

16. Human Health

16.1 Introduction

- 16.1.1 This chapter of the Environmental Statement (ES) assesses the likely significant effects of the Proposed Development with reference to Human Health. The chapter should be read in conjunction with **Chapter 2: Description of the Proposed Development** and with reference to relevant parts of other chapters, including **Chapter 6: Traffic and Transport**, **Chapter 7: Noise and Vibration**, **Chapter 8: Air Quality**, **Chapter 9: Landscape and Visual**, **Chapter 15: Socio-economics** and **Chapter 17: Carbon and Other Greenhouse Gases** (GHG), where common receptors have been considered and where there is an overlap or relationship between the assessment of effects.
- 16.1.2 Although there is no official definition of significance of health in Environmental Impact Assessment (EIA), based on the preamble of the *EIA Directive 2014/52/EC*¹ a likely significant health effect could be considered to be one that should be brought to the attention of the determining authority, as the effect of the Proposed Development is judged to provide, or be contrary to providing, a high level of protection to human health. This may include reasoned conclusions in relation to health protection, health improvement and/or improving services.
- 16.1.3 The chapter uses the World Health Organisation (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"*².
- 16.1.4 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"*³.

16.2 Limitations of this assessment

- 16.2.1 This assessment is based on publicly available statistics and evidence sources. No new primary research or bespoke analysis of non-public National Health Service (NHS) data has been undertaken for the assessment.

16.3 Relevant legislation, planning policy, technical guidance

Legislative context

- 16.3.1 The following legislation is relevant to the assessment of the effects on human health:

¹ European Parliament, Council of the European Union (2014). Directive 2014/52/EU of the European Parliament and of the Council of 16 April 2014 amending Directive 2011/92/EU on the assessment of the effects of certain public and private projects on the environment, [online]. Available at: <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex%3A32014L0052> [Checked 20/10/2018].

² World Health Organization (1948). Preamble to the Constitution of the World Health Organization; signed on 22 July 1946 by the representatives of 61 States and entered into force on 7 April 1948. New York.

³ World Health Organization (2007). Mental health: strengthening mental health promotion, [online]. Available at: <https://www.who.int/news-room/fact-sheets/detail/mental-health-strengthening-our-response> [Checked 20/10/2018].

- The *EIA Regulations 2017*⁴ give effect to the amended European Union *EIA Directive*¹. One of the amendments clarifies that 'population and human health' factors should be on the list of environmental topics considered by EIA;
- The *Health and Safety at Work Act 1974*⁵ 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. In both cases, the requirement for risks to be reduced to As Low As Reasonably Practicable (ALARP) is fundamental and applies to all activities within the scope of the *Health and Safety at Work Act 1974*;
- Part III of the *Environmental Protection Act 1990*⁶ regulates control of emissions (including dust, noise and light) that may be prejudicial to health or a nuisance;
- The *Environment Act 1995*⁷ sets provisions for protecting certain environmental conditions of relevance to health in the UK. Part II covers contaminated land and Part IV covers air quality;
- The *Air Quality Standards Regulations 2010*⁸ transpose into English law the requirements of *Directives 2008/50/EC*⁹ and *2004/107/EC*¹⁰ on ambient air quality; and
- The *Civil Aviation Act 2012*¹¹ gives the Civil Aviation Authority (CAA) a role in promoting better public information about the environmental effects of civil aviation in the UK, their impact on health and safety, and measures taken to mitigate adverse impacts.

Planning policy context

16.3.2 A summary of the relevant planning policies is given in **Table 16.1**.

Table 16.1 Planning policy issues relevant to human health

Policy reference	Policy issue	Relevance
The World Health Organization's (WHO's) Health 2020 ¹²		

⁴ Ministry of Housing, Communities & Local Government (2017). The Town and Country Planning (Environmental Impact Assessment) Regulations 2017. SI 571, [online]. Available at: <http://www.legislation.gov.uk/uksi/2017/571/made> [Checked 20/10/2018].

⁵ HM Government of Great Britain (1974). Health and Safety at Work etc. Act, [online]. Available at: <http://www.hse.gov.uk/legislation/hswa.htm> [Checked 20/10/2018].

⁶ HM Government of Great Britain & Northern Ireland (1990). Environmental Protection Act, [online]. Available at: <https://www.legislation.gov.uk/ukpga/1990/43/contents> [Checked 20/10/2018].

⁷ HM Government of Great Britain & Northern Ireland (1995). Environment Act. Available at: <https://www.legislation.gov.uk/ukpga/1995/25/contents> [Checked 20/10/2018].

⁸ HM Government of Great Britain & Northern Ireland (2010). The Air Quality Standards Regulations, [online]. Available at: <http://www.legislation.gov.uk/uksi/2010/1001/contents/made> [Checked 20/10/2018].

⁹ European Parliament (2008). European C. Directive 2008/50/EC of the European Parliament and of the Council of 21 May 2008 on ambient air quality and cleaner air for Europe, [online]. Available at: <https://eur-lex.europa.eu/legal-content/EN/ALL/?uri=celex:32008L0050> [Checked 20/10/2018].

¹⁰ European Parliament, Council of the European Union (2012). Directive 2004/107/EC of the European Parliament and of the Council of 15 December 2004 relating to arsenic, cadmium, mercury, nickel and polycyclic aromatic hydrocarbons in ambient air, 2004, [online]. Available at: <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex:32004L0107> [Checked 20/10/2018].

¹¹ HM Government of Great Britain & Northern Ireland (2012). Civil Aviation Act, [online]. Available at: <http://www.legislation.gov.uk/ukpga/2012/19/contents/enacted> [Checked 20/10/2018].

¹² World Health Organization Regional Office for Europe (2012). Health 2020: a European policy framework supporting action across government and society for health and well-being, [online]. Available at: <http://www.euro.who.int/en/publications/abstracts/health-2020-a-european-policy-framework-supporting-action-across-government-and-society-for-health-and-well-being> [Checked 20/10/2018].

Policy reference	Policy issue	Relevance
-	A policy framework and strategy for the 21st century. It aims to significantly improve the health and well-being of populations, reduce health inequalities, strengthen public health and ensure sustainable people-centred health systems that are universal, equitable, sustainable and of high quality. The Health 2020 policy is based on four priority areas: investing in health through a life-course approach and empowering people; tackling the region's major health challenges of non-communicable and communicable diseases; strengthening people-centred health systems, public health capacity and emergency preparedness, surveillance and response; and creating resilient communities and supportive environments.	Health 2020 sets the international policy context for public health, this is particularly relevant given the international transport links of the Proposed Development.
Global Health Strategy 2014 - 2019¹³		
-	Public Health England works in support of the priorities set out by WHO centrally, and in support of WHO's European health policy framework Health 2020.	The strategy affirms the relevance of the Health 2020 policy context to England.
Helping people live well for longer¹⁴		
-	The UK policy statement and resource pack sets out national policy actions and support for delivering local priorities to reduce levels of premature mortality, for example due to cancer, heart disease, stroke, respiratory and liver disease.	Helping people live well for longer forms part of the national policy context for health services, including recognising the need to maintain clinically robust and outcome focused health and care systems.
National Planning Policy Framework (NPPF) 2018¹⁵		
Paragraph 91	<i>"Planning policies and decisions should aim to achieve healthy, inclusive and safe places which... promote social interaction... are safe and accessible... and enable and support healthy lifestyles, especially where this would address identified local health and well-being needs..."</i>	The NPPF sets the national policy context for planning in general, including expectations for how development and planning decisions should take health into account. The NPPF sets out a range of potential health issues relevant to planning generally.
Paragraph 92	<i>"To provide the social, recreational and cultural facilities and services the community needs, planning policies and decisions should... take into account and support the delivery of local strategies to improve health, social and cultural well-being for all sections of the community... [and] guard against the unnecessary loss of valued facilities and services, particularly where this would reduce the community's ability to meet its day-to-day needs..."</i>	
Paragraph 96	<i>"Access to a network of high quality open spaces and opportunities for sport and physical activity is important for the health and well-being of communities."</i>	
Paragraph 98	<i>"Planning policies and decisions should protect and enhance public rights of way and access, including taking opportunities to provide better facilities for users..."</i>	

¹³ Public Health England (2014). Global Health Strategy 2014 to 2019, [online]. Available at: https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=1&ved=2ahUKewjtjTQu43fAhVHDQwKHfM5wQFjAAegQIBhAC&url=https%3A%2F%2Fassets.publishing.service.gov.uk%2Fgovernment%2Fuploads%2Fsystem%2Fuploads%2Fattachment_data%2Ffile%2F354156%2FGlobal_Health_Strategy_final_version_for_publication_12_09_14.pdf&usq=AOvVaw1hdaFHDTNpkyeCN_BwzSbJ [Checked 20/10/2018].

¹⁴ Department of Health (2014). Living Well for Longer: National Support for Local Action to Reduce Premature Avoidable Mortality, [online]. Available at: https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=1&ved=2ahUKewilvDhu43fAhVLdewKHcrVA2UQFjAAegQIChAC&url=https%3A%2F%2Fassets.publishing.service.gov.uk%2Fgovernment%2Fuploads%2Fsystem%2Fuploads%2Fattachment_data%2Ffile%2F307703%2FLW4L.pdf&usq=AOvVaw2B9juVveOM1Y8JrxOzi8V1 [Checked 20/10/2018].

¹⁵ Ministry of Housing, Communities and Local Government (2018). National Planning Policy Framework, [online]. Available at: <https://www.gov.uk/government/publications/national-planning-policy-framework--2> [Checked 20/10/2018].

Policy reference	Policy issue	Relevance
Paragraph 102	<i>"Transport issues should be considered from the earliest stages of plan-making and development proposals, so that... opportunities to promote walking, cycling and public transport use are identified and pursued;... and patterns of movement, streets, parking and other transport considerations are integral to the design of schemes, and contribute to making high quality places."</i>	
Paragraph 103	<i>"Significant development should be focused on locations which are or can be made sustainable, through limiting the need to travel and offering a genuine choice of transport modes. This can help to reduce congestion and emissions and improve air quality and public health."</i>	
Paragraph 127	<i>"Planning policies and decisions should ensure that developments: are visually attractive as a result of good architecture, layout and appropriate and effective landscaping... create attractive, welcoming and distinctive places to live, work and visit... and create places that are safe, inclusive and accessible and which promote health and well-being, with a high standard of amenity for existing and future users".</i>	
Paragraph 180	<i>"Planning policies and decisions should also ensure that new development is appropriate for its location taking into account the likely effects (including cumulative effects) of pollution on health, living conditions and the natural environment... In doing so they should: avoid noise giving rise to significant adverse impacts on health and the quality of life; identify and protect tranquil areas which have remained relatively undisturbed by noise and are prized for their recreational and amenity value for this reason; and limit the impact of light pollution from artificial light on local amenity."</i>	
Paragraph 181	<i>"Planning policies and decisions should sustain and contribute towards compliance with relevant limit values or national objectives for pollutants... Opportunities to improve air quality or mitigate impacts should be identified, such as through traffic and travel management, and green infrastructure provision and enhancement. So far as possible these opportunities should be considered at the plan-making stage, to ensure a strategic approach and limit the need for issues to be reconsidered when determining individual applications."</i>	
The Aviation Policy Framework¹⁶		
-	<p>Sets out the government's policy to allow the aviation sector to continue to make a significant contribution to economic growth across the country. The points included here are noted in relation to health:</p> <ul style="list-style-type: none"> • The aviation sector is a major contributor to the economy (with economic prosperity being an important positive determinant of health). • For aviation related local environmental impacts, such as air pollution, the overall objective is to ensure appropriate health protection by focusing on meeting relevant legal obligations; • Emissions from transport, including at airports, contribute to air pollution. EU legislation sets legally binding air quality limits for the protection of human health. Around airports, sources of air pollution include aircraft engines, airport-related traffic on local roads and surface vehicles. The most important pollutants are oxides of nitrogen (NOx) and particulate matter (PM). Studies have shown that NOx emissions from aviation-related operations reduce rapidly beyond the immediate area around the runway. Road traffic remains the main problem with regard to NOx in the UK. Airports are 	The Aviation Policy Framework forms part of the national policy context for airport development, including a recognition of considering the balance between economic benefits and environmental impacts, including to health.

¹⁶ Secretary of State for Transport (2013). Aviation policy framework, [online]. Available at: www.gov.uk/government/publications/aviation-policy-framework [Checked 20/10/2018].

Policy reference	Policy issue	Relevance
	<p>large generators of surface transport journeys and as such share a responsibility to minimise the air quality impact of these operations;</p> <ul style="list-style-type: none"> • The Government's overall policy on aviation noise is to limit and, where possible, reduce the number of people in the UK significantly affected by aircraft noise. This is consistent with the Government's Noise Policy, as set out in the Noise Policy Statement for England (NPSE) which aims to avoid significant adverse impacts on health and quality of life. The Government wants to strike a fair balance between the negative impacts of noise (on health, amenity (quality of life) and productivity) and the positive economic impacts of flights. The Government expects that the aviation industry will continue to reduce and mitigate noise as airport capacity grows. As noise levels fall with technology improvements the aviation industry should be expected to share the benefits from these improvements with local communities; • The Government will continue to treat the 57dB LAeq 16-hour contour as the average level of daytime aircraft noise marking the approximate onset of significant community annoyance. However, this does not mean that all people within this contour will experience significant adverse effects from aircraft noise. Nor does it mean that no-one outside of this contour will consider themselves annoyed by aircraft noise. The Government recommends that average noise contours should not be the only measure used when airports seek to explain how locations under flight paths are affected by aircraft noise; and • The Government recognises that the costs on local communities are higher from aircraft noise during the night, particularly the health costs associated with sleep disturbance. Noise from aircraft at night is therefore widely regarded as the least acceptable aspect of aircraft operations. However, the Government also recognises the importance to the UK economy of certain types of flights, such as express freight services, which may only be viable if they operate at night. In recognising these higher costs upon local communities, the Government expects the aviation industry to make extra efforts to reduce and mitigate noise from night flights through use of best-in-class aircraft, best practice operating procedures, seeking ways to provide respite wherever possible and minimising the demand for night flights where alternatives are available. • Whilst the Government's policy is to give particular weight to the management and mitigation of noise in the immediate vicinity of airports, there may be instances where prioritising noise creates unacceptable costs in terms of local air pollution. For example, displacing the runway landing threshold to give noise benefits could lead to significant additional taxiing and emissions. For this reason, the impacts of any proposals which change noise or emissions levels should be carefully assessed to allow these costs and benefits to be weighed up; and • Airports also have an impact on other aspects of the local environment such as water, waste management and habitat, through for example, de-icing of aircraft and runways, fuel handling and storage or the production of on-site heat or power. In England and Wales, where these activities produce waste, lead to discharges to local watercourses or groundwater, or are carried out using activities specified in the Environmental Permitting Regulations 2010, airports may require a permit from the Environment Agency or local authority. The permits contain conditions to protect the environment and human health and, where 	

Policy reference	Policy issue	Relevance
	necessary, require the site operator to carry out monitoring.	
Noise Policy Statement for England (NPSE)¹⁷		
-	<p>The NPSE sets out the Government's position on the underlying principles and aims of noise management decisions. The NPSE applies to all forms of noise, including environmental noise (except occupational noise). The NPSE has three aims:</p> <ul style="list-style-type: none"> • Avoid significant adverse impacts on health and quality of life from environmental, neighbour and neighbourhood noise within the context of Government policy on sustainable development. • Mitigate and minimise adverse impacts on health and quality of life from environmental, neighbour and neighbourhood noise within the context of Government policy on sustainable development. • Where possible, contribute to the improvement of health and quality of life through the effective management and control of environmental, neighbour and neighbourhood noise within the context of Government policy on sustainable development. 	The NPSE sets the Governments expectation that development should avoid significant adverse effects on health from noise.
Air Quality Strategy for England, Scotland, Wales and Northern Ireland¹⁸		
-	The Environment Agency works with local authorities, Highways England and others to manage the government's Air Quality Strategy in England and Wales. The strategy sets air pollution standards to protect people's health and the environment. The Strategy sets out the National Air Quality Objectives (AQOs) and Government policy on achieving these objectives.	The Air Quality Strategy sets the limit values for air pollutants. These are the levels that are considered acceptable in the UK.
Beyond the horizon - the future of UK aviation: next steps towards an aviation strategy¹⁹		
-	<p>The Strategy notes that:</p> <ul style="list-style-type: none"> • The Government expects that demand for air services will continue to rise significantly through to 2050. Aviation plays a crucial role in the UK's wider economy and export markets. Economic benefits would be expected to make a positive contribution as a determinant of health. • The government must ensure that growth is sustainable and is balanced with local and global environmental concerns; • The government recognises the impact on communities living near airports and understands their concerns over local environmental issues, particularly noise. As airports grow, it is important that communities share in the economic benefits of this growth, and that adverse impacts are mitigated where possible; and 	The Beyond the horizon strategy forms part of the national policy context for airport development, including a recognition of sharing the economic benefits with local communities and of addressing potential inequalities in access to air travel.

¹⁷ Department for Environment, Food & Rural Affairs (2010). Noise Policy Statement for England, [online]. Available at: https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=1&cad=rja&uact=8&ved=2ahUKewiEqv6MvI3fAhUPzKQKHVnMAWIOFjAAegQIChAC&url=https%3A%2F%2Fassets.publishing.service.gov.uk%2Fgovernment%2Fuploads%2Fsystem%2Fuploads%2Fatachment_data%2Ffile%2F69533%2Fpb13750-noise-policy.pdf&usq=AOvVaw1gKQNa_0w8mh7iUYRQYNNz [Checked 20/10/2018].

¹⁸ Department for Environment, Food and Rural Affairs (2011). The air quality strategy for England, Scotland, Wales and Northern Ireland: Volume 1, [online]. Available at: <https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=1&cad=rja&uact=8&ved=2ahUKewjTkPibvI3fAhWLyqQKHSzeALoQFjAAegQIChAB&url=https%3A%2F%2Fwww.gov.uk%2Fgovernment%2Fpublications%2Fthe-air-quality-strategy-for-england-scotland-wales-and-northern-ireland-volume-1&usq=AOvVaw3KsresqPIQwg2ndi69GeJT> [Checked 20/10/2018].

¹⁹ HM Government (2018). Beyond the horizon – the future of UK aviation: next steps towards an aviation strategy Ref: ISBN 978-1-84864-199-0, [online]. Available at: <https://www.gov.uk/government/consultations/a-new-aviation-strategy-for-the-uk-call-for-evidence> [Checked 20/10/2018].

Policy reference	Policy issue	Relevance
	<ul style="list-style-type: none"> The strategy will ensure that passengers with reduced mobility or disabilities are able to travel by air as seamlessly as possible. This includes addressing difficulties (particularly access barriers) that their health condition or disability would cause at airports or while flying. 	
Somerset County Plan 2016 - 2020²⁰		
	<p>The vision includes reducing inequalities. These are set out as:</p> <ul style="list-style-type: none"> Social inequalities, such as within the education system where children on free school meals underachieve; Economic inequalities, where people in deprived areas have fewer chances to succeed and are less likely to find good quality jobs; and Health inequalities, where people from deprived backgrounds have poorer health, are more likely to live with long-term conditions, and have a shorter lifespan than people living in more affluent areas. 	The Somerset County Plan sets a strategic vision for addressing inequalities. This is a cross-cutting theme that runs through the health assessment.
North Somerset Council (NSC) Core Strategy January 2017²¹		
	<p>The Strategy has the following policies under the Sustainable Community Strategy theme of 'Ensuring safe and healthy communities'. Policy CS26 Supporting healthy living and the provision of health care facilities. The policy includes:</p> <ul style="list-style-type: none"> Requiring HIA on all large-scale developments in the district that assess how the development will contribute to improving the health and wellbeing of the local population; Working with relevant stakeholders to reduce geographical inequalities in health within the district; and Encouraging development that promotes active living through creating places that are easily accessible, attractive and safe to move around by walking or cycling. 	The NSC Core Strategy sets the local planning policy context. The expectations set by this local level policy context are of particular relevance to the assessment of health effects. The local policy (described in greater detail within Appendix 16A) applies the broader national and international policy objectives to the local context. By having appropriate regard to HIA methods, this chapter meets the policy requirements in relation to HIA.

Technical guidance

- 16.3.3 *Planning Practice Guidance on Environmental Impact Assessment*²² explains requirements of the EIA Regulations⁴. However, the guidance does not provide additional information in relation to defining, scoping or assessing 'population and human health'. Regard has therefore been given to the 2017 publication *Health in Environmental Assessment, a primer for a proportionate approach*²³. Public Health England has also issued a briefing note on health in EIA for local public health teams²⁴.

²⁰ Somerset County Council (2016). County Plan 2016 – 2020, [online]. Available at: <http://www.somerset.gov.uk/policies-and-plans/plans/county-plan/> [Checked 20/10/2018].

²¹ North Somerset Council (2017). Core Strategy, [online]. Available at: <https://www.n-somerset.gov.uk/wp-content/uploads/2015/11/Core-Strategy-adopted-version.pdf> [Checked 20/10/2018].

²² Ministry of Housing, Communities & Local Government (2014). Planning practice guidance. Environmental Impact Assessment. Requirements of the Town and Country Planning (Environmental Impact Assessment) Regulations 2017, Last updated 28 July 2017, [online] Available at: <https://www.gov.uk/guidance/environmental-impact-assessment> [Checked 20/10/2018].

²³ Cave B, Fothergill J, Pyper R, Gibson G, Saunders P (2017). Health in Environmental Impact Assessment: a primer for a proportionate approach. IEMA, Faculty of Public Health and Ben Cave Associates Ltd. Lincoln, England. [Checked 20/10/2018].

²⁴ Cave B, Fothergill J, Pyper R, Gibson G (2017). Health and Environmental Impact Assessment: a briefing for public health teams in England. Public Health England. London, England. [Checked 20/10/2018].

16.3.4

*Planning Practice Guidance on health and wellbeing*²⁵ that applies more broadly than just EIA, notes the following:

- *"The link between planning and health has been long established. The built and natural environments are major determinants of health and wellbeing;...*
- *...A healthy community is a good place to grow up and grow old in. It is one which supports healthy behaviours and supports reductions in health inequalities. It should enhance the physical and mental health of the community and, where appropriate, encourage:*
 - ▶ *Active healthy lifestyles that are made easy through the pattern of development, good urban design, good access to local services and facilities; green open space and safe places for active play and food growing, and is accessible by walking and cycling and public transport; and*
 - ▶ *The creation of healthy living environments for people of all ages which supports social interaction. It meets the needs of children and young people to grow and develop, as well as being adaptable to the needs of an increasingly elderly population and those with dementia and other sensory or mobility impairments....*
- *...The range of issues that could be considered through the plan-making and decision-making processes, in respect of health and healthcare infrastructure, include how:*
 - ▶ *Development proposals can support strong, vibrant and healthy communities and help create healthy living environments which should, where possible, include making physical activity easy to do and create places and spaces to meet to support community engagement and social capital;*
 - ▶ *The healthcare infrastructure implications of any relevant proposed local development have been considered;*
 - ▶ *Opportunities for healthy lifestyles have been considered (e.g. planning for an environment that supports people of all ages in making healthy choices, helps to promote active travel and physical activity, and promotes access to healthier food, high quality open spaces, green infrastructure and opportunities for play, sport and recreation);*
 - ▶ *Potential pollution and other environmental hazards, which might lead to an adverse impact on human health, are accounted for in the consideration of new development proposals; and*
 - ▶ *Access to the whole community by all sections of the community, whether able-bodied or disabled, has been promoted."*

16.3.5

The approach to assessing health in the EIA has also been informed by relevant UK guidance on Health Impact Assessment (HIA). In England there is no overarching guidance for HIA. However, generic principles are evident in specialist guidance such as that by the Department of Health in relation to HIA of government policy²⁶, or that by the London Healthy Urban Development Unit in relation to urban planning²⁷. In Wales there is good quality project level guidance on HIA²⁸, while in

²⁵ Ministry of Housing, Communities & Local Government (2014). Planning practice guidance. Health and wellbeing. The role of health and wellbeing in planning Last updated 28 July 2017, [online]. Available at: <https://www.gov.uk/guidance/health-and-wellbeing> [Checked 20/10/2018].

²⁶ Department of Health (2010). Health Impact Assessment of Government Policy. Department of Health, England, [online]. Available at: <https://www.gov.uk/government/publications/health-impact-assessment-of-government-policy> [Checked 20/10/2018].

²⁷ NHS Healthy Urban Development Unit (2015). Healthy Urban Planning Checklist. London, [online]. Available at: <https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=1&ved=2ahUKEwi49JaWvY3fAhWBCOWKHdfbBXcQFjAAegQIChAC&url=https%3A%2F%2Fwww.healthyurbandevlopment.nhs.uk%2Fwp-content%2Fuploads%2F2014%2F04%2FHealthy-Urban-Planning-Checklist-March-2014.pdf&usq=AOvVaw3NW-s2cYGB32QjGkvMLaQV> [Checked 20/10/2018].

²⁸ WHIASU (2012). Health Impact Assessment: a practical guide. Cardiff, Wales: Wales Health Impact Assessment Support Unit, [online]. Available at:

Northern Ireland, overarching project level HIA guidance is provided by the Institute of Public Health in Ireland²⁹. HIA guidance from Scotland includes discussion of issues relevant to rural contexts³⁰.

16.4 Data gathering methodology

Study area

- 16.4.1 Study areas for the assessment are defined in relation to population groups. A population is all members of a group defined by the presence of a common characteristic (in this case, geographical).
- 16.4.2 Four population groups have been selected based on the geographic Zone of Influence (ZoI):
- The population near Bristol Airport (site-specific);
 - The population of North Somerset Unitary Authority (local);
 - The population of South West England and South East Wales (regional); and
 - The population of England and beyond the borders of England (national and international).
- 16.4.3 The study areas used in other chapters of the ES are of relevance, but do not necessarily define the boundaries of potential health effects. For example, effects on mental health and wellbeing are subjective and may not be limited to the area defined in relation to certain thresholds (e.g. for air quality or noise). Consequently, this chapter uses study areas to broadly define representative population groups rather than to set boundaries on the extent of potential effects.
- 16.4.4 The South East Wales region has been defined with a range of statistical collection types to cover equivalent data to that for English regions (data summarised in **Appendix 16A** and set out in full within **Appendix 16B**). This includes reference to local authority areas, health board areas and electoral regions.

Desk study

- 16.4.5 A summary of the sources from which publicly available data has been drawn, together with the nature of that data is as follows:
- Public Health England (PHE):
 - ▶ Health Profiles³¹;

https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=1&cad=rja&uact=8&ved=2ahUKewj_rPuovY3fAhVO3KQKHZpPCsMQFjAAegQIBRAC&url=https%3A%2F%2Fwhiasu.publichealthnetwork.cymru%2Ffiles%2F1415%2F0710%2F5107%2FHIA_Tool_Kit_V2_WEB.pdf&usq=AOvVaw0QhQFvuo2vtgfyicN7VYg [Checked 20/10/2018].

²⁹ Metcalfe O, Higgins C, Lavin T (2009). Health Impact Assessment guidance: Institute of Public Health in Ireland, [online]. Available at: <https://www.publichealth.ie/publications/healthimpactsassessmentguidance2009> [Checked 20/10/2018].

³⁰ Higgins M, Arnot J, Farman P, Wares J, Aboud S, Douglas MJ (2015). Health Impact Assessment of rural development: a guide, [online]. Available at:

https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=1&cad=rja&uact=8&ved=2ahUKewjA0vHTvY3fAhXFzqQKHTmRBbqQFjAAegQICBAC&url=https%3A%2F%2Fwww.scotphn.net%2Fwp-content%2Fuploads%2F2015%2F10%2F2015_05_28_SHIAN_Final_Report.pdf&usq=AOvVaw02cNpW2kwjUY_FMAD18LWm [Checked 20/10/2018].

³¹ Public Health England Health Profiles (2018). District and County level, [online]. Available at: <http://fingertips.phe.org.uk/profile/health-profiles> [Checked 20/10/2018].

- ▶ Health Assets Profiles³²;
- ▶ Wider Determinants of Health Profiles³³;
- PubMed MEDLINE database of biomedical and life sciences journal literature³⁴:
 - ▶ Health literature review;
- NSC:
 - ▶ Joint Strategic Needs Assessment³⁵;
 - ▶ Core Strategy 2017²¹;
 - ▶ Definitive map³⁶;
- North Somerset Partnership:
 - ▶ North Somerset's People and Communities Strategy 2017-2020³⁷;
 - ▶ Sustainable Community Strategy 2008 – 2026³⁸;
- Bristol, North Somerset and South Gloucestershire Clinical Commissioning Group:
 - ▶ Health priorities for the local population³⁹;
- UK Government Official Statistics:
 - ▶ English indices of deprivation⁴⁰;
- Office of National Statistics and Nomis official labour market statistics⁴¹:
 - ▶ Census 2011 data;
- Google Earth Pro:
 - ▶ Aerial photography;
- Other ES chapters;
 - ▶ **Chapter 6: Traffic and Transport;**

³² Public Health England Health Assets Profiles. County level, [online]. Available at: <https://fingertips.phe.org.uk/profile/comm-assets> [Checked 20/10/2018].

³³ Public Health England Wider Determinants of Health Profiles. District level, [online]. Available at: <https://fingertips.phe.org.uk/profile/wider-determinants> [Checked 20/10/2018].

³⁴ PubMed MEDLINE database of biomedical and life sciences journal literature, [online]. Available at: <https://www.ncbi.nlm.nih.gov/pmc/advanced> [Checked 20/10/2018].

³⁵ North Somerset Council Joint Strategic Needs Assessment, [online]. Available at: <https://www.n-somerset.gov.uk/my-council/statistics-data/jsna/joint-strategic-needs-assessment/> [Checked 20/10/2018].

³⁶ North Somerset Council. Definitive Map [online]. [Checked 20/10/2018]. <http://map.n-somerset.gov.uk/dande.html>

³⁷ North Somerset Partnership (2017). People and Communities Strategy 2017-2020, [online]. Available at: <http://www.northsomersetpartnership.org.uk/whoware/people+and+communities+board/healthandwellbeing/index1.asp> [Checked 20/10/2018].

³⁸ North Somerset Partnership. Sustainable Community Strategy. 2008 – 2026, [online]. <http://www.northsomersetpartnership.org.uk/whatwedo/sustainablecommunitystrategy/index1.asp> [Checked 20/10/2018].

³⁹ Health priorities for the local population. Bristol, North Somerset and South Gloucestershire Clinical Commissioning Group. Health priorities for the local population, [online]. Available at: <https://bnssgccg.nhs.uk/about-us/what-we-do/our-priorities/health-priorities-local-population/> [Checked 20/10/2018].

⁴⁰ English indices of deprivation (2015). File 10: local authority district summaries, [online]. Available at: <https://www.gov.uk/government/statistics/english-indices-of-deprivation-2015> [Checked 20/10/2018].

⁴¹ Office of National Statistics and Nomis official labour market statistics, [online]. Available at: <https://www.nomisweb.co.uk/query/select/getdatasetbytheme.asp?theme=75> [Checked 20/10/2018].

- ▶ **Chapter 7: Noise and Vibration;**
- ▶ **Chapter 8: Air Quality;**
- ▶ **Chapter 9: Landscape and Visual;**
- ▶ **Chapter 15: Socio-economics; and**
- ▶ **Chapter 17: Carbon and Other Greenhouse Gases.**

16.5 Overall baseline

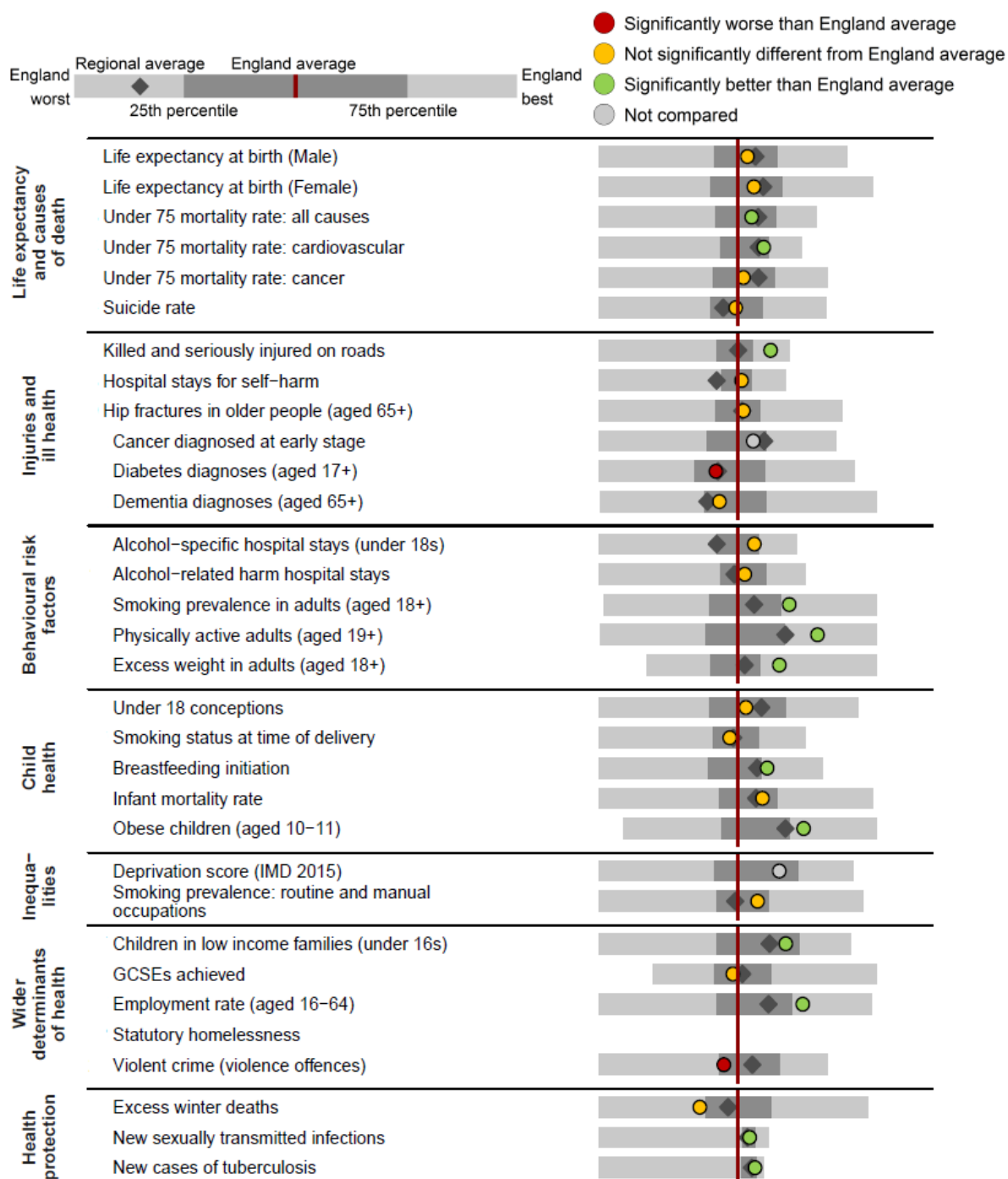
Current baseline

- 16.5.1 The following section summarises the general state of health in North Somerset based on reporting by PHE. Further detailed baseline information relevant to the human health topics assessed in this chapter are presented in **Appendix 16A** (with supporting data in **Appendix 16B**).

General health baseline in North Somerset Unitary Authority³¹

- 16.5.2 *Health in summary: The health of people in North Somerset is varied compared with the England average. About 12% (4,500) of children live in low income families. Life expectancy for both men and women is similar to the England average.*
- 16.5.3 *Health inequalities: Life expectancy is 9.9 years lower for men and 7.9 years lower for women in the most deprived areas of North Somerset than in the least deprived areas.*
- 16.5.4 *Child health: In Year 6, 14.7% (284) of children are classified as obese, better than the average for England.*
- 16.5.5 *Adult health: Estimated levels of adult excess weight, smoking and physical activity are better than the England average. Rates of sexually transmitted infections, people killed and seriously injured on roads and TB are better than average. The rate of violent crime is worse than average. Rates of early deaths from cardiovascular diseases and the percentage of people in employment are better than average.*
- 16.5.6 **Figure 16.1** shows, based on a standardised selection of routine population health indicators, how the health of people in North Somerset compares with the rest of England. North Somerset's value for each indicator is shown as a circle. The England average is shown by the red line, which is always at the centre of the chart. The range of results for all local areas in England is shown as a grey bar. A red circle means that this area is significantly worse than England for that indicator. The graphic shows that overall the health of people in North Somerset is similar to regional and national comparators. This suggests that the general population does not have a heightened sensitivity to changes that may affect health.

Figure 16.1 Summary health indicators for North Somerset – based on PHE Profile 2018



Future baseline

16.5.7

Population health data presents a snapshot at a particular time (for example the 2011 census or 2015 to 2017 PHE profile data used in **Appendix 16A** and **Appendix 16B**). 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.

- 16.5.8 Longer term trends and interventions in population health may also influence the future baseline. NHS 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 aging population and rising levels of obesity (and its associated adverse effects on health). The current baseline used in this assessment includes appropriate health indicators to reflect the types of health outcomes that that would also be relevant for the future population (e.g. in relation to age and long-term conditions). The assessment methodology includes a categorisation of vulnerable population groups (refer to **Section 16.7**), which, for example, allows for the effects of 'older people' and 'people with existing poor health' to be distinguished from the general population. The assessment score for each vulnerable group is independent of the population size within that group, which would be the main change between the current and future baseline.
- 16.5.9 For assessment purposes, the current health baseline (as presented in paragraph 16.5.1, **Appendix 16A** and **Appendix 16B**) is considered a suitable proxy of the future baseline, with identifiable conclusions for relevant vulnerable groups that may have increased representation within the future baseline. It would not be proportionate (or consistent with the qualitative assessment approach taken) to attempt to quantitatively model the population's future health. This is due to the fact that it would not be proportionate to undertake further analysis or reporting to extrapolate the current health baseline. 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 not be of any great value. Monitoring should have regard to the next release of national census dataset to re-benchmark baseline health trends against 2021 data. Construction and operational baseline changes specific to particular determinants, such as air quality, noise and traffic are discussed in the respective ES chapters for those issues (**Chapter 6: Traffic and Transport**, **Chapter 7: Noise and Vibration** and **Chapter 8: Air Quality**).

16.6 Consultation

- 16.6.1 **Table 16.2** provides a summary of the issues regarding the Proposed Development that have been raised by consultees and the responses given.

Table 16.2 Summary of issues raised during consultation regarding human health

Issue raised	Consultee(s)	Response and how considered in this chapter	Section Ref
NSC are satisfied with the scope of the health section. Reference to local health and wellbeing strategies could be improved. Noted that as many aspects of health are subjective particularly when it comes to mental health and noise. Noted that whilst primarily a desk based exercise, the consultation and views of residents will be important in the final report.	NSC officers (email 17/07/18)	Reference to local health and wellbeing strategies has been added (e.g. see discussion of North Somerset's people and communities strategy 2017-2020). The subjective nature of responses to noise and the effects these may have on mental health and wellbeing are discussed in this health chapter. Consultation responses in relation to the Scoping Report (Appendix 1A) have been taken into account.	Appendix 16A (health priorities and consultation sections)
Traffic and Transport: Further information should be requested on the potential for Hazardous loads and consideration may need to be given to these in other area of the EIA (e.g. in relation to Human Health). It does however, appear reasonable to conclude that assuming any such loads are moved in accordance with relevant best practice and legislation there is unlikely to be a potential for significant environmental effects.	NSC	Hazardous loads (e.g. aviation fuel) have been scoped out of the assessment. It is anticipated that such loads will be moved in accordance with current procedures undertaken at Bristol Airport such as the Joint Inspection Group (JIG) 1 – Aviation Fuel Quality Control and Operating Standards for Into-Plane Fuelling Services and JIG 2 – Aviation Fuel Quality Control and Operating Standards for Airport Depots. Fuel is also handled and moved in accordance with Energy Institute guidance and a Safety Management System document is implemented by North Air which includes undertaking regular reviews and audits to maintain safe working practices.	Section 6.5
Noise and vibration: Chapter 6 [of the Scoping Report] – Refers to most of policies at both a local and national level although some are missing, mainly those relating to health.	NSC	Additional local and national policies are referred to.	Section 7.3 and Appendix 7B
Noise and vibration: It is noted that BAL do not intend to increase the number of 'night-time' flights per annum, which is limited to 4000, but they do wish to include greater flexibility to their distribution, which is restricted to 3000 in the summer time and 1000 in the winter time. If this leads to a higher concentration of night-time flights in the summer season, which is when more residents may choose to sleep with windows open, the potential impacts on sleep disturbance and human health should be examined.	NSC	The assessment of 12 mppa has assumed that the 3,000-summer restriction is lifted (but 4,000 annual remains). The comparisons to 12 mppa are therefore worst-case comparisons as the effects of both the increase in movements and the relaxation of summer restriction are assessed.	Sections 7.10 and 7.11
Human health: The scope and methodology of the health section is generally satisfactory, but further reference particularly to noise impacts on health and wellbeing strategies could be improved.	NSC	Further information relating to noise impacts on health and wellbeing strategies is included in this health chapter as well as in the noise chapter (where relevant). Local health and wellbeing strategies are summarised in Appendix 16.A.	Appendix 16A (health priorities sections)

Issue raised	Consultee(s)	Response and how considered in this chapter	Section Ref
Scoping Report paragraph 15.5.13 states that life expectancy in North Somerset is above-average. Whilst this is true for the whole population, it is important to recognise that there are parts of North Somerset with high deprivation levels where residents generally have significantly poorer life expectancies. (This will also apply in Bristol.)	NSC Interim Director for Public Health (email 06/08/18)	The health chapter of the ES sets out further baseline information. This includes noting variation in deprivation, both within North Somerset, as well as neighbouring areas of Bristol.	Section 16.5 (for example, paragraph 16.5.29).
Scoping Report paragraph 15.5.15 is incorrect. 2017 data shows that the difference in life expectancy between those born into the most affluent areas and those born into the most deprived is 9.1 years for males and 6.9 years for females. This is correctly stated in para 15.5.18.	NSC Interim Director for Public Health (email 06/08/18)	Paragraph 15.5.15 of the Scoping Report (Appendix 1A) related to Somerset County, whereas paragraph 15.5.18 of the Scoping Report related to North Somerset. The 2017 release was the most up-to-date at the time the Scoping Report was prepared. It is noted that as of 3 July 2018 there are 2018 PHE area profiles, which are used by this ES.	Section 16.5 (for example, paragraph 16.5.6).
Scoping Report paragraph 15.6.16. Request to consider a revised version of the 1991 Dahlgren and Whitehead diagram as updated by the North Somerset Council's Interim Director for Public Health.	NSC Interim Director for Public Health (email 06/08/18)	This has been taken into account and revised.	Figure 16.3
Scoping Report paragraphs 15.5.9 – 15.5.16 Somerset Joint Strategic Needs Assessment. This data relates to Somerset County, not North Somerset Unitary Authority and is therefore not relevant and/or misinforming data. Section 15.5.25 is equally irrelevant.	Wrighton Parish Council (email 18/07/18)	Duly noted. Data for the wider spatial area of Somerset County was considered within the Scoping Report (Appendix 1A). The ES health chapter consideration of local health priorities has focused on North Somerset and the North Somerset Unitary Authority Joint Strategic Needs Assessment ³⁵ .	Appendix 16A.
Existing and future light pollution impacts to local residents from terminal buildings. The potential noise and visual impacts of the new MSCP and new surface access roads, particularly for properties on the airport boundaries. Unauthorised off-site parking causing concern to local residents.	Backwell Parish Council (email 17/07/18)	Chapter 9: Landscape and Visual considers the existing and future light pollution for local residents. The Lighting impact assessment concludes minor incremental changes from the lighting due to the lighting strategy minimising or preventing light spill and glare allied to the baseline in which lighting at the existing terminal is sometimes visible. This is shown in the night time base photographs (Viewpoints 3, 7 and 14). The visual impacts on the communities and individual properties sited close to Bristol Airport are considered in the Landscape and Visual Impact Assessment. Noise effects from new car parks is discussed in Appendix 7E .	Lighting Impact Assessment sections 4.3.1 and 4.3.2. Chapter 9: Landscape and Visual Appendix 9G Appendix 7E
Natural England encourages any proposal to incorporate measures to help encourage people to access the countryside for quiet enjoyment. Measures	Natural England (email 12/07/18)	This point links with travel issues discussed in the human health chapter, including in relation to active travel and physical activity. Public rights of way	Sections 6.9, 6.10 and 6.11

Issue raised	Consultee(s)	Response and how considered in this chapter	Section Ref
such as reinstating existing footpaths together with the creation of new footpaths and bridleways are to be encouraged. Links to other green networks and, where appropriate, urban fringe areas should also be explored to help promote the creation of wider green infrastructure. Relevant aspects of local authority green infrastructure strategies should be incorporated where appropriate.		which have the potential to be impacted have been assessed in terms of severance and amenity to pedestrians and cyclists in the Chapter 6: Traffic and Transport . Shared pedestrian and cycle paths are also proposed between the north Bristol Airport junction and West Lane and at the junction with Downside Road.	

16.7 Scope of the assessment

Spatial scope

- 16.7.1 The spatial scope of the assessment of human health covers the application site, together with four spatial levels defined for the assessment as:
- Site-specific (the population near Bristol Airport);
 - Local (the population of North Somerset Unitary Authority);
 - Regional (the population of South West England and South East Wales); and
 - National (and international) (the population of England and Wales (and beyond in relation to international travel)).
- 16.7.2 See paragraph 16.4.2 for how representative populations for these areas are defined.

Temporal scope

- 16.7.3 The temporal scope of the assessment is consistent with the period over which the Proposed Development would be carried out and therefore covers the construction and operational periods.
- 16.7.4 It is anticipated that construction will take place over an approximate 87-month period between April 2019 and June 2026, with full operation commencing later in 2026 when the 12 million passengers per annum (mppa) horizon is expected to be reached. The assessment does not place an end date on the operations of Bristol Airport.
- 16.7.5 The health chapter provides a qualitative assessment based on findings of other relevant chapters of the ES. Where relevant chapters define specific assessment years, the health chapter assessment uses those same assessment years. The assessment also considers qualitatively how the changes in 2026 (full operation) may subsequently affect population health over the longer-term. This point is not fixed as a specific assessment year as it would vary by determinant of health, health outcome and population group. The following assessment years are used in the technical chapters applicable to this assessment:
- **Chapter 6: Traffic and Transport** uses assessment years 2018 and 2026;
 - **Chapter 7: Noise and Vibration** uses assessment years 2017, 2021 and 2026;
 - **Chapter 8: Air Quality** uses assessment years 2017 (for model evaluation) and 2026;
 - **Chapter 9: Landscape and Visual** uses assessment years 2018, 2026 and 2041;
 - **Chapter 15: Socio-economics** uses assessment years 2021 and 2026; and
 - **Chapter 17: Carbon and Other Greenhouse Gases** does not use specific assessment years but considers emissions in the context of targets for the period 2028 to 2032.
- 16.7.6 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 (e.g. effects, associated with changes in exposure during particular weather conditions);
 - 'Short term' relates to effects measured in months (e.g. activities near particular dwellings within the construction stage);
 - 'Medium term' relates to effects measured in years (e.g. the construction stage); and

- 'Long term' relates to effects measured in decades (e.g. the long-term effects on health from increased flights).

Population scope

- 16.7.7 Human health effects are assessed in terms of population, rather than individual receptor outcomes. This is consistent with established principles of public health and impact assessment practice⁴². It also reflects the EIA Regulations 2017⁴ requirement to consider 'population and human health', including the interaction between these factors. Population health can be defined as the health outcomes of a group of individuals, including the distribution of such outcomes within the group. The field of population health includes health outcomes, patterns of health determinants and policies and interventions that link these two⁴³.

Geographic population groups

- 16.7.8 Four population groups have been selected based on the geographic ZoI (refer to paragraph 16.4.2).

Potentially vulnerable groups

- 16.7.9 In addition, four further population groups have been defined in relation to their potential sensitivity to changes associated with the Proposed Development (beneficial or adverse):
- Children and young people;
 - Older people;
 - People with existing poor health (physical and mental health); and
 - People living in deprivation, including those on low incomes.
- 16.7.10 These groups are intentionally broadly defined to facilitate a consistent discussion across health issues and as a basis to considering cumulative effects. The assessment sections (**Section 16.10** and **16.11**) discusses detail relevant to particular health issues. People falling into more than one group may be especially sensitive.
- 16.7.11 Within these groups, the assessment focuses primarily on community effects to residents, but also considers: visitors to local communities and Bristol Airport; the workforce and passengers of Bristol Airport; and the Proposed Development's construction workforce.

Topic scope

- 16.7.12 The effects of the Proposed Development that are considered likely and which have the potential to be significant with regards to human health are summarised in the following sections.
- 16.7.13 The scope has developed from that presented in the Scoping Report (**Appendix 1A**) based on the assessments within other ES chapters. This reflects that, in some cases, it would not be proportionate to assess issues that, based on the further information available, would be highly unlikely to result in significant effects (see **Table 16.4**).
- 16.7.14 The Scoping Report (**Appendix 1A**) sets out a range of topics based on 'project themes'. The health chapter assessment groups issues from these themes, e.g. all issues relating to air quality. This

⁴² Quigley R, et al (2006). Health Impact Assessment: International Association for Impact Assessment, [online]. Available at: <http://bit.ly/2d6r1jk> [Checked 20/10/2018].

⁴³ Kindig D, Stoddart G (2003). What Is Population Health? American Journal of Public Health 2003; 93(3): 380-3, [online]. Available at: <http://dx.doi.org/10.2105/AJPH.93.3.380> [Checked 20/10/2018].

approach is adopted to improve clarity where there are shared evidence bases. Issues scoped out are as described in the Scoping Report or in the relevant chapters of the ES where primary analysis has been undertaken (such as **Section 6.6** of **Chapter 6: Traffic and Transport**, **Section 7.7** of **Chapter 7: Noise and Vibration** and **Section 8.7** of **Chapter 8: Air Quality**). Where issues that were within the scope of the health chapter in the Scoping Report (**Appendix 1A**) have subsequently been scoped out they are described in **Table 16.4**.

- 16.7.15 The assessment covers all aspects of the Proposed Development and does not seek to assess different development components individually or in isolation. Specific activities or elements that have driven the findings of quantitative assessments are described in those relevant chapters of the ES. The Human Health assessment is reported in relation to effects expected during construction and operation.
- 16.7.16 For air quality, noise and travel a qualitative assessment of population health effects has been undertaken, based on the quantitative modelling and analysis reported in those ES chapters respectively (**Chapter 6: Traffic and Transport**, **Chapter 7: Noise and Vibration** and **Chapter 8: Air Quality**).
- 16.7.17 The outcomes considered in the scope of this health chapter cover a range of health-related states or events. These include: physical and mental health outcomes; issues of health service capacity; and changes in health-related behaviours or risk factors.

Summary of effects included within the assessment

- 16.7.18 The effects that have been included in this assessment are summarised in **Table 16.3**.

Table 16.3 Effects that have been assessed for human health

Topic	Issue	Notes
Construction		
Air quality	An assessment of dust due to construction activities.	Chapter 8: Air Quality assesses potential dust effects and explains the reasons for scoping out other construction related air quality issues (refer Table 16.4 for a summary).
Noise	An assessment of levels of construction related noise disturbance.	As per Scoping Report.
Travel	An assessment of construction road traffic and road works affecting road safety, travel times, accessibility and active/sustainable travel.	As per Scoping Report.
Community identity	An assessment of current land use and the value placed on the current setting.	As per Scoping Report.
Operation		
Air quality	An assessment of Nitrogen Dioxide (NO ₂), Particulate Matter (PM ₁₀ and PM _{2.5}) relating to combined changes from aviation and operational road traffic.	Chapter 8: Air Quality combines the assessment of aviation and operational road transport within a single model and set of conclusions (see paragraph 8.10.35 of Chapter 8: Air Quality). The health chapter reporting adopts this combined approach which differs to the splitting out of issues within the Scoping Report.

Topic	Issue	Notes
Noise	An assessment of changes in surface access and aviation related disturbance (including air noise, ground noise and road traffic noise).	Chapter 7: Noise and Vibration considers the operational effects side-by-side with a single assessment section discussing aviation air noise, aviation ground noise and road traffic noise. The health chapter reporting adopts this combined approach which differs to the splitting out of issues within the Scoping Report (Appendix 1A).
Travel	An assessment of operational road traffic affecting road safety, travel times, accessibility and active/sustainable travel.	As per Scoping Report (Appendix 1A).
Community identity	An assessment of community identity for community residents due the expanded airport having a greater influence on the local environmental and economic landscape.	Chapter 15: Socio-economic concludes that there is unlikely to be any significant change in the resident population locally or regionally as a result of the Proposed Development. The health chapter discussion of community identity therefore focuses on the experience of existing residents to environmental and economic change, rather than social and cultural change.
Economic effects	An assessment of direct and indirect employment and local/regional economy opportunities during operation.	Chapter 15: Socio-economic concludes for construction the economic benefits would be positive but negligible. For this reason, construction economic effects are not within the scope of the health chapter.
Healthcare services	An assessment of health service demand associated with an expanded non-permanent UK population in the area affecting the local NHS and community residents (i.e. an increased temporary population entitled to use NHS services).	As per Scoping Report (Appendix 1A).
Climate change	An assessment of climate altering pollutants due to the Proposed Development and the effect these may have on human health (globally).	The inclusion of a discussion of climate change within the health chapter reflects a wider reporting decision to discuss this issue when relevant across the ES topic chapters, rather than presenting it as a dedicated chapter. This was agreed as part of the Scoping Opinion (Appendix 1B).

Potential effects not requiring assessment

- 16.7.19 A number of determinants of health were scoped out on the basis of assumptions that would be kept under review during the assessment stage. Those assumptions have been reviewed and it continues to be appropriate to scope those issues out of further assessment. This includes the water environment and land quality as determinants of health.
- **Chapter 10: Land Quality** concludes that there are no significant effects on Land Quality from the development after taking into account the embedded mitigation measures. This includes as consideration of human health in relation to hazards and risk factors listed in paragraphs 10.10.3 and 10.10.8.
 - **Chapter 12: Surface Water and Flood Risk** concludes that there are no significant effects on surface water and flood risk from the Proposed Development after taking into account the embedded mitigation measures. This includes consideration of water supplies.
- 16.7.20 The potential effects that have not been assessed and which constitute a change of scope from the Scoping Report (**Appendix 1A**) are summarised in **Table 16.4**.

Table 16.4 Summary of effects that have not been assessed for human health

Topic	Issue	Reason
Construction		
Air quality	Changes in air quality or odour due to combustion emissions from construction vehicles.	Chapter 8: Air Quality has scoped these issues out as the activity associated with construction plant and equipment is expected to be small compared with the ongoing operational activities, so the impacts on air quality and odour are expected to be negligible, and accordingly have been scoped out.
Air quality	Changes in construction road traffic related air quality.	Chapter 8: Air Quality has scoped these issues out as estimates of traffic associated with construction activity are well below the IAQM/EPUK screening criterion, which is annual average daily traffic of 100 heavy good vehicle movements. Impacts from construction traffic have therefore not been assessed further.
Operation		
Air quality	Changes in aviation and road transport related air quality for pollutants other than NO ₂ , PM ₁₀ and PM _{2.5} .	Chapter 8: Air Quality explains why it is appropriate (based on the experience of other projects) to scope out other air pollutants (see Section 8.7 of Chapter 8: Air Quality).
Travel	Changes in opportunities for increased national and international travel for community residents and the wider population.	Following a review of the literature it has been concluded that there is limited evidence on the health effects of leisure travel ^{44,45,46,47} . Taking a vacation/holiday tends to be associated with modest short-term mental health benefits. Some evidence indicates that the benefits are from the anticipation of a break, other sources show that there are benefits on return to work. Overall, whilst the Proposed Development is likely to have a beneficial influence, the strength of evidence does not support including this potential determinant of health within the assessment scope of likely significant effects.
Community identity	Socio-economic effects on local services and community facilities.	Chapter 15: Socio-economics has scoped issues relating to demand on local services (such as schools) out as there will be no significant increases in population associated with the Proposed Development. For the same reasons Chapter 15: Socio-economics has scoped out effects on local community facilities (beyond potential effects on noise and traffic), such as sport and recreation, housing demand/supply, and cultural or religious facilities as there will be no change in the provision of these services arising from the Proposed Development.

16.8 Environmental measures embedded into the development proposals

- 16.8.1 A range of environmental measures have been embedded into the development proposals as outlined in **Section 2.3**.
- 16.8.2 Measures discussed in other chapters of the ES are also relevant (these are not duplicated here), see:

⁴⁴ de Bloom, J., Kompier, M., Geurts, S., et al. (2009). Do we recover from vacation? Meta-analysis of vacation effects on health and well-being. *J Occup Health*, 51, 13-25.

⁴⁵ Blank, C., Gatterer, K., Leichtfried, V., et al. (2018). Short Vacation Improves Stress-Level and Well-Being in German-Speaking Middle-Managers-A Randomized Controlled Trial. *Int J Environ Res Public Health*, 15.

⁴⁶ Strauss-Blasche, G., Reithofer, B., Schobersberger, W., et al. (2005). Effect of vacation on health: moderating factors of vacation outcome. *J Travel Med*, 12, 94-101.

⁴⁷ Nawijn, J., Marchand, M. A., Veenhoven, R., et al. (2010). Vacationers Happier, but Most not Happier After a Holiday. *Appl Res Qual Life*, 5, 35-47.

- **Chapter 6: Traffic and Transport**, specifically **Table 6.12**;
- **Chapter 7: Noise and Vibration**, specifically **Table 7.16**;
- **Chapter 8: Air Quality**, specifically **Table 8.17**;
- **Chapter 9: Landscape and Visual**, specifically **Table 9.8**; and
- **Chapter 17: Carbon and Other GHGs**, specifically **Table 17.1**.

16.8.3 **Chapter 15: Socio-economics**, does not identify further embedded measures for socio-economic effects. However, it does acknowledge the role of relevant activities such as training and access to employment (though these are not part of the Proposed Development design per se).

16.9 Assessment methodology

- 16.9.1 The generic project-wide approach to the assessment methodology is set out in **Chapter 4: Approach to Preparing the ES**, and specifically in **Sections 4.5 to 4.7**. However, whilst this has informed the approach that has been used in this human health assessment, it is necessary to set out how this methodology has been applied, and adapted as appropriate, to address the specific needs of this human health assessment.
- 16.9.2 The methodology outlined in this section is based on emerging best practice for the consideration of health in EIA. It has been informed by approaches used in HIA and by interim advice from the IEMA²³ and Public Health England²⁴.

General Approach

- 16.9.3 This section sets out the methods for providing reasoned conclusions for the identification and assessment of any likely significant effects of the Proposed Development on population health. This includes reasoned conclusions in relation to health protection, health improvement and/or improving services.
- 16.9.4 The methods provide a framework to identify (at both scoping and assessment):
- The 'likelihood' of the Proposed Development having an effect on health; and
 - If an effect is likely, whether it may be 'significant' in EIA terms.

Health determinants

- 16.9.5 Population health is influenced by a wide variety of direct and indirect factors, from controllable factors such as lifestyle to uncontrollable factors such as genetics. The influences and effects can be wide-ranging and are likely to vary between individuals. In determining 'physical, mental and social wellbeing', contributory factors, known as 'determinants', are considered. Determinants are a reflection of a mix of influences from society and environment on population and individual health.
- 16.9.6 The 'wider determinants of health' model is used to conceptualise how population health spans environmental, social and economic aspects. This is illustrated in **Figure 16.2**. **Figure 16.3** sets out an adapted version of this model (provided NSC during consultation on the Scoping Report (**Appendix 1A**)) showing issues that may be of particular relevance in North Somerset, for example the figure highlights lifestyle choices, the built environment and public services.
- 16.9.7 Influences that result in a change in determinants have the potential to cause beneficial or adverse effects on health, either directly or indirectly. The degree to which these determinants influence health varies, given the degree of personal choice, location, mobility and exposure.

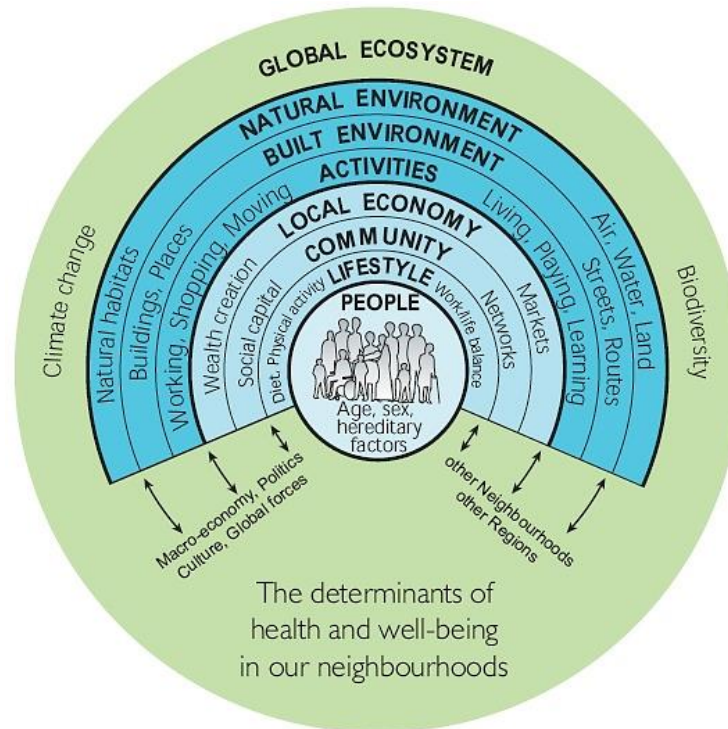
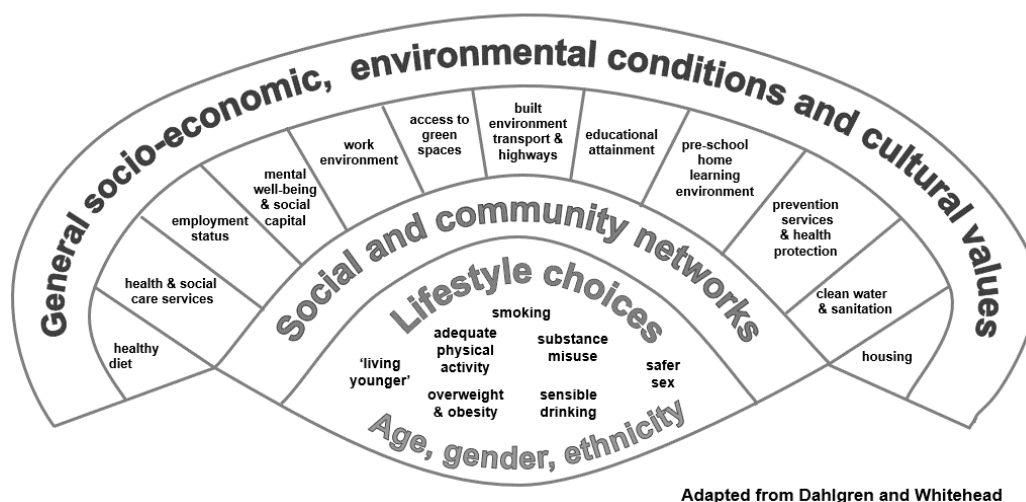
Figure 16.2 Wider determinants of health^{48, 49}

Figure 16.3 North Somerset Council adapted wider determinants of health



Likelihood

16.9.8 The first issue to consider is the likelihood of the Proposed Development having an effect. A likely effect should be both plausible and probable.

- Plausible relates to their being a relevant source, pathway and receptor; and

⁴⁸ Dahlgren G, Whitehead M (1991). Policies and strategies to promote social equity in health. Stockholm: Institute for Future Studies.

⁴⁹ Barton H, Grant M (2006). A health map for the local human habitat. The Journal of the Royal Society for the Promotion of Health; 126(6): 252-3.

- Probable relates to a qualitative judgement to exclude those effects that could only occur under certain very rare conditions, except where these relate to the Proposed Development's vulnerability to major accidents or disasters (as required by Part 1 paragraph 4(4) EIA Regulations 2017⁴ (refer to Scoping Report (**Appendix 1A**), specifically Chapter 16: Major Accidents and Disasters. Refer also to **Chapter 2: Description of the Proposed Development** of the ES for discussion of such issues).

16.9.9 The term 'health pathways' describes how a specific activity of the Proposed Development could change a determinant of health and potentially result in a change in health outcomes (an effect):

- A 'source' represents an activity or factor that could affect the health outcomes of a receptor population;
- A 'pathway' describes the method or route by which the 'source' could affect the 'receptor' (either causation or association); and
- A 'receptor' is the recipient of an effect from the 'source', via the 'pathway'.

16.9.10 **Table 16.6** shows how the Source-Pathway-Receptor model can be used to identify plausible health effects. For example, in the case of construction dust, the source is dust mobilised by construction activities; the pathway is dispersion through the air; and receptors are communities of people.

Table 16.6 Use of a Source-Pathway-Receptor model to identify plausible health effects

Source	Pathway	Receptor	Plausible health effect?	Rationale
✗	✓	✓	No	There is not a clear source from where a potential health effect could originate.
✓	✗	✓	No	The source of a potential health effect lacks a means of transmission to a population.
✓	✓	✗	No	Receptors that would be sensitive or vulnerable to the health effect are not present.
✓	✓	✓	Yes	Identifying a source, pathway and receptor does not mean an effect is a likely significant effect; the probability of the effect should be qualitatively considered, and a professional judgement reached on the significance of effects that are considered likely.

16.9.11 Once a plausible association is established between the Proposed Development's activities and health outcomes, the conclusion on 'likelihood' is also informed by a qualitative judgement on the probability of the effect occurring. If the effect could only occur under very rare conditions (or committed mitigation, design principles or regulatory prerequisites would be in place) then the effect may be plausible but not probable and therefore not likely.

Significance

16.9.12 A determination of significance is required for compliance with the EIA regulations⁴ when a potential effect of the Proposed Development is likely (or relates to the Proposed Development's vulnerability to major accidents or disasters).

- 16.9.13 The 'wider determinants of health' model (introduced in **Figure 16.2**) shows how in broad terms health affects everything and everything affects health. Every project activity will therefore have some influence on health.
- 16.9.14 When a potential effect of the Proposed Development is likely, a conclusion on significance allows the determining authority to place that health effect in context. Effects that are considered significant should be considered when assessing the application. Effects that are considered non-significant should not be the basis for acceptance or refusal (though it may be relevant to note certain effects that are non-significant due to avoidance or mitigation commitments).
- 16.9.15 The determination of significance has two stages:
- Firstly, the sensitivity of the receptor affected, and the magnitude of the effect upon it are characterised. This establishes whether there is a relevant population and a relevant change in health outcomes to consider; and
 - Secondly, a professional judgement is made as to whether or not the change in a population's health is significant. This judgement is based on the collection and presentation of data to evidence reasoned conclusions.

Sensitivity

- 16.9.16 **Table 16.7** sets out factors characterising sensitivity for population health. It informs the professional judgement on scoring high, medium, low or negligible sensitivity. The 'higher' and 'lower' sensitivity characterisations represent instructive positions on a spectrum that would also include more extreme, as well as intermediate, positions.

Magnitude

- 16.9.17 **Table 16.8** sets out factors characterising magnitude for population health. It informs the professional judgement on scoring large, medium, small or negligible magnitude. The 'larger' and 'smaller' magnitude characterisations represent instructive positions on a spectrum that would also include more extreme, as well as intermediate, positions.

Table 16.7 Characterising Sensitivity for Population Health

	Inequalities	Deprivation	Health status	Life stage	Outlook
Higher sensitivity	High levels of inequalities or inequities.	High levels of overall deprivation or a high level of deprivation for a relevant sub-domain of the indices of multiple deprivation. High levels of poor access to financial, social or political resources.	High levels of poor health and/or disability (particularly multiple or complex long-term health conditions). High reliance on (or low capacity in) healthcare facilities, staff or resources.	Presence of dependants (particularly the elderly or children), pregnant women, shift workers or the economically inactive.	Presence of groups with strong views or high degrees of uncertainty about the Proposed Development who may anticipate risks to their health and thus be affected by not only actual changes, but also by the possibility of change.

	Inequalities	Deprivation	Health status	Life stage	Outlook
Lower sensitivity	Low levels of inequalities or inequities.	Low levels of overall deprivation or a low level of deprivation for a relevant sub-domain of the indices of multiple deprivation. Good access to financial, social or political resources.	Low levels of poor health and/or low levels of disability. Low reliance on (or high capacity in) healthcare facilities, staff or resources.	Predominantly a working age population in steady good quality employment.	No indication that strong views are held about the Proposed Development. People are well informed of the issues and potential effects.

Table 16.8 Characterising Magnitude for Population Health

	Severity	Extent	Frequency	Reversibility	Exposure
Larger magnitude	Large change in the risk of developing a new health condition (or injury) or in the progression of an existing condition. Large change in symptoms, quality of life or day-to-day functioning. Large change in inequalities.	Most members of the relevant population affected. Substantial population displacement or influx.	Continuous or daily effects with chronic (long term) changes in health outcomes.	Permanent change in health outcomes once the Proposed Development change ceases. Intergenerational effects.	A low (or high) concentration over a long time, or a high concentration over a short time. Low (or high) exposure to a large population or high exposure to a small population. A high degree of resource sharing with the Proposed Development.
Smaller magnitude	Small change in the risk of developing a new health condition (or injury) or in the progression of an existing condition. Small change in symptoms, quality of life or day-to-day functioning. Small change in inequalities.	Few members of the relevant population affected. Little change in population.	Monthly or yearly affects with acute (short term) changes in health outcomes.	Change in health outcomes reverses once the Proposed Development change ceases. No intergenerational effects.	A low concentration over a short time. Low exposure to a small population. A low degree of resource sharing with the Proposed Development.

16.9.18 The assessment characterises the relevant changes in health outcomes for each health issue. For each professional judgement on sensitivity and magnitude, the text sets out further detail on the one or more relevant factors from **Table 16.7** and **Table 16.8** that informed the scores.

Judgement framework for significance

16.9.19 Having established through the magnitude and sensitivity methods whether there is a relevant population to consider and a relevant change in health outcomes, a judgement has been made as to whether or not the change in a population's health is significant.

16.9.20 The approach uses a framework for reporting on a range of data sources to ensure reasoned and robust conclusions are reached. Key sources of data include: scientific literature; baseline conditions; health priorities; consultation responses; regulatory standards; and policy context.

- 16.9.21 Guide questions set out in **Table 16.9** are used to inform professional judgement on significance. **Table 16.9** informs the professional judgement on scoring effects to be 'significant' or 'not significant' for population health.

Table 16.9 Population health guide questions for determining significance

Evidence sources	Guide questions (that have informed evidence collection, as set out in Appendix 16A, and the analysis in section 16.10 and section 16.11)
Scientific literature	Is there a sufficient strength of evidence from sufficiently high-quality studies to support an association between the development, a relevant determinant of health and a relevant health outcome? Does the literature indicate thresholds or conditions for effects to occur? Are particular population groups identified as being particularly susceptible?
Baseline conditions	Are relevant sensitivities or inequalities identified in the scientific literature present? Does the baseline indicate that conditions differ from relevant local, regional or national comparators? Are their geographic or population features of the baseline that indicate effects could be amplified?
Health priorities	Have local, regional or national health priorities been set for the relevant determinant of health or health outcome (e.g. in Joint Strategic Needs Assessments or in Health and Wellbeing Strategies)?
Consultation responses	Has a theme of local, regional or national consultation responses related to the relevant determinant of health or health outcome?
Regulatory standards (if appropriate)	Is the change one that would be formally monitored by regulators? Are there regulatory or statutory limit values set for the relevant context? Has EIA modelling predicted change that exceed thresholds from the scientific literature or set by regulators? Are there relevant international advisory guideline limit values (e.g. by the World Health Organization)?
Policy context	Does local, regional or national government policy raise particular expectations for the relevant project change, determinant of health or health outcome (e.g. levels should be as low as reasonably practicable)? Is there a relevant international policy context (e.g. treaties or conventions)?

- 16.9.22 The assessment section provides an analysis that responds to these questions for each health issue. With reference to evidence set out in **Appendix 16A** the analysis provides reasoned conclusions for the judgement as to whether an issue is significant, or not, for population health. Where appropriate, variation expressed in each evidence source is reported. This approach is considered proportionate and in line with best practice for the consideration of population health.
- 16.9.23 Ultimately a likely significant health effect is one that should be brought to the attention of the determining authority, as the effect of the Proposed Development is judged to provide, or be contrary to providing, a high level of protection to population health. This may include reasoned conclusions in relation to health protection, health improvement and/or improving services.
- 16.9.24 Where significant adverse effects are identified having taken account of embedded mitigation, additional mitigation has been considered to reduce the significance of such effects.

Population conclusions

- 16.9.25 A population health approach has been used, as it would be disproportionate to reach conclusions on the potential health outcomes of individuals. To take account of potential inequalities, where appropriate, conclusions on a particular health issue have been reached for more than one population. For example:
- One conclusion for the general population (for a defined area); and
 - A second separate sub-population conclusion for relevant vulnerable groups (as a single defined class of sensitivities for that issue).

16.10 Construction stage: assessment of human health effects

Predicted effects and their significance

- 16.10.1 This section assesses the construction stage effects of the Proposed Development. Operational effects are assessed in **Section 16.11**. The assessment sections for each stage of the Proposed Development are structured by health topics. For each health issue within a topic, sensitivity and magnitude are characterised prior to drawing conclusions on significance, with reference to the guide questions presented in **Table 16.9**. Evidence from **Appendix 16A** is cross-referenced as appropriate.
- 16.10.2 For all health topics the baseline (set out in **Section 16.5**, **Appendix 16A** and **Appendix 16B**) indicates that broadly the general population in North Somerset is healthy, with below average deprivation and better than average self-reported health and wellbeing (compared to national averages). This characterisation has been taken into account when scoring the sensitivity of the general population. This statement of general population health is not duplicated in each assessment.
- 16.10.3 A summary of the results of the assessment of the human health is provided in **Table 16.10** (adverse effects) and **Table 16.11** (beneficial effects).

Air quality

Construction dust

- 16.10.4 See **Chapter 8: Air Quality** for the conclusions of the air quality assessment and for the embedded mitigation measures, specifically **Table 8.17**, taken into consideration during this assessment of effects on human health.
- 16.10.5 This focuses on the discussion of nuisance dust and PM (PM_{10} – $PM_{2.5}$, with the relevant metric being PM_{10}). As discussed in **Appendix 16A**, construction activities that produce dust relate to the coarser fractions of PM_{10} and potential nuisance from dust deposition on property. The great majority of anthropogenic $PM_{2.5}$ health effects relate to operational combustion related processes, particularly changes in transport patterns or industrial processes that use fossil fuels.
- 16.10.6 Whilst the focus of discussion differs in this health chapter between coarse PM during construction and fine PM during operation, the health outcomes of PM_{10} and $PM_{2.5}$ are not distinguished in this assessment. This reflects that both are typically present (though the relative proportions change) and that the evidence base does not consistently distinguish their effects (particularly given that $PM_{2.5}$ is a subset of PM_{10}). However, generally, elevated concentrations of $PM_{2.5}$ are considered of greater concern due to their greater potential to interact within the body.
- 16.10.7 For construction dusts, the main health outcomes are likely to relate to exacerbation of existing conditions, such as asthma or chronic obstructive pulmonary disease (COPD) (i.e. airway inflammation by coarse PM) and to reductions in wellbeing associated with annoyance or reduced amenity. Whilst other outcomes (e.g. cardiovascular events) may be relevant in the event of short-term high concentrations, such elevated exposures are expected to be avoided through the embedded standard good practice mitigation of the Proposed Development (see discussion in **Chapter 8: Air Quality** and the Outline Construction Environmental Management Plan (CEMP) (**Appendix 2B**).
- 16.10.8 The population groups relevant to this assessment, due to either proximity or other sensitivity (as defined in **Section 16.7**) are:

- The population near Bristol Airport (site-specific);
- Children and young people;
- Older people; and
- People with existing poor health (physical and mental health).

16.10.9 The potential effect is considered likely because (see **Table 16.6**) there is a plausible source-pathway-receptor relationship:

- Sources of dust mobilised by construction activities;
- The pathway is dispersion through the air; and
- Receptors are communities of people.

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

16.10.11 The magnitude of the change due to the Proposed Development is **small** (see **Table 16.8**). In line with Institute of Air Quality Management guidance dust effects have not been quantitatively modelled in **Chapter 8: Air Quality**. The risk assessment-based approach set out in that chapter has identified limited potential for dust related nuisance or health effects. This approach encompasses all particulate sizes. Levels of coarse (and fine) PM would therefore be expected to remain within UK AQO thresholds. Occasionally, weather conditions may coincide with construction activities to generate higher levels of dust. This could cause temporary annoyance, and for people with existing poor health, higher levels of coarse dust in the air could exacerbate some conditions (e.g. asthma). Coarse PM (being larger and heavier) would be expected to rapidly reduce in concentration with distance from source due to deposition. The potential for nuisance-type dust effects is therefore expected to be occasional and limited in extent (particularly given the mitigation proposals described in **Chapter 8: Air Quality**). For finer PM, deposition rates would be slower, affecting a wider area and thus more people. However, exposure is expected to be very low due to the finer PM being typically a relatively small component of construction dusts and the effects of dispersion would reduce concentrations with increased distance. At these levels it is unlikely that there would be discernible changes in the risk of developing a new health condition or of exacerbating an existing condition.

16.10.12 The sensitivity of the general population and for vulnerable groups (collectively as a single group) is characterised as follows (see **Table 16.7**):

- The sensitivity of the general population is considered to be **low**. Most people live, work or study at a distance from the construction areas of the components of the Proposed Development at which dust emissions would benefit from high levels of dispersion and deposition, reducing exposure. Furthermore, most people enjoy good respiratory health (e.g. are not asthmatic) and are not at a life stage (e.g. infant or frail elderly) for which lower levels of emissions could be of concern; and
- The sensitivity of vulnerable groups is considered **high**. This reflects the presence of populations (residents or airport workers) who are likely to spend extended periods near to airport or road network construction works (while at work or at home, e.g. dwellings near the A38). 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. Bristol Airport passengers and visitors may still have high sensitivity due to existing poor health and/or age but are unlikely to have high sensitivity on the basis of occasional geographic proximity to the construction works.

16.10.13

The guide questions in **Table 16.9** have been used to consider the significance of the potential effect. The findings are shown below:

- The scientific literature summarised in **Appendix 16A** indicates evidence from sufficiently high-quality studies to support an association between construction dust emissions due to the Proposed Development and health and wellbeing effects. The literature indicates a causal link between PM and health effects (particularly for PM_{2.5}). Whilst the literature supports there being thresholds set for health protection purposes, it also acknowledges that for PM there are non-threshold health effects (i.e. when there is no known exposure threshold level below which adverse health effects may not occur). The assessment has identified population groups that may be particularly sensitive to air quality effects. The dust risk assessment in **Chapter 8: Air Quality** shows that the concentration of particulates are not likely to exceed thresholds set for health protection (i.e. UK AQOs). For non-respirable particulates, the effects relate to amenity and potentially nuisance. Again, the dust risk assessment (**Chapter 8: Air Quality**) indicates that the levels of exposure are unlikely to result in such outcomes. In both cases occupational levels of dust exposure described in the literature are expected to be avoided, both for workers and the public, due to the standard good practice mitigation measures embedded in the Proposed Development;
- The baseline summarised in **Appendix 16A** indicates that relevant sensitivities and inequalities identified in the scientific literature may be present. It also shows where relevant baseline indicators differ from their local, regional or national comparators. The baseline does not identify any geographic or population features that suggest effects could be unusually amplified. Baseline conditions show that there is a population of people that are likely to be at work, or at home, i.e. closer to the construction area. This may include groups with increased sensitivity due to age or existing ill health;
- The health priorities summarised in **Appendix 16A** link with air quality as a determinant of health, including: supporting children to thrive in their early years; enabling people to live in safe, healthy environments, with influence over how those environments develop; reducing preventable risk factors for people with COPD; and enhancing local environmental quality in both new and existing developments;
- Health outcomes, in relation to air quality, was not identified as a theme in the consultation (on the Scoping Report) summarised in **Appendix 16A**;
- Relevant regulatory standards are summarised in **Appendix 16A**. Based on **Chapter 8: Air Quality**, assessment findings, with mitigation and control measures implemented, the construction works would be within statutory requirements (UK AQOs) and would be unlikely to result in nuisance from widespread dust deposition; and
- The health policy context (of NSC) summarised in **Appendix 16A** raises expectations in relation to achieving 'acceptable' air quality levels through mitigating and monitoring. It is considered that these expectations are appropriately responded to by the Proposed Development.

16.10.14

The conclusion of the assessment for human health is that the significance of the effect would be **negligible** for the general population and up to **minor adverse (not significant)** in EIA terms) for vulnerable groups. The change associated with construction activities would be short-term, temporary and would cease on completion of the Proposed Development.

Noise and vibration

Construction noise

- 16.10.15 Refer **Chapter 7: Noise and vibration** for the conclusions of the noise assessment and for the embedded mitigation measures, specifically **Table 7.16**, taken into consideration during this assessment of effects on human health.
- 16.10.16 During construction, there is potential for noise to temporarily arise from construction works, road works and movement of construction related vehicles.
- 16.10.17 The key health outcomes relevant to this determinant of health are cardiovascular health and mental health conditions (e.g. stress, anxiety or depression). Sleep disturbance is particularly associated with night-time working, though the day-time rest of some vulnerable groups (such as the very young, elderly, or shift workers) could potentially be affected. Cognitive performance in children, particularly at school is also a potential outcome.
- 16.10.18 Most construction works will take place during the daytime during the hours of 07:30 to 18:00 Monday to Friday and Saturday 08:00 to 13:00. There is no planned working on Sundays or Bank Holidays. Some work will need to be undertaken at night, specifically for the east taxiway link and taxiway widening fillets. These works are scheduled to occur between 23:00 and 06:00 over a six-month period. This is the only night-time construction work scheduled.
- 16.10.19 The population groups relevant to this assessment, due to either proximity or other sensitivity are (as defined in **Section 16.7**):
- The population near Bristol Airport (site-specific);
 - Children and young people;
 - Older people; and
 - People with existing poor health (physical and mental health).
- 16.10.20 The potential effect is considered likely because (see **Table 16.6**) there is a plausible source-pathway-receptor relationship:
- The source is construction plant and activities;
 - The pathway is pressure waves through the air; and
 - Receptors are communities of people.
- 16.10.21 Furthermore, the potential effect is probable as no highly unusual conditions are required for the source-pathway-receptor linkage.
- 16.10.22 The magnitude of the change due to the Proposed Development is **small** (see **Table 16.8**). The predicted construction noise levels are relatively localised and temporary. At the locations where higher levels of noise are predicted during the daytime (e.g. close to the A38 roadworks and close to the new gyratory roadwork) the adoption of mitigation described in **Chapter 7: Noise and Vibration** (i.e. best practicable means, which may include conventional solid timber site hoarding and temporary solid road-side site hoardings) would be expected to greatly reduce the magnitude of potential noise effects. For night-time construction activity the change in noise levels would be small within in the context of background noise levels, though some change may be discernible due to differing noise characteristics. For analysis please refer to **Section 7.13** of **Chapter 7: Noise and Vibration**. It is noted that night-time works during winter months may coincide with lower use of residential outdoor spaces (e.g. gardens) and less frequent opening of windows at night.

16.10.23

The sensitivity of the general population and for vulnerable groups (collectively as a single group) is set out below (see **Table 16.7**):

- The sensitivity of the general population is considered to be **low**. This reflects that most people will not spend extended periods of time in proximity to construction works during their normal working hours (e.g. because they are at work, at school, or are passing through the airport or the local road network). Those experiencing temporary day-time annoyance from a very short-term exposure to elevated noise levels would be unlikely to experience a discernible change in health outcomes; and
- The sensitivity of vulnerable groups is considered **high**. This reflects the presence of populations (residents or airport employees) who are likely to spend extended periods near to airport or road network construction works (while at work or at home). Vulnerability in this case is particularly linked to: living close to sources of noise (e.g. close to the A38 roadworks and those close to the new gyratory roadworks); age (both young people and older people); existing poor health (e.g. long-term illness); spending more time in affected dwellings (e.g. due to low economic activity, shift work; or ill health); vulnerability due to deprivation or health inequalities; or having strong views or high degrees of uncertainty about the Proposed Development (which may be associated with health effects even below noise thresholds that are generally considered acceptable).

16.10.24

The guide questions in **Table 16.9** have been used to consider the significance of the potential effect. The findings are shown below:

- The scientific literature summarised in **Appendix 16A** indicates evidence from sufficiently high-quality studies to support an association between the noise disturbance due to the Proposed Development and health and wellbeing outcomes. The literature predominantly relates to transport related noise exposure, but (adopting a conservative approach) this can be taken to also apply to construction noise. 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. 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. The assessment has had regard to the population groups identified in the literature that may be particularly sensitive;
- The baseline summarised in **Appendix 16A** indicates that relevant sensitivities and inequalities identified in the scientific literature may be present. It also shows where relevant baseline indicators differ from their local, regional or national comparators. The baseline does not identify any geographic or population features that suggest effects could be unusually amplified. Typical daytime ambient noise levels around Bristol Airport lie between 50dB $L_{Aeq,12h}$ and 60dB $L_{Aeq,12h}$ during the daytime (see **Appendix 7C**) and 45dB $L_{Aeq,8h}$ and 55dB $L_{Aeq,8h}$ during the night-time;
- The health priorities summarised in **Appendix 16A** indicate that relevant priorities have been set that link with noise as a determinant of health, including: enabling people to live in safe, healthy environments, with influence over how those environments develop; and enhancing local environmental quality in both new and existing developments;
- Sleep-disturbance and subjective responses to increased noise as potential health effects, was raised in the consultation (on the Scoping Report). This is summarised in **Appendix 16A**;
- Relevant regulatory standards summarised in **Appendix 16A**. Based on the findings of **Chapter 7: Noise and Vibration**, with mitigation and control measures implemented, the changes due to the Proposed Development are assessed as meeting relevant standards; and

- The health policy context (of North Somerset Council) summarised in **Appendix 16A** raises expectations in relation to achieving 'acceptable' noise levels through mitigating and monitoring. It is considered that these expectations are appropriately responded to by the Proposed Development.

16.10.25 The conclusion of the assessment for human health is that the significance of the effect would be **negligible** for the general population and up to **minor adverse (not significant)** in EIA terms) for vulnerable groups (described above in relation to sensitivity). The change associated with construction activities would be short-term, temporary and would cease on completion of the works.

16.10.26 As discussed in **Section 7.15** of **Chapter 7: Noise and Vibration**, optional additional mitigation includes an improved noise insulation grant scheme. Although the focus of that scheme would be operational noise, the early availability and uptake of that scheme would be expected to also have benefits during the construction period.

Travel

Construction traffic effects

16.10.27 See **Chapter 6: Traffic and transport** for the conclusions of the transport assessment and for the embedded mitigation measures, specifically **Table 6.12** as well as set out in the CEMP (**Appendix 2B**), taken into consideration during this assessment of effects on human health.

16.10.28 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 (e.g. cardiovascular health) and mental health conditions (e.g. stress, anxiety or depression) associated with obesity and levels of physical activity.

16.10.29 The population groups relevant to this assessment, due to either proximity or other sensitivity are (as defined in **Section 16.7**):

- The population near Bristol Airport (site-specific) (including relevant stretches of the local road network described in **Chapter 6: Traffic and Transport**, e.g. the A38, West Lane and Downside Road);
- The population of North Somerset Unitary Authority (local) (including relevant stretches of the wider road network described in **Chapter 6: Traffic and Transport**, e.g. A4174, A370 and A368);
- Children and young people (as potentially more vulnerable road users);
- Older people (as potentially more vulnerable road users);
- People with existing poor health (physical and mental health) (in relation to health trip journey times); and
- People living in deprivation, including those on low incomes.

16.10.30 The potential effect is considered likely because (see **Table 16.6**) there is a plausible source-pathway-receptor relationship:

- The source is vehicles on the road network or changes in routes that link community residential, commercial or amenity services;

- The pathway is changes in road safety, community severance, journey times or levels of intimidation of other road users. This links with physical activity and active travel. It also links with emergency response times; and
- Receptors are local road users, including those using motor vehicles as well as pedestrians and cyclists, as well as emergency services using the highway network.

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

16.10.32 The magnitude of the change due to the Proposed Development is **small** (see **Table 16.8**). This reflects the findings presented in **Chapter 6: Traffic and Transport**; during construction the increase in vehicle movements would be small and any delay is characterised as localised, temporary and minor.

16.10.33 The sensitivity of the general population and for vulnerable groups (collectively as a single group) is set out below (see **Table 16.7**):

- The sensitivity of the general population is considered to be **low**. This reflects that most people in the local area (North Somerset Unitary Authority) would only make occasional use of the affected road network. The score also reflects the ability to adapt to changes in traffic conditions (e.g. during the junction works); and
- The sensitivity of vulnerable groups is considered **high**. Vulnerability in this case is linked to mode of travel, including: pedestrians and cyclists; age (young people and older people); frequent use of services accessed on affected sections of the highway network (e.g. traveling to schools); and deprivation. Deprived populations may already face more access barriers compared to general population and therefore be more sensitive to access changes. Vulnerability also includes those accessing health services (emergency or non-emergency) at times and locations where there may be some increase in 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).

16.10.34 The guide questions in **Table 16.9** have been used to consider the significance of the potential effect. The findings are shown below:

- The scientific literature summarised in **Appendix 16A** indicates evidence from sufficiently high-quality studies to support an association between the construction transport changes due to the Proposed Development and road safety, travel times, accessibility and active/sustainable travel. The literature does not identify particular thresholds for effects. The assessment has had regard to the population groups identified in the literature that may be particularly sensitive;
- The baseline summarised in **Appendix 16A** indicates that relevant sensitivities and inequalities identified in the scientific literature may be present. It also shows where relevant baseline indicators differ from their local, regional or national comparators. The baseline does not identify any geographic or population features that suggest effects could be unusually amplified;
- The health priorities summarised in **Appendix 16A** indicates that relevant priorities have been set that link with travel as a determinant of health, including reducing rates of obesity, type-2-diabetes and inactivity, as well as increasing road safety and sustainable travel options;
- The management of hazardous loads (though standard best practice) and the importance of active travel, particularly preserving tranquil walking and cycling routes was raised in consultation. This summarised in **Appendix 16A**; and

- The health policy context (of North Somerset Council) summarised in **Appendix 16A** raises the following expectations in relation to travel: making improvements in the transport network to allow for a wide choice of modes of transport; and appropriate surface access infrastructure at Bristol Airport, including consideration of the growth in surrounding communities.

16.10.35 The conclusion of the assessment for human health is that the significance of the effect would be **negligible** for the general population and up to **minor adverse (not significant)** in EIA terms) for vulnerable groups (described above in relation to sensitivity). During completion of the road works, the priority given to ambulances travelling under blue lights would be expected to reduce any changes in journey times. For non-emergency journeys to healthcare facilities, there would be the potential for a slight increase in journey times. However, due to the temporary nature of the works and ability for people to adapt to known planned roadworks, such delays are not expected to significantly change population health outcomes. The change associated with construction activities would be short-term, temporary and would cease on completion of the works.

Community identity

Construction land requirements

- 16.10.36 See **Chapter 9: Landscape and Visual** for the conclusions of the landscape assessment and for the embedded mitigation measures, specifically **Table 9.8**, taken into consideration during this assessment of effects on human health.
- 16.10.37 Health effects may be associated with mental health conditions (e.g. stress, anxiety or depression) due to underlying social determinants influencing community cohesion.
- 16.10.38 The population groups relevant to this assessment, due to either proximity or other sensitivity are (as defined in **Section 16.7**):
- The population near Bristol Airport (site-specific);
 - Children and young people;
 - Older people;
 - People with existing poor health (physical and mental health); and
 - People living in deprivation, including those on low incomes.
- 16.10.39 The potential effect is considered likely because (see **Table 16.6**) there is a plausible source-pathway-receptor relationship:
- The source is environmental change due to land take and new structures;
 - The pathway is visual or auditory cues that contribute to behaviour and a sense of identity; and
 - Receptors are communities of people.
- 16.10.40 Furthermore, the potential effect is probable as no highly unusual conditions are required for the source-pathway-receptor linkage.
- 16.10.41 The magnitude of the change due to the Proposed Development is **small** (see **Table 16.8**). This conclusion reflects that the Proposed Development is an expansion of an existing operational airport with a history of ongoing improvement works. The assessment acknowledges that whilst construction related visual change would be temporary, over the seven-year construction period there would be an increasing number of permanent visual changes as components of the Proposed Development were completed. This includes the changing identity of localised areas due to new

land use (e.g. the Silver Zone Car Park Extension (Phase 2) or new structures (MSCP Phase 3)). Whilst there would be some pronounced and localised effects (of small extent), the construction programme is broadly characterisable as a series of successive changes over seven years, rather than a single large change in a shorter timeframe. For the majority of the surrounding population, Bristol Airport would be a prominent feature of the landscape before, during and on completion of construction activities, suggesting construction of the Proposed Development would have a limited influence in changing community identity to an extent that could affect population health.

16.10.42 The sensitivity of the general population and for vulnerable groups (collectively as a single group) is set out below (see **Table 16.7**):

- The sensitivity of the general population is considered to be **low**. This reflects that the majority of people near Bristol Airport would not experience a change in setting (e.g. change in views or soundscape from dwellings) due to construction of the Proposed Development. Furthermore, the Proposed Development does not affect shared community resources (e.g. availability of village halls); and
- The sensitivity of vulnerable groups is considered **high**. Vulnerability in this case is particularly linked to the proportion of people who have expectations that their community or way of life would be changed to a large degree by construction of the Proposed Development.

16.10.43 The guide questions in **Table 16.9** have been used to consider the significance of the potential effect. The findings are shown below:

- The scientific literature summarised in **Appendix 16A** indicates evidence from sufficiently high-quality studies to support an association between the environmental changes due to the Proposed Development and determinants of health and wellbeing linked to community context. The evidence broadly indicates that favourable psychosocial environments⁵⁰ are associated with better health and that unfavourable psychosocial environments are associated with poorer health. The literature does not identify particular thresholds for effects. The assessment has had regard to the population groups identified in the literature that may be particularly sensitive;
- The baseline summarised in **Appendix 16A** indicates that relevant sensitivities and inequalities identified in the scientific literature may be present. It also shows where relevant baseline indicators differ from their local, regional or national comparators. The baseline does not identify any geographic or population features that suggest effects could be unusually amplified;
- The health priorities summarised in **Appendix 16A** indicate that relevant priorities have been set that link with community identity as a determinant of health, including increasing community resilience; addressing disadvantage; and developing strong inclusive communities;
- The potential for visual impacts, including lighting from new buildings or structures was raised in consultation (on the Scoping Report) summarised in **Appendix 16A**; and
- The health policy context (of North Somerset Council) summarised in **Appendix 16A** raises the following expectations in relation to community identity: protecting the character, distinctiveness, diversity and quality of North Somerset's landscape; improving the network of green infrastructure; and maintaining strategic gaps that separate identity, character and/or landscape setting.

16.10.44 The conclusion of the assessment for human health is that the significance of the effect would be **negligible** for the general population and up to **minor adverse (not significant)** in EIA terms) for

⁵⁰ Environments about which people feel positive and which support social interactions.

vulnerable groups (described above in relation to sensitivity). The change associated with construction activities themselves would be short-term, temporary and would cease on completion of the works. Permanent operational changes to setting are discussed in **Section 16.11**.

16.11 Operational stage: assessment of human health effects

Predicted effects and their significance

Air quality

Operation air quality from aviation and surface access

- 16.11.1 See **Chapter 8: Air Quality** for the conclusions of the air quality assessment and for the embedded mitigation measures, specifically **Table 8.17**, taken into consideration during this assessment of effects on human health.
- 16.11.2 This section assesses changes in air quality relating to combined changes from aviation and operational road traffic (including effects associated with any changed airspace configurations, as well as take-off and landing patterns / frequency).
- 16.11.3 This focuses on the discussion of nitrogen dioxide (NO₂) and the finer fraction of PM (PM_{2.5}–PM₁, with the relevant metric being PM_{2.5}). These are the main combustion related air pollutants that affect health and which may change due to the Proposed Development.
- 16.11.4 For operational air emissions, the main health outcomes are likely to relate to increased risk of cardiovascular and respiratory related conditions or events (including reduced lung function, hypertension⁵¹ and myocardial infarction⁵²) (i.e. due to fine PM and NO₂ interacting within the body), as well as general measures of population mortality and hospital service use (e.g. emergency department visits). Such outcomes relate generally to long-term ambient exposure, but may also be affected by short-term exposure peaks, e.g. due to meteorological conditions reducing normal levels of pollutant dispersion. For both PM_{2.5} and NO₂ there is no identifiable threshold below which there is no risk to health.
- 16.11.5 The population groups relevant to this assessment, due to either proximity or other sensitivity are (as defined in **Section 16.7**):
- The population near Bristol Airport (site-specific);
 - The population of North Somerset Unitary Authority (local);
 - Children and young people;
 - Older people; and
 - People with existing poor health (physical and mental health).
- 16.11.6 The potential effect is considered likely because (see **Table 16.6**) there is a plausible source-pathway-receptor relationship:
- Sources of combustion related particulates and emissions from aviation (ground and airborne) and from ground vehicles (particularly due to surface access by passengers);

⁵¹ High blood pressure.

⁵² Heart attack.

- The pathway is dispersion through the air; and
- Receptors are communities of people (including community residents, airport visitors/passengers and airport employees).

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

16.11.8 The magnitude of the change due to the Proposed Development is **medium** (see **Table 16.8**). Changes in concentrations of all modelled air pollutants are within UK AQOs, levels considered acceptable in terms of health protection. The score reflects that in the case of NO₂ the increase at a small number of receptors, when considered within the context of the existing baseline, is potentially of concern (though does not exceed the annual mean UK AQO). The extent of the elevated NO₂ concentrations is relatively small (around the junction of the A38 and Downside Road).

- For NO₂ concentrations, the majority of the exposed population, including those expected to have the greatest exposure, are characterised as transitory (i.e. motel and B&B guests or road users). Such short-term exposure is unlikely to result in health outcomes associated with chronic (long-term) exposure to elevated NO₂ levels. Furthermore, the modelling indicates that exceedances of the hourly UK AQO for NO₂ is unlikely. Emissions are therefore also unlikely to result in health outcomes associated with acute (short-term) exposure to very high NO₂ levels; and
- A small residential population may also be exposed. For this population there is potential for a small change in health outcomes due to long-term exposure to elevated NO₂ levels that are approaching the annual mean UK AQO. It is noted that the baseline conditions are likely to already be resulting in such influences on health outcomes. In population health terms the change due to the Proposed Development is unlikely to be discernible. However, the incremental effect to population health is noted and has been taken into account in determining the significance of potential air quality effects. This type of health effect is relatively common in urban areas where major transport infrastructure and communities exist in close proximity.

16.11.9 The sensitivity of the general population and for vulnerable groups (collectively as a single group) is set out below (see **Table 16.7**):

- The sensitivity of the general population is considered to be **low**. This reflects that most people in North Somerset live, work or study at a distance from Bristol Airport (or parts of the local road network that are expected to experience additional vehicle movements) where emissions would benefit from high levels of dispersion, reducing exposure. As noted in **Chapter 8: Air Quality**, aircraft in the air have a limited impact on ground-level pollutant concentrations, with off-airport concentrations being dominated by emissions on the ground being blown horizontally rather than dispersing downwards from aircraft overhead. Furthermore, most people enjoy good respiratory health (e.g. are not asthmatic) and are not at a life stage (e.g. infant or frail elderly) for which lower levels of emissions could be of concern; and
- The sensitivity of vulnerable groups is considered **high**. This reflects the presence of populations (residents or airport workers) who (while at work or at home) are likely to spend extended periods near to Bristol Airport 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. Bristol Airport passengers and visitors may still have high sensitivity due to existing poor health and/or age but are

unlikely to have high sensitivity on the basis of occasional geographic proximity to Bristol Airport's operational activities.

16.11.10

The guide questions in **Table 16.9** have been used to consider the significance of the potential effect. The findings are shown below:

- The scientific literature summarised in **Appendix 16A** indicates evidence from sufficiently high-quality studies to support an association between air pollutants (including NO₂, PM₁₀ and PM_{2.5}) due to aviation, airport and surface access sources of the Proposed Development and health and wellbeing effects. Whilst the literature supports there being thresholds set for health protection purposes, it also acknowledges potential for non-threshold health effects (i.e. when there is no known exposure threshold level below which adverse health effects may not occur, including for NO₂ and PM_{2.5}). The assessment has identified population groups that may be particularly sensitive to air quality effects;
- The baseline considerations are as set out in paragraph 16.10.13 above in relation to construction air quality effects;
- The health priorities considerations are as set out in paragraph 16.10.13 above in relation to construction air quality effects;
- Relevant regulatory standards are summarised in **Appendix 16A**. Based on the **Chapter 8: Air Quality**, assessment findings, with mitigation and control measures implemented, the operational emissions of the Proposed Development would be within statutory requirements (UK AQOs), including for NO₂. The Government define these 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 the environment.⁵³ Recognising the non-threshold nature of some air pollutants the assessment has had regard to WHO guide values (but does not hold the Proposed Development to WHO guide values where they are more stringent than UK AQOs); and
- The health policy considerations are as set out in paragraph 16.10.13 above in relation to construction air quality effects.

16.11.11

The conclusion of the assessment for human health is that the significance of the effect would be **negligible** for the general population and up to **minor adverse (not significant in EIA terms)** for vulnerable groups (described above in relation to sensitivity). The conclusion reflects the UK Government view that compliance with UK AQOs demonstrates an acceptable level of health protection and that these air quality protection measures are produced in the knowledge that particular groups within a population will have particular health vulnerabilities. The operational air quality effects should be considered long-term, making an incremental addition to air quality related risk factors for population health.

Noise and vibration

Operational noise

16.11.12

See **Chapter 7: Noise and vibration** for the conclusions of the noise assessment and for the embedded mitigation measures, specifically **Table 7.16**, taken into consideration during this assessment of effects on human health.

⁵³ Department for Environment Food & Rural Affairs. UK and EU Air Quality Limits, [online]. Available at: <https://uk-air.defra.gov.uk/air-pollution/uk-eu-limits> [Checked 20/10/2018].

- 16.11.13 The key health outcomes relevant to this determinant of health are cardiovascular health and mental health conditions (e.g. stress, anxiety or depression relating to annoyance). Sleep disturbance, particularly associated with changes to night-time noise levels, has the potential to affect day-time functioning, physical health and mental health. Cognitive performance in children, particularly at school is also a potential outcome.
- 16.11.14 The population groups relevant to this assessment, due to either proximity or other sensitivity are (as defined in **Section 16.7**):
- The population near Bristol Airport (site-specific);
 - The population of North Somerset Unitary Authority (local);
 - Children and young people;
 - Older people;
 - People with existing poor health (physical and mental health); and
 - People living in deprivation, including those on low incomes.
- 16.11.15 The potential effect is considered likely because (see **Table 16.6**) there is a plausible source-pathway-receptor relationship:
- The source is surface access (road traffic) and aviation (ground noise and air noise);
 - The pathway is pressure waves through the air; and
 - Receptors are communities of people.
- 16.11.16 Furthermore, the potential effect is probable as no highly unusual conditions are required for the source-pathway-receptor linkage.
- 16.11.17 The magnitude of the change due to the Proposed Development is **small** (see Table). For air noise, ground noise and road traffic noise, **Chapter 7** sets out the changes due to the Proposed Development. Effects of the Proposed Development are modelled for 2026, with comparisons against the baseline (2017) and the expected effects of current permitted expansion (modelled for 2021 and/or 2026). The main measure of magnitude is the size of population exposed to noise levels (over a defined period) that: either represent the level above which adverse effects on health and quality of life can be detected (LOAEL); or the level above which significant adverse effects on health and quality of life occur (SOAEL). The values for these levels vary between day and night and between air noise, ground noise and road traffic noise as described in **Chapter 7**.
- 16.11.18 It is acknowledged that the 2026 'with development' (i.e. the Proposed Development) compared to the 2026 'without development' scenario (i.e. 10 mppa in 2026 whilst including similar benefits from aviation fleet modernisation) 'with development' scenario results in a larger population being adversely affected by noise. The greatest potential for population level changes to health, in terms of noise effects of sufficient extent and severity, relate to night-time air noise (exposure at or above the SOAEL for 100 more dwellings when comparing the 2026 'with development' and the 2026 'without development' scenarios). Whilst ground noise and road traffic noise are also associated with some exposures at or above the SOAEL, the extents are much smaller (i.e. far fewer dwellings are affected). For the LOAEL, the extents are larger (the largest being night-time air noise affecting 900 more dwellings when comparing the 2026 'with development' and the 2026 'without development' scenarios). However, these noise levels (having lower severity) would be expected to make a smaller contribution to any change in population health compared to levels at the SOAEL or above.

- 16.11.19 The conclusion on magnitude takes into account: the expected benefits from the existing air noise insulation scheme; expected air fleet modernisation over time (i.e. quieter planes); that the Proposed Development brings some benefits for ground noise through new structures providing noise screening; that one school (Winford Primary school) would continue to experience noise levels that could affect learning outcomes; and various amenity spaces (including playgrounds, parks and open spaces) would continue to experience similar levels of noise disturbance. Through the airport's community fund, BAL over the past two years has provided funding for two outdoor classrooms to support active health, learning and well-being at Winford Primary school. To further support such initiatives BAL has provided funding to introduce raised beds for flowers, fruit and vegetable plantations for children to use as part of their curriculum.
- 16.11.20 The sensitivity of the general population and for vulnerable groups (collectively as a single group) is set out below (see **Table 16.7**):
- Existing proximity to the baseline noise conditions of the airport and local road network suggests the general population may already have a degree of exposure to transport noise (including road and aviation) that may affect cardiovascular and annoyance outcomes, as well as being at times that may disturb sleep or reduce amenity. The sensitivity of the general population is considered to be **medium**. This reflects that existing noise stressors (from air noise, ground noise and road traffic noise) affect a wide area and the general population is likely to have heightened sensitivity to aviation noise as an issue.
 - The sensitivity of vulnerable groups is considered **high**. This reflects the presence of populations (residents or airport workers) who (while at work or at home) are likely to spend extended periods near to Bristol Airport, its flight-paths or parts of the local road network that are expected to experience additional vehicle movements. Vulnerability in this case is particularly linked to: living close to sources of noise (including attending schools affected by high noise levels); age (both young people and older people); existing poor health (e.g. long-term illness); spending more time in affected dwellings (e.g. 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, such as under night-time flight paths); or having strong views or high degrees of uncertainty about the Proposed Development (which may be associated with health effects even below thresholds that are generally considered acceptable).
- 16.11.21 The guide questions in **Table 16.9** have been used to consider the significance of the potential effect. The findings are shown below:
- The scientific literature summarised in **Appendix 16A** indicates evidence from sufficiently high-quality studies to support an association between noise disturbance due to the Proposed Development and health and wellbeing outcomes. The literature highlights cardiovascular effects, annoyance and sleep disturbance (and consequences arising from inadequate rest) as being the main pathways by which population health may be affected. The literature also notes the potential for chronic noise to have a detrimental effect on learning outcomes (e.g. noise distracting and affecting communication within classrooms). 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. 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. The assessment has had regard to the population groups identified in the literature that may be particularly sensitive;
 - The baseline considerations are as set out in paragraph 16.10.24 above in relation to construction noise effects. The noise environment at any given location in the immediate vicinity of Bristol Airport depends on its proximity to Bristol Airport and the A38. The A38 generates a consistent and steady noise around the area and is a contributor to the

background noise level. Superimposed on this are departing and arriving aircraft at Bristol Airport, along with noise from aircraft activity on the ground;

- The health priorities are as set out in paragraph 16.10.24 above in relation to construction noise effects, with the addition of: improving housing conditions; and delivering homes in sustainable locations (which could both include a consideration of proximity to noise sources, including flight-paths);
- The issues raised in consultation are as set out in paragraph 16.10.24 above in relation to construction noise effects, with the addition of: noise effects (including sleep disturbance) due to a redistribution of night-flights;
- Relevant regulatory standards summarised in **Appendix 16A**. Based on **Chapter 7**, noise assessment findings, with mitigation and control measures implemented, whilst the population near Bristol Airport may experience significant levels of daytime and night-time noise (due to existing noise issues and the permitted changes that would occur without the Proposed Development), the changes due to the Proposed Development are assessed as negligible and therefore not significant in EIA terms; and
- The health policy considerations are as set out in paragraph 16.10.24 above in relation to construction noise effects.

16.11.22 The conclusion of the assessment for human health is that the significance of the effect would be **negligible** for the general population and up to **minor adverse (not significant)** in EIA terms) for vulnerable groups (described above in relation to sensitivity). The conclusion reflects that whilst a low magnitude of change is expected due to the Proposed Development (compared to the future baseline position), the effects would be experienced across a wide area. The small increase in exposure for much of the local population is unlikely to result in a significant population health effect (i.e. not a moderate or high significance score), but equally should not be seen as a negligible effect for those groups more vulnerable to the effects of noise. The operational noise effects should be considered long-term, making an incremental addition to population risk factors for sleep disturbance, cardiovascular outcomes and learning outcomes (at one school). It is noted that the baseline conditions are likely to already be resulting in such influences on health outcomes. In population health terms the change due to the Proposed Development is unlikely to be discernible.

Travel

Operation airport related road traffic

- 16.11.23 Refer to **Chapter 6: Traffic and transport** for the conclusions of the transport assessment and for the embedded mitigation measures, specifically **Table 6.12**, taken into consideration during this assessment of effects on human health.
- 16.11.24 This section assesses 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.
- 16.11.25 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 (e.g. cardiovascular health) and mental health conditions (e.g. stress, anxiety or depression) associated with obesity and levels of physical activity.

- 16.11.26 The population groups relevant to this assessment, due to either proximity or other sensitivity are (as defined in **Section 16.7**):
- The population near Bristol Airport (site-specific) (including relevant stretches of the local road network described in **Chapter 6: Traffic and Transport**, e.g. the A38, West Lane and Downside Road);
 - The population of North Somerset Unitary Authority (local) (including relevant stretches of the wider road network described in **Chapter 6: Traffic and Transport**, e.g. A4174, A370 and A368);
 - Children and young people (as potentially more vulnerable road users);
 - Older people (as potentially more vulnerable road users);
 - People with existing poor health (physical and mental health) (in relation to health trip journey times); and
 - People living in deprivation, including those on low incomes.
- 16.11.27 The potential effect is considered likely because (refer to **Table 16.6**) there is a plausible source-pathway-receptor relationship:
- The source is vehicles on the road network or changes in routes that link community residential, commercial or amenity services;
 - The pathway is changes in road safety, community severance, journey times or levels of intimidation of other road users. This links with physical activity and active travel. It also links with emergency response times; and
 - Receptors are local road users, including those using motor vehicles as well as pedestrians and cyclists, as well as emergency services using the highway network.
- 16.11.28 Furthermore, the potential effect is probable as no highly unusual conditions are required for the source-pathway-receptor linkage.
- 16.11.29 The magnitude of the change due to the Proposed Development is **medium** (refer to **Table**). This reflects the highway improvements, particularly in relation to the availability of shared pedestrian and cycle routes along sections of the A38 that promote active travel and provide appropriate links with the airport, including to NCR 410 that crosses the A38 at West Lane. The junction improvements on the A38, including crossing facilities for pedestrians and cyclists, are likely to make a modest improvement to road safety. These infrastructure improvements are permanent and likely to make a modest but beneficial contribution to health outcomes associated with physical activity.
- 16.11.30 It is noted that the A38 (North of West Lane) is expected to experience total traffic flows that may disincentive pedestrians and cyclists. This partially reflects the baseline high traffic flows. The improvements to provide a permanent widened shared footway/cycleway on the A38 between the north Bristol Airport junction and West Lane is considered a positive measure that is likely to mitigate any widespread change in active travel behaviour by the local community, e.g. in using this short stretch along the A38 to access the network of footpaths on Felton Common.
- 16.11.31 The sensitivity of the general population and for vulnerable groups (collectively as a single group) is set out below (refer to **Table 16.7**):
- The sensitivity of the general population is considered to be **low**. This reflects that most people in the North Somerset would only make occasional use of the affected section of the road network. It also reflects the ability to adapt to changes in traffic conditions. Many health-related

journeys (emergency or non-emergency) would at off-peak times (i.e. outside the times when the Proposed Development may contribute to existing delays at peak travel times).

- The sensitivity of vulnerable groups is considered **high**. Vulnerability in this case is linked to mode of travel, e.g. pedestrians and cyclists; age (young people and older people); frequent use of services accessed on affected sections of the highway network (e.g. traveling to schools); and deprivation. Deprived populations may already face more access barriers than the general population and therefore be more sensitive to access changes. Vulnerability also includes those accessing health services (emergency or non-emergency) at times and locations where there may be some increase in congestion. Ambulance services (and the recipients of their care) are particularly sensitive to delays in response times.

16.11.32 The considerations on scientific literature, baseline, health priorities, consultation and health policy (summarising relevant evidence from **Appendix 16A**), which inform the professional judgement reached, are as set out in paragraph 16.10.34 in relation to construction travel effects.

16.11.33 The conclusion of the assessment for human health is that the significance of the effect would be **negligible** for the general population and up to **minor beneficial (not significant in EIA terms)** for vulnerable groups (described above in relation to sensitivity). The beneficial effects relate to improvements in transport infrastructure, including pedestrian and cycle ways, which would be expected to improve road safety, encourage active travel and avoid significant adverse effects on journey times (including health-related journeys). These changes would be expected to make a long-term incremental benefit to population health.

Economic effects

16.11.34 Refer to **Chapter 15: Socio-economics** for the conclusions of the economic assessment and for the embedded mitigation measures, taken into consideration during this assessment of effects on human health.

16.11.35 This section assesses changes in direct and indirect employment and local/regional economy opportunities for community residents and the wider population.

16.11.36 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, e.g. eating a healthier diet and undertaking more physical activity. If members of the community are employed, this can also generate indirect economic activity.

16.11.37 The population groups relevant to this assessment, due to either proximity or other sensitivity are (as defined in **Section 16.7**):

- The population near Bristol Airport (site-specific);
- The population of North Somerset Unitary Authority (local);
- The population of South West England and South East Wales (regional);
- Children and young people;
- Older people;
- People with existing poor health (physical and mental health); and
- People living in deprivation, including those on low incomes.

16.11.38 The potential effect is considered likely because (refer to **Table 16.6**) there is a plausible source-pathway-receptor relationship:

- The source is direct and indirect job creation;
- The pathway is through good quality employment providing more health supporting resources; and
- The receptor is people of working age (and their dependants).

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

16.11.40 The magnitude of the change due to the Proposed Development is **medium** (refer to **Table 16.8**). The Proposed Development is expected to result in economic benefits and additional jobs (as described in **Chapter 2: Description of the Proposed Development** and **Chapter 15: Socio-economics**). The jobs are expected to be filled by existing residents (rather than an influx of new residents taking up these roles). The effects are expected to be greatest at the local level (North Somerset), but also extend to the regional level (South West England and South East Wales). New permanent roles are considered to have the potential for long-term health benefits through good employment opportunities. Benefits could include reducing levels of poverty and inequalities, as well as facilitating healthier decision-making behaviours through additional household resources (affecting risk factors for health and well-being, as well as quality of life for both those employed and their dependants).

16.11.41 The sensitivity of the general population and for vulnerable groups (collectively as a single group) is set out below (refer to **Table 16.7**):

- The sensitivity of the general population is considered to be **low**. This reflects that the majority of people would already be within stable employment that would be unaffected by the Proposed Development (or being a dependant of such a person); and
- The sensitivity of vulnerable groups is considered **high**. The health of vulnerable groups is particularly sensitive to employment. Vulnerability in this case relates to people and their dependants who are on low incomes or who are unemployed. Young people, including leaving education or early in their careers may have the most to gain from an increase in good quality job opportunities. Future young or older people may also come to rely on those employed.

16.11.42 The guide questions in **Table 16.9** have been used to consider the significance of the potential effect. The findings are shown below:

- The scientific literature summarised in **Appendix 16A** indicates evidence from sufficiently high-quality studies to support an association between employment opportunities due to the Proposed Development and health and wellbeing outcomes. The literature does not identify particular thresholds for effects. The assessment has had regard to the population groups identified in the literature that may be particularly sensitive;
- The baseline summarised in **Appendix 16A** indicates that relevant sensitivities and inequalities identified in the scientific literature may be present. It also shows where relevant baseline indicators differ from their local, regional or national comparators. The baseline does not identify any geographic or population features that suggest effects could be unusually amplified;
- The health priorities summarised in **Appendix 16A** indicates that relevant priorities have been set that link with economic effects as a determinant of health, including: enabling children and young people to thrive, develop skills and achieve their full potential; promoting opportunities for young people at risk of long-term unemployment; and developing a prosperous economy and enterprising community;

- The consultation (on the Scoping Report (**Appendix 1A**)) summarised in **Appendix 16A** did not raise this issue in relation to health outcomes; and
- The health policy context (of NSC) summarised in **Appendix 16A** raises the following expectations in relation to economic effects: an employment-led approach to achieve a more sustainable alignment between jobs and the economically active population.

16.11.43 The conclusion of the assessment for human health is that the significance of the effect would be up to **minor beneficial** for the general population and up to **moderate beneficial (significant in EIA terms)** for vulnerable groups (described above in relation to sensitivity). The provision of long-term good quality employment opportunities (directly at Bristol Airport, or indirectly through wider economic investment within the region facilitated by the expansion) should be considered likely to have a long-term beneficial effect on population health.

Community identity

Operational contribution to local identity

16.11.44 Refer to **Chapter 15: Socio-economics** and **Chapter 9: Landscape and Visual** for the conclusions of the economic and landscape assessments and for the embedded mitigation measures, specifically **Table 9.8**, taken into consideration during this assessment of effects on human health.

16.11.45 This section assesses changes in community identity for community residents due the expanded airport having a greater influence on the local environmental and economic landscape, as well as the potential for changes to non-permanent population associated with increased travel opportunities. Change in the permanent population are not expected as described in **Chapter 15: Socio-economics**.

16.11.46 Health effects may be associated with mental health conditions (e.g. stress, anxiety or depression) due to underlying social determinants influencing community cohesion.

16.11.47 The population groups relevant to this assessment, due to either proximity or other sensitivity are (as defined in **Section 16.7**):

- The population near Bristol Airport (site-specific);
- Children and young people;
- Older people;
- People with existing poor health (physical and mental health); and
- People living in deprivation, including those on low incomes.

16.11.48 The potential effect is considered likely because (refer to **Table 16.6**) there is a plausible source-pathway-receptor relationship:

- The source is environmental change due to land take and new structures and social change due to greater numbers of airport passengers and visitors staying temporarily in the area;
- The pathway is cues, visual or auditory, that contribute to behaviour and a sense of identity, as well as a greater proportion of social interactions being conducted with a non-resident population; and
- Receptors are communities in the site-specific population.

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

- 16.11.50 The magnitude of the change due to the Proposed Development is **medium** (refer to **Table**). This reflects the influence of the Proposed Development in terms of permanently increasing:
- Visual change, including airport structures and more flights;
 - Economic benefits through investment and jobs; and
 - Social and societal benefits in terms of the airport as a location and resource for people from across geographic, cultural and socio-economic sections of society.
- 16.11.51 The sensitivity of the general population and for vulnerable groups (collectively as a single group) is set out below (refer to **Table 16.7**):
- The sensitivity of the general population is considered to be **medium**. This reflects that for the majority of people near to Bristol Airport, the airport is a prominent feature of the natural, cultural and economic landscape, on account of its visibility, the employment opportunities it provides as well as the access to national and international travel. The general population are therefore likely to have an interest in, and awareness of, the Proposed Development; and
 - The sensitivity of vulnerable groups is considered **high**. Vulnerability in this case is particularly linked to the proportion of people who have expectations that their community or way of life would be changed to a large degree by the Proposed Development. People living in homes with direct views of Bristol Airport or under flight paths close to the airport may be particularly sensitive.
- 16.11.52 The considerations on scientific literature, baseline, health priorities, consultation and health policy (summarising relevant evidence from **Appendix 16A**) are set out in paragraph 16.10.43 above in relation to construction community identity effects.
- 16.11.53 The conclusion of the assessment for human health is that the significance of the effect would range from **minor adverse (not significant)** in EIA terms), through to **negligible** and up to **moderate beneficial** for both the general population and vulnerable groups (described above in relation to sensitivity). The operational changes to views and the increased influence of Bristol Airport on the identity of surrounding communities should be considered long-term effects. The inclusion of both adverse and beneficial scores reflects that the population response would be highly subjective and is likely to encompass a range of views. Some people may focus on the economic and travel benefits of being close to an expanded airport. Other people may focus on the reduction (even though it is mitigated) in environmental amenity inherent to expansion. The scores reflect that the changes are within the context of an existing airport, rather than the development of a new airport in an area unfamiliar with aviation activity.

Healthcare services

- 16.11.54 This section assesses changes in health service demand associated with a non-permanent UK population in the area affecting demand on the local NHS. This may include some staff, passengers and airport visitors (e.g. dropping off or collecting passengers) who are not usually resident in the area.
- 16.11.55 The assessment excludes consideration of communicable illness transmission and health tourism, which were issues scoped out in the Scoping Report (**Appendix 1A**). In relation to communicable illness, BAL have Port Health Incidence Procedures in place, which are reviewed on an annual basis. BAL receive information from the WHO and work with PHE and NSC to ensure arrangements are unified and in line with any current risks. This would continue to be the case under the Proposed Development.

- 16.11.56 The key health outcomes (linked to unplanned need for NHS attendance whilst at (or travelling to or from) Bristol Airport) relate to the direct effect on quality of NHS services and the indirect effect any change may have on early diagnosis, treatment outcomes and preventative measures.
- 16.11.57 The population groups relevant to this assessment, due to either proximity or other sensitivity are (as defined in **Section 16.7**):
- The population near Bristol Airport (site-specific) (in relation to primary care);
 - The population of North Somerset Unitary Authority (local) (in relation to secondary care);
 - Children and young people;
 - Older people; and
 - People with existing poor health (physical and mental health).
- 16.11.58 The potential effect is considered likely because (refer **Table 16.6**) there is a plausible source-pathway-receptor relationship:
- Source relates to changes in demand for medical and healthcare facilities (e.g. GP, A&E or ambulance services) as a result of unplanned need for NHS attendance whilst at (or travelling to or from) Bristol Airport;
 - The pathway is a change in capacity, staffing and resources of the local NHS; and
 - Receptors are local community populations accessing these services or facilities. This may include healthcare staff should they experience resource pressures.
- 16.11.59 Furthermore, the potential effect is probable as no highly unusual conditions are required for the source-pathway-receptor linkage.
- 16.11.60 The magnitude of the change due to the Proposed Development is **small** (refer to **Table**). Any use of NHS services (above that already accounted for within routine NHS service planning) would relate to the small proportion of staff, passengers and airport visitors who fall ill (or are injured) at the airport, or whilst travelling to or from it. The majority of such service use is likely to relate to accessing the nearest GP or A&E unit (including transport by ambulance). The discussion therefore focuses on these healthcare services. The following bullets discuss considerations in relation to Bristol Airport's passengers and visitors and then BAL staff.
- The Proposed Development would result in a two mppa increase in capacity at Bristol Airport. The proportion of these additional passengers (and airport visitors) who may make use of local NHS services whilst at (or travelling to or from) Bristol Airport is likely to be low. There is no requirement for NHS and Bristol Airport protocols to record the numbers of people (passengers or visitors) who have unplanned need for GP services whilst at (or travelling to or from) Bristol Airport. Such service use is therefore not well documented. The NHS allows that if a person falls ill while away from home they can still contact the nearest GP surgery for treatment. A person can receive emergency treatment for 14 days on this basis, after which they will have to register as a temporary resident or permanent patient⁵⁴. It is considered unlikely that many non-local passengers or visitors to Bristol Airport would remain in the area long enough to formally register with a local GP as a temporary resident. Any effect is therefore likely to relate to a small proportion of demand for GP emergency appointments by non-registered patients. This also reflects the potential for a small increase in demand for fitness to

⁵⁴ NHS (2016). Using the NHS website, [online]. Available at: <https://www.nhs.uk/using-the-nhs/nhs-services/gps/how-to-register-with-a-gp-practice/> [Checked 15/11/18]

fly assessments by a local GP if such assessments are requested by the airline once the passenger is already at the airport⁵⁵;

- Similarly, A&E and ambulance services use is not documented in relation people who require such services whilst at (or travelling to or from) Bristol Airport. Whilst such services would record name, address and reason for attendance, such data would not be routinely analysed, anonymised and published in a way that would allow associations with Bristol Airport to be identified;
- It is noted that the catchment area of Bristol Airport (for passengers and visitors) and the catchment areas of Bristol Royal Infirmary (for A&E attendance) and South Western Ambulance Service NHS Trust (for ambulance callouts) are likely to have a large overlap. A reasonable proportion of A&E attendances and ambulance callouts associated with Bristol Airport would therefore be likely to be for a resident population who would already be factored into routine NHS service planning;
- It is also noted that Bristol Airport (and any NHS service use associated with it) is an existing part of the context in which current NHS routine service planning occurs. The Proposed Development would be an extension to an existing service planning consideration (even if a general unspecified but acknowledge demand) rather than a new factor to be taken into account;
- The timescales of the Proposed Development (up to 2026) provide opportunity for NHS service planning to anticipate any increase in demand that may be associated with people at (or travelling to or from) Bristol Airport;
- Any increase in demand for local NHS services associated with the increase in BAL staff is expected to be negligible. This reflects that most staff are resident in the local area, so would access their usual NHS services (such demand would be expected and managed within routine NHS service planning). In terms of existing protocols, if a member of BAL staff falls ill whilst at work, then BAL go through the normal channels of contacting the NHS (telephone services using 111 or 999). If a BAL employee is asked to attend primary care, then they use their own registered GP. BAL has a Health and Wellbeing policy for employees. This policy sits alongside policies on Absence Management, Dignity at Work, Equal Opportunities, Alcohol and Substance Misuse, Flexible Working and Health and Safety. The Health and Wellbeing policy prompts good health, includes measures to avoid poor health and provides relevant support, including a confidential counselling service for staff whose wellbeing is affected by either work or external factors. Use of these protocols and policies would continue under the Proposed Development; and
- Overall, for NHS GP, A&E and ambulance services, any increase is likely to be proportionate to the existing (though unquantified) level of unplanned NHS usage by passengers and visitors to the airport. A qualitative assessment suggests that the level of change is likely to be small. This reflects: a 20% increase to what is expected to be a low level of usage of local NHS services; by Bristol Airport users; who are not already factored into routine NHS service planning due to residence or general unspecified but acknowledge demand above that based on the resident population or patient list size. The great majority of unspecified but acknowledged demand is likely to relate to unplanned NHS local service use by a non-permanent population in the area for business, education or leisure unrelated to Bristol Airport.

⁵⁵ For example relating to advice by the Civil Aviation Authority, <https://www.caa.co.uk/Passengers/Before-you-fly/Am-I-fit-to-fly-/> or airline medical advisory services such as the British Airways Medical Service, <https://www.britishairways.com/en-gb/information/travel-assistance/medical-conditions-and-pregnancy> [Checked 15/11/18].

16.11.61 The sensitivity of the general population and for vulnerable groups (collectively as a single group) is set out below (refer to **Table 16.7**):

- The sensitivity of the general population is considered to be **medium**. The NHS provides essential care to people across North Somerset. The closest medical facility to Bristol Airport is the Backwell Medical Centre in Backwell, approximately 4km north west of Bristol Airport. There are 15 other GP surgeries within a 10km radius of Bristol Airport, while the South Bristol NHS Community Hospital is approximately 10km to the north east of Bristol Airport. It is a relatively new hospital (opened in 2012) and allows more streamlined diagnosis and treatment for South Bristol. The closest accident and emergency facility is Bristol Royal Infirmary, 12km to the north east of Bristol Airport. This is a 24-hour facility that offers emergency services and has numerous other medical departments.
- The sensitivity of vulnerable groups is considered **high**. This reflects the presence of populations who require regular health care (e.g. older people with multiple long-term conditions). Insufficiently resourced health professionals should also be considered to have high sensitivity. The Bristol, North Somerset and South Gloucestershire Clinical Commissioning Groups face challenges (see **Appendix 16A**) which are likely to increase the sensitivity of any additional pressures on their services or resources.

16.11.62 The guide questions in **Table 16.9** have been used to consider the significance of the potential effect. The findings are shown below:

- The scientific literature summarised in **Appendix 16A** indicates evidence from sufficiently high-quality studies to support an association between the potential for a change in demand for NHS services due to the Proposed Development and health and wellbeing outcomes, including for staff and patients. The literature does not identify particular thresholds for effects. The assessment has had regard to the population groups identified in the literature that may be particularly sensitive;
- The baseline summarised in **Appendix 16A** indicates that relevant sensitivities and inequalities identified in the scientific literature may be present. It also shows where relevant baseline indicators differ from their local, regional or national comparators. The baseline does not identify any geographic or population features that suggest effects could be unusually amplified;
- The health priorities summarised in **Appendix 16A** indicates that relevant priorities have been set that link with health services as a determinant of health, including: improving population mental health and well-being; providing high quality mental health services that are widely accessible; enabling people to maintain independence, live longer, good quality lives, with access to appropriate care and support when needed; making appropriate and timely referrals; ensuring healthcare services are resilient; and avoiding long waits for emergency care;
- The consultation (on the Scoping Report (**Appendix 1A**)) summarised in **Appendix 16A** did not raise the issue of existing or future use of NHS services or local population health outcomes; and
- The health policy context (of NSC) summarised in **Appendix 16A** raises the following expectations in relation to health services: ensuring that major development proposals are delivered in tandem with the necessary improvements in physical and social infrastructure including healthcare facilities; and developments should be supported where they increase and improve health services.

16.11.63 The conclusion of the assessment for human health is that the significance of the effect would be **negligible** for the general population and **minor adverse (significant in EIA terms)** for vulnerable groups (described above in relation to sensitivity). The conclusion reflects the existing strain that

local NHS services are under (refer to discussion of the Bristol, North Somerset and South Gloucestershire Clinical Commissioning Group (CCG) in **Appendix 16A**).

- 16.11.64 The expectation is that with appropriate service planning local NHS services would be in a position to accommodate an increase in unplanned attendances by people not registered with a local GP (i.e. passengers or visitors passing through Bristol Airport and needing NHS services). Such attendance at GP surgeries by unregistered patients is normal.
- 16.11.65 Mitigation in the form of information collection and sharing is proposed to facilitate building the appropriate level of capacity ahead of the anticipated increase in demand (rather than retrospectively).

Climate change

- 16.11.66 Refer to **Chapter 17: Carbon and other Greenhouse Gases** for the conclusions of the economic assessment and for the embedded mitigation measures, specifically **Table 17.7**, taken into consideration during this assessment of effects on human health.
- 16.11.67 This section assesses changes in climate altering pollutants (which include GHG) due to the Proposed Development and the effect these may have on human health (globally). This section focuses on operational emissions, which are the main contribution to climate altering pollutants due to the Proposed Development.
- 16.11.68 There are important global inequalities in the effects of climate change, with the greatest adverse effects on health expected in the some of the poorest and least economically developed populations. In contrast, populations that benefit from rapid social and economic development are expected to experience reduced (but not eliminated) adverse effects to health from climate change. Changes in health outcomes related to climate change are therefore expected to be relatively small in the UK. When considering health and well-being, there is a global responsibility to reduce the effect of climate-altering pollutants that are expected to reduce health outcomes in low- and middle-income countries. The Intergovernmental Panel on Climate Change states that there are opportunities to achieve co-benefits from actions that reduce emissions of climate altering pollutants and at the same time improve health⁵⁶.
- 16.11.69 Key health outcomes (globally) relate to heat-related disorders (e.g. heat stress and lower work capacity), respiratory disorders (e.g. worsened asthma), infectious diseases, food insecurity (e.g. lower crop yields) and mental stress associated with natural disasters.
- 16.11.70 The population groups relevant to this assessment, due to either proximity or other sensitivity are (as defined in **Section 16.7**):
- The population of England and Wales (and beyond for international travel) (national and international);
 - Children and young people;
 - Older people;
 - People with existing poor health (physical and mental health); and
 - People living in deprivation, including those on low incomes.

⁵⁶ Smith, K. R. *et al.* (2014) *Human health: impacts, adaptation, and co-benefits* in Climate Change 2014: Impacts, Adaptation, and Vulnerability. Part A: Global and Sectoral Aspects. Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel of Climate Change (eds V.R. Barros *et al.*) Ch. 11, 709-754 (Cambridge University Press).

- 16.11.71 The potential effect is considered likely because (refer to **Table 16.6**) there is a plausible source-pathway-receptor relationship:
- Source: transport (including embodied energy, fuel and waste management) contributes to climate-altering pollutants, notably carbon dioxide. Aviation and surface access related road transport are both climate-altering pollutant sources;
 - Pathway: climate-altering pollutants contribute to climate change, which is associated with global changes in temperature, crop yields, productivity and disease prevalence; and
 - Receptor: international global population, particularly deprived populations in low- and middle-income countries.
- 16.11.72 Furthermore, the potential effect is probable as no highly unusual conditions are required for the source-pathway-receptor linkage.
- 16.11.73 The magnitude of the change due to the Proposed Development is **small** (refer to **Table 16.8**). This acknowledges that the change due to the Proposed Development would be very small within the national emission context. The score also reflects that the Proposed Development would make a small but irreversible contribution to a determinant of health that has global reach and potentially widens health inequalities. This type of health effect is relatively common in major infrastructure projects. Whilst it is appropriate to acknowledge the potential impact, it is also appropriate to note that as an issue, climate change is being addressed through international cooperation, with emissions targets and strategies set at the national level not the individual project level.
- 16.11.74 The sensitivity of the general population and for vulnerable groups (collectively as a single group) is set out below (refer to **Table 16.7**):
- The sensitivity of the general population is considered to be **low**. This reflects that the UK is a developed economy and has comparatively high resilience and capacity to adapt, so in general the UK population can be considered to be of low sensitivity.
 - The sensitivity of vulnerable groups is considered **high**. This reflects that the adverse effects would fall most heavily on the poorest and most vulnerable members and regions of society (globally), including older people, children and low-income families. Disproportionate effect on the most disadvantaged in society are likely to widen health inequalities. Although people in the UK are generally less vulnerable, as they are able to get support to cope with the effects of climate change, some may still be at greater risk (e.g. low incomes or age making it harder to cope with heatwaves or flooding).
- 16.11.75 The guide questions in **Table 16.9** have been used to consider the significance of the potential effect. The findings are shown below:
- The scientific literature summarised in **Appendix 16A** indicates evidence from sufficiently high-quality studies to support an association between the contribution to climate change from the change in climate altering pollutants due to the Proposed Development and health and wellbeing outcomes. The literature does not identify particular thresholds for effects. The assessment has had regard to the population groups identified in the literature that may be particularly sensitive;
 - The health priorities summarised in **Appendix 16A** indicates that relevant priorities have been set that link with climate change as a determinant of health, including living within environmental limits; ensuring new developments are low carbon; helping reduce the carbon footprint of businesses; tackling and adapting to climate change; and better travel planning;
 - Themes of consultation (on the Scoping Report (**Appendix 1A**)) summarised in **Appendix 16A** did not raise this issue in relation to health outcomes; and

- The health policy context (of NSC) summarised in **Appendix 16A** raises the following expectations in relation to climate change: reducing carbon emissions and tackling climate change, mitigating further impacts and supporting adaptation to its effects.

16.11.76

The conclusion of the assessment for human health is that the significance of the effect would be **negligible** for the general population and **minor adverse (not significant)** in EIA terms) for vulnerable groups (described above in relation to sensitivity). The operational contribution by the Proposed Development to climate altering pollutants should be considered long-term, making an incremental addition to climate change related risk factors for population health (globally).

16.12 Summary of effects

Table 16.10 Summary of significance of adverse effects

Health issues and population groups	Sensitivity of population ¹	Magnitude of change ²	Significance ³	Summary rationale
Construction – Air quality				
General population	Low	Small	Negligible	The health effects from construction dust have been considered based on the findings, analysis and embedded mitigation presented in Chapter 8: Air Quality . For construction dusts the main health outcomes are likely to relate to exacerbation of existing conditions, such as asthma or COPD and to reductions in wellbeing associated with annoyance or reduced amenity. Overall there is limited potential for dust related nuisance or health effects. Occasionally, weather conditions may coincide with construction activities to generate higher levels of dust that could cause temporary annoyance and could exacerbate some conditions (e.g. asthma). The change associated with construction activities would be short-term, temporary and would cease on completion of the works.
Vulnerable groups	High	Small	Up to minor adverse	
Construction – Noise				
General population	Low	Small	Negligible	The health effects from construction noise have been considered based on the findings, analysis and embedded mitigation presented in Chapter 7: Noise and Vibration . For noise the main health outcomes are cardiovascular health, mental health conditions (e.g. stress, anxiety or depression), sleep disturbance and cognitive performance in children. Overall the predicted increases in construction noise levels are relatively localised and, in most cases, close to background noise levels. Mitigation is described for the locations where higher levels of noise are predicted, though some change may be discernible due to differing noise characteristics. The change associated with construction activities would be short-term, temporary and would cease on completion of the works.
Vulnerable groups	High	Small	Up to minor adverse	
Construction – Traffic effects				
General population	Low	Small	Negligible	The health effects from construction traffic have been considered based on the findings, analysis and embedded mitigation presented in Chapter 6: Traffic and Transport . For traffic effects the main health outcomes are road traffic incidents, emergency response times, journey times, physical health (e.g. cardiovascular health), mental health (e.g. stress, anxiety or depression), obesity and levels of physical activity. During construction the increase in vehicle movements would be small and any delay is characterised as localised, temporary and minor. The potential for changes in road safety, active travel or health related journeys is therefore considered limited. The priority given to ambulances travelling under blue lights would be expected to reduce any changes in response times. The change associated with construction activities would be short-term, temporary and would cease on completion of the works.
Vulnerable groups	High	Small	Up to minor adverse	
Construction –				The health effects from construction activities and changes in land use have been considered based on the findings, analysis and embedded mitigation presented in Chapter 9: Landscape and Visual . For community identity effects the

Health issues and population groups	Sensitivity of population ¹	Magnitude of change ²	Significance ³	Summary rationale
Community identity General population Vulnerable groups	Low High	Small Small	Negligible Up to minor adverse	<p>main health outcomes are associated with mental health conditions (e.g. stress, anxiety or depression) due to underlying social determinants influencing community cohesion. Bristol Airport would be a prominent feature of the landscape before, during and on completion of construction activities. Whilst there would be some pronounced and localised effects, construction of the Proposed Development is: neither likely to change community identity to an extent that would have discernible effects on population health; nor likely to result in disturbance at a level that would impede formal or informal community social gatherings. The change associated with construction activities would be short-term, temporary and would cease on completion of the works. Land changes and new structures would be permanent.</p>
Operation – Air quality General population Vulnerable groups	Low High	Medium Medium	Negligible Up to minor adverse	<p>The health effects from operational air quality have been considered based on the findings, analysis and embedded mitigation presented in Chapter 8: Air Quality. For operational air emissions the main health outcomes are increased risk of cardiovascular and respiratory related conditions or events, as well as general measures of population mortality and hospital service use. Changes in concentrations of all modelled air pollutants are within statutory levels considered acceptable in terms of health protection. In the case of NO₂ the increase for a small area may contribute to a small change in health outcomes, but this change is largely due to the existing baseline conditions and would be unlikely to be a discernible change in population health. This type of health effect is relatively common in urban areas where major transport infrastructure and communities exist in close proximity. The operational air quality effects should be considered long-term, making an incremental addition to air quality related risk factors for population health.</p>
Operation – Noise General population Vulnerable groups	Medium High	Small Small	Negligible Up to minor adverse	<p>The health effects from operational noise have been considered based on the findings, analysis and embedded mitigation presented in Chapter 7: Noise and Vibration. For noise the main health outcomes are cardiovascular health, mental health conditions (e.g. stress, anxiety or depression), sleep disturbance and cognitive performance in children. The Proposed Development results in a larger population being adversely affected by noise, mainly due to increased night-time noise from airborne aircraft. In the context of existing significant levels of daytime and night-time noise (due to existing noise issues and the permitted changes that would occur without the Proposed Development), the changes due to the Proposed Development are small. In population health terms the change due to the Proposed Development is unlikely to be discernible. The operational noise effects should be considered long-term, making an incremental addition to population risk factors for sleep disturbance, cardiovascular outcomes and learning outcomes.</p>
Operation – Community identity General population Vulnerable groups	Medium High	Medium Medium	From minor adverse up to moderate beneficial	<p>The health effects from operational community identity have been considered based on the findings, analysis and embedded mitigation presented in Chapter 9: Landscape and Visual and Chapter 15: Socio-economics. For community identity effects the main health outcomes are associated with mental health conditions (e.g. stress, anxiety or depression) due to underlying social determinants influencing community cohesion. The expansion of Bristol Airport would be in the context of a population already accustomed to airport and aviation activity. For the majority of people near to Bristol Airport, the airport is already a prominent feature of the natural, cultural and economic landscape,</p>

Health issues and population groups	Sensitivity of population ¹	Magnitude of change ²	Significance ³	Summary rationale
			From minor adverse up to moderate beneficial	including through views, employment and ease of access to national and international travel. The inclusion of both adverse and beneficial scores reflects that the population response would be highly subjective and is likely to encompass a range of views. Some people may focus on the economic and travel benefits of being close to an expanded airport. Other people may focus on the reduction (even though it is mitigated) in environmental amenity inherent to expansion. The operational changes to views and the increased influence of Bristol Airport on the identity of surrounding communities should be considered long-term effects.
Operation – Healthcare services				
General population	Medium	Small	Negligible	The health effects from operational healthcare service use relate to potential changes in unplanned need for NHS attendance whilst at (or travelling to or from) Bristol Airport. For changes in use of healthcare services the main health outcomes are direct effects to the quality of NHS services and indirect effects to early diagnosis, treatment outcomes and preventative measures. Use of NHS services (above that already accounted for within routine NHS service planning) would relate to the very small proportion of Bristol Airport staff, passengers and airport visitors. Any effect is likely to relate to a small demand for GP emergency appointments by non-registered patients, or attendance at A&E (including transport by ambulance). GP attendance may include the potential for a small increase in demand for 'fitness to fly' assessments where such assessments are requested by the airline once the passenger is already at the airport. Most staff and many passengers/visitors are likely to be within existing catchment areas for routine healthcare service planning. For other passengers/visitors, Bristol Airport (and any NHS service use associated with it) is an existing part of the context in which current NHS routine service planning occurs (where the airport is a small part of general unspecified but acknowledge demand above that based on the resident population or patient list size). The timescales of the Proposed Development (up to 2026) provide ample opportunity for NHS service planning. It is not for BAL to provide funding for the NHS, however BAL can support the local NHS in understanding how any change in service demand can be appropriately planned for. The expectation is that with appropriate service planning local NHS services would be in a position to accommodate any increase in demand.
Vulnerable groups	High	Small	Up to minor adverse	
Operation – Climate change				
General population	Low	Small	Negligible	The health effects from operational contributions to climate change have been considered based on the findings, analysis and embedded mitigation presented in Chapter 17: Carbon and Other GHGs . For climate change the main health outcomes (globally) are heat-related disorders, respiratory disorders, infectious diseases, food insecurity and mental stress associated with natural disasters. Adverse effects fall most heavily on the poorest and most vulnerable members and regions of society (globally). The change due to the Proposed Development would be very small within the national emission context. Whilst it is appropriate to acknowledge the potential impact, it is also appropriate to note that as an issue, climate change is being addressed through international cooperation, with emissions targets and strategies set at the national level not the individual project level. The operational contribution by the Proposed Development to climate altering pollutants should be considered long-term, making an incremental addition to climate change related risk factors for population health (globally).
Vulnerable groups	High	Small	Up to minor adverse	

Table 16.11 Summary of significance of beneficial effects

Health issues and population groups	Sensitivity of population ¹	Magnitude of change ²	Significance ³	Summary rationale
Operation – Traffic effects				
General population	Low	Medium	Negligible	The health effects from operational traffic have been considered based on the findings, analysis and embedded mitigation presented in Chapter 6: Traffic and Transport . For traffic effects the main health outcomes are road traffic incidents, emergency response times, journey times, physical health (e.g. cardiovascular health), mental health (e.g. stress, anxiety or depression), obesity and levels of physical activity. During operation a number of permanent infrastructure improvements are likely to make a modest but beneficial contribution to health outcomes associated with road safety, encouraging active travel and avoiding significant adverse effects on journey times (including health-related journeys). These include: the shared pedestrian and cycle routes along sections of the A38; junction improvements on the A38, including crossing facilities for pedestrians and cyclists. These changes would be expected to make a long-term incremental benefit to population health.
Vulnerable groups	High	Medium	Up to minor beneficial	
Operation – Economic effects				
General population	Low	Medium	Up to minor beneficial	The health effects from operational economic effects have been considered based on the findings, analysis and embedded mitigation presented in Chapter 15: Socio-economics . For employment effects the main health outcomes relate to making health-promoting resources available to the employee and any dependants. This may improve living conditions and supports making healthier choices, e.g. eating a healthier diet and undertaking more physical activity. The provision of long-term good quality employment opportunities (directly at Bristol Airport, or indirectly through wider economic investment within the region facilitated by the expansion) are likely to have a long-term beneficial effect on population health locally and, to a lesser extent, regionally. Such benefits could include reducing levels of poverty and inequalities.
Vulnerable groups	High	Medium	Up to moderate beneficial	
Operation – Community identity				
General population	Medium	Medium	From minor adverse up to moderate beneficial	See discussion of this issue (including potential for beneficial effects) in Table .
Vulnerable groups	High	Medium	From minor adverse up to moderate beneficial	

1. The sensitivity of a population is defined using the criteria set out in **Section 16.9** above and is defined as low, medium and high.
2. The magnitude of change on a population resulting from activities relating to the development is defined using the criteria set out in **Section 16.9** above and is defined as small, medium and large.

3. The significance of the environmental effects is based on the combination of the sensitivity and the magnitude of change, as well as a consideration of guide questions and is expressed as major (significant), moderate (probably significant) or minor/negligible (not significant), subject to the evaluation methodology outlined in **Section 16.9**.

16.13 Consideration of optional additional mitigation or compensation

- 16.13.1 The assessment set out above has concluded that it will be necessary to implement some further mitigation measures. These have been identified through the iterative process of scheme design and would be in addition to those outlined and assessed in **Sections 16.8 to 16.11**. These additional measures have not been assessed as part of the Proposed Development.
- 16.13.2 These measures reflect that although the assessment does not expect a change in significant adverse effects, it would be appropriate to ensure adverse effects to health are as low as reasonably practicable (e.g. where there would be an incremental increase in health risk factors for conditions such as cardiovascular disease due to the Proposed Development).
- Noise: – e.g. double glazing, mechanical ventilation, internal movable acoustic room dividers within classrooms and teaching assistant support.
- 16.13.3 Health services:
- Protocols to be developed for monitoring local NHS demand associated with Bristol Airport. Detail to be developed in collaboration between BAL and Bristol, North Somerset and South Gloucestershire Clinical Commissioning Group.

16.14 Conclusions of significance evaluation

- 16.14.1 Significant beneficial effects to population health are likely in relation to investment and employment due to the Proposed Development. Other effects that are likely to be beneficial, but which would not be significant in EIA terms, include the infrastructure improvements around the airport entrance that improve road safety and promote walking and cycling.
- 16.14.2 A change in significant adverse effects to population health is considered unlikely. Compared to the existing baseline and the consented increase to a 10 mppa capacity, the Proposed Development results in similar environmental exposures. Whilst there would be some localised increases in adverse effects during construction and operation for people living closest to the airport; at the population level the Proposed Development is unlikely to result in a discernible change to health outcomes.

16.15 Implementation of environmental measures

- 16.15.1 No further environmental measures are embedded within the Proposed Development.