Effect Level (SOAEL), for whom the Project's enhanced Noise Insulation Scheme would mitigate against potentially significant population health effects. Consideration has also been given to a larger minority exposed to noise between the Lowest Observed Adverse Effect Level (LOAEL) and SOAEL. Whilst there would be incremental increases in exposure due to the Project, the absolute level of change is very small and unlikely to measurably affect population health outcomes. Quantitative analysis of health outcomes supports this conclusion.

Construction Noise

18.12.18 Construction noise impacts of the Project are considered to result in a **minor adverse** (not significant) effect on population health.

Air Noise (from aircraft)

18.12.19 Consistent with **ES Chapter 14: Noise and Vibration** (Doc Ref. 5.1), the health assessment focuses its commentary on the year of greatest effect, 2032. It is concluded that the significance of the effect for population health is **minor adverse** (not significant).

Ground Noise (from aircraft)

18.12.20 As per the approach in **ES Chapter 14: Noise and Vibration** (Doc Ref. 5.1), the health and wellbeing assessment relating to ground noise focusses on the 2032 assessment year as a worst-case for ground noise. The significance of the resultant effect is considered **minor adverse** (not significant) for population health.

Road Traffic Noise

18.12.21 The significance of the resultant effect is considered **minor adverse** (not significant) for population health.

Transport Nature and Flow Rate

18.12.22 The health assessment considers changes in road traffic affecting road safety, travel times, accessibility and active/sustainable travel. Whilst there would be increases in traffic, the Project includes substantive highway improvements that manage the additional traffic volumes and enhance the active and sustainable transport routes to, and around, the airport.

Construction Phase

18.12.23 The significance of the population health effect for all construction phases is up to a **minor adverse** (not significant) effect due to the very slight reduction in road safety, slight increase in journey times and slight reduction in active travel amenity associated with increased traffic volumes.

Operational Phase

18.12.24 For all operational assessment years it is concluded that the significance of any adverse effect for population health is **minor adverse** (not significant). There is also considered to be a up to **minor beneficial** (not significant) effect due to the increase in active travel associated with use of public transport.

Lifestyle Factors

18.12.25 The health assessment considers changes in availability of public areas of open space and public rights of way for walking and cycling. While there would be some disruption and reduction of existing spaces used for leisure and recreation, including Riverside Garden Park, National Cycle Route 21 and the Sussex Border Path; there would also be additional new open space created of a greater extent and enhancements to active travel routes.

Construction and Operational Phases

18.12.26 For all construction and operational assessment years the effect is characterised as being beneficial and adverse. Adverse effects predominantly relate to temporary disruptions and beneficial effects relate to permanent enhancements. The significance of the population health effect is up to **minor beneficial** (not significant) and **minor adverse** (not significant).

Socio-economic Factors

18.12.27 The health assessment considers changes in population health due to increased employment and economic impacts. The benefits of employment are greatest when there is good quality stable employment.

Construction Phase

18.12.28 The significance of the population health effect for a potential change in construction related employment is at most **minor beneficial** (not significant) for the initial construction phase: 2024-2029.

Operational Phase

18.12.29 The significance of the population health effect for a potential change in operational employment is at most **moderate beneficial** (significant) for assessment years 2032, 2038, 2047. Following enhancement strategies proposed in the Chapter that target benefits to vulnerable groups, these effects could increase to **major beneficial** (significant).

Exposure to Light

18.12.30 The health assessment considers changes in community exposure to night lighting due to the Project changes. Transitory night lighting for construction would be a very low level of change to very few people. There would be some greater exposure to highway related lighting effects in operational years following vegetation clearance. Effects would reduce over time as new planting matured.

Construction Phase

18.12.31 For construction assessment years 2024-2029 and 2030-2032, the significance of the population health effect is **negligible** (not significant). For construction assessment years 2033-2038 the significance of the population health effect is **minor adverse** (not significant).

Operational Phase

18.12.32 A **minor adverse** (not significant) effect to population health is expected due to changes in lighting due to the Project.

Water Quality, Flood Risks and Ground Conditions

18.12.33 The health assessment considers the potential for pollution of water or soils to affect community populations, including associated with flood events.

Construction Phase

18.12.34 For all assessment years the professional judgement is that the significance of the population health effect in relation to any contamination, water capacity or increased surface water flood risk during construction would be up to **minor adverse** (not significant).

Operational Phase

18.12.35 For all assessment years the professional judgement is that the significance of the population health effect would be up to **minor adverse** (not significant) in relation to any contamination, water capacity or increased surface water flood risk. A **negligible beneficial** (not significant) effect due to reduced fluvial flood risk is also noted.

Local Healthcare Capacity

18.12.36 The health assessment considers potential implications for NHS routine service planning and port health from changes due to the Project, including the healthcare needs of workers and passengers. As set out in the **CoCP** (ES Appendix 5.3.2 (Doc Ref. 5.3)), there would be measures to promote and manage construction workers' health and healthcare access. In relation to passenger number growth, there would be scaled first aid and first responder support at the airport. This would mitigate against an increase in the rates of ambulance callouts associated with the very small proportion of people falling ill whilst at the airport. The great majority of such persons would be expected to have existing NHS entitlements or appropriate healthcare insurance. The Chapter provides data to support routeing NHS service planning that would effectively mitigate against unexpected demand. Operational workforce occupational health provisions would be provided in line with statutory requirements. In addition, there is established and ongoing engagement with the West Sussex ICB to explore opportunities to improve access to NHS services for airport workers. Port health activities at the airport would be scaled in line with passenger growth as part of business-as-usual activities in line with existing statutory obligations.

Construction and Operational Phases

18.12.37 For all construction and operational assessment years, the professional judgement is that the significance of the population health effect associated with the construction workforce would be up to **minor adverse** (not significant).

18.12.38 For all construction and operational assessment years, the professional judgement is that the significance of the population health effect associated with the operational workforce would be up to **minor adverse** (not significant).

18.12.39 For all construction and operational assessment years, the professional judgement is that the significance of the population health effect associated with passengers requiring emergency healthcare would be up to **minor adverse** (not significant).

18.12.40 For all construction and operational assessment years, the professional judgement is that the significance of the population health effect in relation to port health would be **negligible** (not significant).

Understanding of Risk (Risk Perception)

18.12.41 The health assessment considers the potential for public understanding of risk linked to Project changes to adversely affect the mental health and wellbeing of the local population. Issues include electromagnetic fields (EMF), extended operational hazards and pests. Whilst the actual risks on these issues are appropriately addressed through existing design and management measures of the Project, the assessment considers how the potential for widespread concern could nonetheless influence population health.

Construction and Operational Phases

18.12.42 The actual risks from EMF and pests would be well within regulatory standards and that most members of the public would expect this to be the case. The context that airport infrastructure, including electrical infrastructure and fuel storage, as well as public safety zones are an existing feature of the local context would also be expected to inform population understanding of risk. Therefore, for all construction and operational assessment years the significance of the population health effect is **minor adverse** (not significant).

Potential Changes to the Assessment as a Result of Climate Change

18.12.43 Climate change influences water availability, crop yields, extreme temperature exposures, air quality concentrations, work productivity and migration patterns which could plausibly affect a range of health and wellbeing outcomes.

18.12.44 Whilst the effects of climate change are likely to be realised during the operational lifetime of the Project, they are not expected to materially alter the conclusions of the health assessment.

Cumulative Effects

18.12.45 No new or materially different significant population health effects due to cumulative projects.

Inter-Related Effects

18.12.46 No new or materially different significant population health effects due to inter-related effects.

Table 18.12.1: Summary of Effects

Receptor	Receptor Sensitivity	Description of Impact	Short/ medium/ long term/ permanent	Magnitude of Impact	Significance of Effect	Significant/ not significant
Initial Construction Period: 2024-2029						
Health and wellbeing effects from changes in air quality (2024-2029 and 2029-2032)	Low (general population) High (vulnerable group population)	Increase in exposure to construction dust and transport related air pollutants (NO_2 and PM)	Medium term, temporary	Low	Minor adverse	Not significant
Health and wellbeing effects from changes in noise exposure	Medium (general population) High (vulnerable group population)	Increase in noise exposure associated with construction activities	Short to medium term, temporary	Low	Minor adverse	Not significant
		Increase in exposure to noise associated with construction and operational traffic	Short to medium term, temporary	Low to negligible	Negligible	Not significant
Health and wellbeing effects from changes in transport nature and flow rate	Low (general population) High (vulnerable group population)	Changes to road safety, travel times, accessibility and active/sustainable travel	Medium term, temporary	Low	Minor adverse	Not significant
Health and wellbeing effects from changes in lifestyle factors	Low (general population)	Disruption to access to green space, recreation and physical activity	Short to medium term, temporary	Low	Minor adverse	Not significant

Receptor	Receptor Sensitivity	Description of Impact	Short/ medium/ long term/ permanent	Magnitude of Impact	Significance of Effect	Significant/ not significant
	High (vulnerable group population)	Enhancements to access to green space, recreation and physical activity	Long term, temporary	Low	Minor beneficial	Not significant
Health and wellbeing effects from changes in socio-economic factors	Low (general population) High (vulnerable group population)	Construction increase in direct, indirect and induced employment opportunities	Medium term, temporary	Low	Minor beneficial	Not significant
Health and wellbeing effects from changes in exposure to light	Low (general population) High (vulnerable group population)	Increase in exposure to light required for night-time construction work	Medium term, temporary	Negligible	Negligible adverse	Not significant
Health and wellbeing effects from changes to water quality, flood risks and ground conditions	Low (general population) High (vulnerable group population)	Population health implications of potential pollution releases	Very short term, temporary	Low	Minor adverse	Not significant
Health and wellbeing effects from changes in healthcare capacity	Low (general population) High (vulnerable group population)	Construction workforce increase in demand for local health care services	Medium term, temporary	Low	Minor adverse	Not significant
Health and Wellbeing Effects from Understanding of Risk (Risk Perception)	Low (general population) High (vulnerable group population)	Potential for a population health effect related to concern about	Long-term, permanent	Low	Minor adverse	Not significant

Receptor	Receptor Sensitivity	Description of Impact	Short/ medium/ long term/ permanent	Magnitude of Impact	Significance of Effect	Significant/ not significant
		EMF, extended operational hazards and pests				
First Full Year of Opening: 2029						
Health and wellbeing effects from changes in air quality	Low (general population) High (vulnerable group population)	Increase in exposure to air pollutants (NO_2 and PM)	Long-term, permanent	Low	Minor adverse	Not significant
Health and wellbeing effects from changes in noise exposure	Medium (general population) High (vulnerable group population)	Increase in noise exposure associated with construction activities	Short to medium term, temporary	Low	Minor adverse	Not significant
		Air noise	Long-term, permanent	Low	Minor adverse	Not significant
		Ground noise	Long-term, permanent	Low	Minor adverse	Not significant
		Road traffic noise	Long-term, permanent	Low	Minor adverse	Not significant
Health and wellbeing effects from changes in transport nature and flow rate	Low (general population) High (vulnerable group population)	Changes to road safety, travel times, accessibility and active/sustainable travel	Long-term, permanent	Low	Minor adverse	Not significant
		Benefit to public health from a greater modal share of public transport	Long-term, permanent	Low	Minor beneficial	Not significant

Receptor	Receptor Sensitivity	Description of Impact	Short/ medium/ long term/ permanent	Magnitude of Impact	Significance of Effect	Significant/ not significant
Health and wellbeing effects from changes in lifestyle factors	Low (general population) High (vulnerable group population)	Disruption to access to green space, recreation and physical activity	NA	NA	NA	NA
		Enhancements to access to green space, recreation and physical activity	NA	NA	NA	NA
Health and wellbeing effects from changes in socio-economic factors	Low (general population) High (vulnerable group population)	Construction increase in direct, indirect and induced employment opportunities	Medium term, temporary	Low	Minor beneficial	Not significant
		Operational increase in direct, indirect and induced employment opportunities	Long-term, permanent	Low	Minor beneficial	Not significant
Health and wellbeing effects from changes in exposure to light	Low (general population) High (vulnerable group population)	Increase in exposure to light required for night-time construction work	NA	NA	NA	NA
Health and wellbeing effects from changes to water quality, flood risks and ground conditions (2029-2032)	Low (general population) High (vulnerable group population)	Population health implications of potential pollution releases	Very short term, temporary	Low	Minor adverse	Not significant

Receptor	Receptor Sensitivity	Description of Impact	Short/ medium/ long term/ permanent	Magnitude of Impact	Significance of Effect	Significant/ not significant
Health and wellbeing effects from changes in healthcare capacity	Low (general population) High (vulnerable group population)	Construction workforce increase in demand for local health care services	Medium term, temporary	Low	Minor adverse	Not significant
		Operational workforce increase in demand for local health care services	Medium term, temporary	Low	Minor adverse	Not significant
		Passengers requiring emergency care	Long term, permanent	Low	Minor adverse	Not significant
		Port health	Long term, permanent	Negligible	Negligible adverse	Not significant
Health and Wellbeing Effects from Understanding of Risk (Risk Perception)	Low (general population) High (vulnerable group population)	Potential for a population health effect related to concern about EMF, extended operational hazards and pests	Long-term, permanent	Low	Minor adverse	Not significant
Highway Construction Period (2029-2032)						
Health and wellbeing effects from changes in transport nature and flow rate	Low (general population) High (vulnerable group population)	Changes to road safety, travel times, accessibility and active/sustainable travel	Medium term, temporary	Low	Minor adverse	Not significant
Interim Assessment Year: 2032						

Receptor	Receptor Sensitivity	Description of Impact	Short/ medium/ long term/ permanent	Magnitude of Impact	Significance of Effect	Significant/ not significant
Health and wellbeing effects from changes in air quality	Low (general population) High (vulnerable group population)	Increase in exposure to air pollutants (NO_2 and PM)	Long-term, permanent	Low	Minor adverse	Not significant
Health and wellbeing effects from changes in noise exposure	Medium (general population) High (vulnerable group population)	Air noise	Long-term, permanent	Low	Minor adverse	Not significant
		Ground noise	Long-term, permanent	Low	Minor adverse	Not significant
		Road traffic noise	Long-term, permanent	Low	Minor adverse	Not significant
Health and wellbeing effects from changes in transport nature and flow rate	Low (general population) High (vulnerable group population)	Changes to road safety, travel times, accessibility and active/sustainable travel	Long-term, permanent	Low	Minor adverse	Not significant
Health and wellbeing effects from changes in lifestyle factors (2030-2032 and 2033 to 2038)	Low (general population) High (vulnerable group population)	Disruption to access to green space, recreation and physical activity	Short to medium term, temporary	Low	Minor adverse	Not significant
		Enhancements to access to green space, recreation and physical activity	Long term, temporary	Low	Minor beneficial	Not significant

Receptor	Receptor Sensitivity	Description of Impact	Short/ medium/ long term/ permanent	Magnitude of Impact	Significance of Effect	Significant/ not significant
Health and wellbeing effects from changes in socio-economic factors	Low (general population) High (vulnerable group population)	Construction increase in direct, indirect and induced employment opportunities	Medium term, temporary	Negligible	Negligible beneficial	Not significant
		Operational increase in direct, indirect and induced employment opportunities	Long-term, permanent	Medium	Moderate to major beneficial	Significant
Health and wellbeing effects from changes in exposure to light (2030-2032)	Low (general population) High (vulnerable group population)	Increase in exposure to light required for night-time construction work	Medium term, temporary	Negligible	Negligible adverse	Not significant
Health and wellbeing effects from changes to water quality, flood risks and ground conditions (2032-2038)	Low (general population) High (vulnerable group population)	Population health implications of potential pollution releases	Very short term, temporary	Low	Minor adverse	Not significant
Health and wellbeing effects from changes in healthcare capacity	Low (general population) High (vulnerable group population)	Construction workforce increase in demand for local health care services	Medium term, temporary	Low	Minor adverse	Not significant
		Operational workforce increase in demand for local health care services	Medium term, temporary	Low	Minor adverse	Not significant
		Passengers requiring emergency care	Long term, permanent	Low	Minor adverse	Not significant

Receptor	Receptor Sensitivity	Description of Impact	Short/ medium/ long term/ permanent	Magnitude of Impact	Significance of Effect	Significant/ not significant
		Port health	Long term, permanent	Negligible	Negligible adverse	Not significant
Health and Wellbeing Effects from Understanding of Risk (Risk Perception)	Low (general population) High (vulnerable group population)	Potential for a population health effect related to concern about EMF, extended operational hazards and pests	Long-term, permanent	Low	Minor adverse	Not significant
Design Year 2038						
Health and wellbeing effects from changes in air quality	Low (general population) High (vulnerable group population)	Increase in exposure to air pollutants (NO_2 and PM)	Long-term, permanent	Low	Minor adverse	Not significant
Health and wellbeing effects from changes in noise exposure	Medium (general population) High (vulnerable group population)	Air noise	Long-term, permanent	Low	Minor adverse	Not significant
		Ground noise	Long-term, permanent	Low	Minor adverse	Not significant
		Road traffic noise	Long-term, permanent	Low	Minor adverse	Not significant
Health and wellbeing effects from changes in transport nature and flow rate	Low (general population) High (vulnerable group population)	Changes to road safety, travel times, accessibility and active/sustainable travel	NA	NA	NA	NA

Receptor	Receptor Sensitivity	Description of Impact	Short/ medium/ long term/ permanent	Magnitude of Impact	Significance of Effect	Significant/ not significant
Health and wellbeing effects from changes in lifestyle factors	Low (general population) High (vulnerable group population)	Disruption to access to green space, recreation and physical activity	Short to medium term, temporary	Low	Minor adverse	Not significant
		Enhancements to access to green space, recreation and physical activity	Long term, temporary	Low	Minor beneficial	Not significant
Health and wellbeing effects from changes in socio-economic factors	Low (general population) High (vulnerable group population)	Operational increase in direct, indirect and induced employment opportunities	Long-term, permanent	Medium	Moderate to major beneficial	Significant
Health and wellbeing effects from changes in exposure to light (2033-2038)	Low (general population) High (vulnerable group population)	Increase in exposure to light required for night-time construction work	Medium to long term, temporary	Low	Minor adverse	Not significant
Health and wellbeing effects from changes to water quality, flood risks and ground conditions	Low (general population) High (vulnerable group population)	Population health implications of potential pollution releases	Very short term, temporary	Low	Minor adverse	Not significant
Health and wellbeing effects from changes in healthcare capacity	Low (general population) High (vulnerable group population)	Operational workforce increase in demand for local health care services	Medium term, temporary	Low	Minor adverse	Not significant
		Passengers requiring emergency care	Long term, permanent	Low	Minor adverse	Not significant

Receptor	Receptor Sensitivity	Description of Impact	Short/ medium/ long term/ permanent	Magnitude of Impact	Significance of Effect	Significant/ not significant
		Port health	Long term, permanent	Negligible	Negligible adverse	Not significant
Health and Wellbeing Effects from Understanding of Risk (Risk Perception)	Low (general population) High (vulnerable group population)	Potential for a population health effect related to concern about EMF, extended operational hazards and pests	Long-term, permanent	Low	Minor adverse	Not significant
Year 2047						
Health and wellbeing effects from changes in air quality	Low (general population) High (vulnerable group population)	Increase in exposure to air pollutants (NO_2 and PM)	Long-term, permanent	Low	Minor adverse	Not significant
Health and wellbeing effects from changes in noise exposure	Medium (general population) High (vulnerable group population)	Air noise	Long-term, permanent	Low	Minor adverse	Not significant
		Ground noise	Long-term, permanent	Low	Minor adverse	Not significant
		Road traffic noise	Long-term, permanent	Low	Minor adverse	Not significant
Health and wellbeing effects from changes in transport nature and flow rate	Low (general population) High (vulnerable group population)	Changes to road safety, travel times, accessibility and active/sustainable travel	Long-term, permanent	Low	Minor adverse	Not significant

Receptor	Receptor Sensitivity	Description of Impact	Short/ medium/ long term/ permanent	Magnitude of Impact	Significance of Effect	Significant/ not significant
Health and wellbeing effects from changes in lifestyle factors	Low (general population) High (vulnerable group population)	Disruption to access to green space, recreation and physical activity	Short to medium term, temporary	Low	Minor adverse	Not significant
		Enhancements to access to green space, recreation and physical activity	Long term, temporary	Low	Minor beneficial	Not significant
Health and wellbeing effects from changes in socio-economic factors	Low (general population) High (vulnerable group population)	Operational increase in direct, indirect and induced employment opportunities	Long-term, permanent	Medium	Moderate to major beneficial	Significant
Health and wellbeing effects from changes in exposure to light (2038 and beyond)	Low (general population) High (vulnerable group population)	Increase in exposure to light required for night-time construction work	Medium to long term, temporary	Low	Minor adverse	Not significant
Health and wellbeing effects from changes to water quality, flood risks and ground conditions	Low (general population) High (vulnerable group population)	Population health implications of potential pollution releases	Very short term, temporary	Low	Minor adverse	Not significant
Health and wellbeing effects from changes in healthcare capacity	Low (general population) High (vulnerable group population)	Operational workforce increase in demand for local health care services	Medium term, temporary	Low	Minor adverse	Not significant
		Passengers requiring emergency care	Long term, permanent	Low	Minor adverse	Not significant

Receptor	Receptor Sensitivity	Description of Impact	Short/ medium/ long term/ permanent	Magnitude of Impact	Significance of Effect	Significant/ not significant
		Port health	Long term, permanent	Negligible	Negligible adverse	Not significant
Health and Wellbeing Effects from Understanding of Risk (Risk Perception)	Low (general population) High (vulnerable group population)	Potential for a population health effect related to concern about EMF, extended operational hazards and pests	Long-term, permanent	Low	Minor adverse	Not significant

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18.14. Glossary

Table 18.14.1: Glossary of Terms

Term	Description
A&E	Accident and Emergency
ATM	Air Transport Movement
CEA	Cumulative Effects Assessment
CI	Confidence Interval
CITB	Construction Industry Training Board
CO_2	Carbon dioxide
CoCP	Code of Construction Practice
CRF	Concentration Response Function (relationship between an exposure and a health outcome as set out in the scientific literature)
Defra	Department for Environment, Food and Rural Affairs
DM	Do-minimum scenario (base-case) without the Project
DMRB	Design Manual for Roads and Bridges
EHS	Environmental Health and Safety
EIA	Environmental Impact Assessment
EMF	Electro-magnetic fields
ES	Environmental Statement
ESBS	Employment Skills and Business Strategy
FEMA	Northern West Sussex Functional Economic Market Area (an **ES Chapter 17: Socio-economics** (Doc Ref. 5.1) study area)
HB	Home-based
HGV	Heavy Goods Vehicle
HIA	Health Impact Assessment
HLSA	Health Local Study Area
HWS	Health and Wellbeing Strategy
ICNIRP	International Commission on Non-Ionizing Radiation Protection
ICB	Integrated Care Board
ICS	Integrated Care System
IHD	Ischaemic Heart Disease
JSNA	Joint Strategic Needs Assessment
LMA	Local Market Area (a **Chapter 17: Socio-economics** study area)
LOAEL	Lowest Observed Adverse Effect Level
LSOA	Lower Super Output Area
LSA	Local Study Area (a **Chapter 17: Socio-economics** study area)
NHS	National Health Service
NOx	Nitrogen oxides
NEET	Not in Education, Employment, or Training
NHB	Non-home-based
NPPF	National Planning Policy Framework

Term	Description
NPPG	National Planning Practice Guidance
NPS	National Policy Statement
OCTMP	Outline Construction Traffic Management Plan
ONS	Office for National Statistics
OR	Odds Ratio
PAF	Population Attributable Fraction
PAOC	Potential Area of Concern
PEI	Preliminary Environmental Information
PEIR	Preliminary Environmental Information Report
PHE	Public Health England
QOF	Quality Outcomes Framework
RR	Relative Risk (also known as the Risk Ratio)
SAC	Surface Access Commitments
SAR	Standardised Admission Ratio
SES	Socio-Economic Status
SOAEL	Significant Observed Adverse Effect Level
WHO	World Health Organization
ZoI	Zone of Influence