

REPORT

Boston Alternative Energy Facility – Environmental Statement

Chapter 22 Health

Client: Alternative Use Boston Projects Ltd
Planning Inspectorate Reference: EN010095
Document Reference: 6.2.22
Pursuant to: APFP Regulation: 5(2)(a)
Reference: PB6934-RHD-01-ZZ-RP-N-3022
Status: 0.0/Final
Date: 23 March 2021



HASKONINGDHV UK LTD.

Rightwell House
Rightwell East
Bretton
Peterborough
PE3 8DW
Industry & Buildings
VAT registration number: 792428892

+44 1733 334455 **T**
+44 1733 262243 **F**
email **E**
royalhaskoningdhv.com **W**

Document title: Boston Alternative Energy Facility – Environmental Statement

Document short title: Health
Reference: PB6934-RHD-01-ZZ-RP-N-3022
Status: 0.0/Final
Date: 23 March 2021
Project name: Boston Alternative Energy Facility
Project number: PB6934-RHD-01-ZZ-RP-N-3022
Author(s): Isabel O'Mahoney

Drafted by: Isabel O'Mahoney

Checked by: Gary Bower

Date: 27/11/20 GB

Approved by: Paul Salmon

Date: 21.03.21

Classification

Project related

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Appendices

Appendix 22.1 Health Baseline Statistics
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Executive Summary

This chapter of the Environmental Statement (ES) presents the Health Impact Assessment (HIA) and contains an assessment of activities which may have an impact on human health and wellbeing ('health') during the construction, operation and decommissioning of the Boston Alternative Energy Facility ('the Facility'). This chapter also provides an overview of existing health baseline statistics (e.g. census statistics and Public Health England (PHE) data) to inform on the population (both general and vulnerable groups) in the surrounding area (i.e. site-specific and locally in Boston), which is then compared further afield (i.e. regionally and locally). The health effects that were considered during construction and operation of the Facility were outdoor amenity (i.e. physical activity and access to biodiversity), 'journey times, reduced access and/or safety', air quality, noise, ground and water contamination, 'climate change and flood risk' and 'employment and education'.

The specific assessments of the topics considered in this HIA have been considered in the following technical chapters of the ES: **Chapter 10 Noise and Vibration; Chapter 11 Contaminated Land, Land Use and Hydrogeology; Chapter 12 Terrestrial Ecology; Chapter 13 Surface Water, Flood Risk and Drainage Strategy; Chapter 14 Air Quality; Chapter 17 Marine and Coastal Ecology; Chapter 19 Traffic and Transport; Chapter 20 Socio-Economics; and Chapter 21 Climate Change.** This HIA brings together the conclusions of these assessments (i.e. residual impacts) and the relevant information in terms of population health (i.e. statistics on relevant population groups, Public Health Outcomes Framework, health asset profiles, etc.), thereby assisting in identifying any potential factors associated with the Facility which may affect health.

With the implementation of the mitigation measures identified within the separate technical chapters (e.g. best practice measures to minimise construction noise and dust (also detailed in the Outline Code of Construction Practice (OCoCP)), traffic mitigation measures (also detailed in the Outline Construction Traffic Management Plan (OCTMP)), etc.), no significant impacts were predicted throughout the construction or operational phase of the Facility on health. Decommissioning impacts are expected to be no greater than those identified in the construction phase.

22 Health

22.1 Introduction

22.1.1 This chapter of the Environmental Statement (ES) describes the existing environment in relation to human health and well-being (herein 'health') and considers the potential health effects associated with the construction, operation and decommissioning of the Boston Alternative Energy Facility ('the Facility'). Mitigation measures are described, where relevant, and a discussion of the residual effects provided where significant impacts were identified.

22.1.2 This Health Impact Assessment (HIA) considers potential health effects on both the general population and vulnerable groups, at both a site-specific, local (i.e. Boston), regional (i.e. Lincolnshire and the East Midlands) and national (i.e. England) level, where relevant.

22.1.3 The specific assessments of the topics considered in relation to health have been considered in the following technical chapters of the ES: **Chapter 10 Noise and Vibration; Chapter 11 Contaminated Land, Land Use and Hydrogeology; Chapter 12 Terrestrial Ecology; Chapter 13 Surface Water, Flood Risk and Drainage Strategy; Chapter 14 Air Quality; Chapter 17 Marine and Coastal Ecology; Chapter 19 Traffic and Transport; Chapter 20 Socio-Economics and Chapter 21 Climate Change.**

22.1.4 This HIA brings together the conclusions of these assessments (i.e. residual impacts) and the relevant information in terms of population health (i.e. statistics on relevant population groups, Public Health Outcomes Framework, health asset profiles, etc.), thereby assisting in identifying any potential factors associated with the Facility which may specifically affect health.

22.2 Legislation, Policy and Guidance

Legislation

National Policy Statements

22.2.1 The policy framework for examining and determining applications for NSIPs is provided by National Policy Statements (NPSs). The NPSs that are considered relevant to the Project include:

- The overarching National Policy Statement for Energy (EN-1) (DECC, 2011a); and

- National Policy Statement for Renewable Energy Infrastructure (EN-3) (DECC, 2011b).

22.2.2 NPS EN-1 at Paragraph 1.7.2 states:

*“The energy NPSs are likely to contribute positively towards improving the vitality and competitiveness of the UK energy market by providing greater clarity for developers which should improve the UK’s security of supply and, less directly, **have positive effects for health and well-being in the medium to longer term through helping to secure affordable supplies of energy and minimising fuel poverty**; positive medium and long term effects are also likely for equalities.”*

22.2.3 Health is specifically identified as an issue to be considered by DCO applications as set out in Paragraphs 4.13.1 and 4.13.2 of NPS EN-1. It states that:

“Energy production has the potential to impact on the health and well-being (“health”) of the population. Access to energy is clearly beneficial to society and to our health as a whole. However, the production, distribution and use of energy may have negative impacts on some people’s health.”

*“[...] where the proposed project has an effect on human beings, the ES should **assess these effects for each element of the project, identifying any adverse health impacts, and identifying measures to avoid, reduce or compensate for these impacts as appropriate**. The impacts of more than one development may affect people simultaneously, so the applicant and the IPC should consider the cumulative impact on health.”*

22.2.4 In NPS EN-1, Paragraph 4.13.3 outlines that the potential sources of health effects as the direct effects of:

- Increased traffic;
- Pollution – including air, water, noise, dust, and odour;
- Hazardous waste and substances
- Radiation; and
- Increases in pests.

22.2.5 NPS EN-1 at Paragraph 4.13.4 also states that new energy infrastructure may *“affect the composition, size and proximity of the local population, and in doing so*

have indirect health impacts, for example if it in some way affects access to key public services, transport or the use of open space for recreation and physical activity”.

22.2.6 It is noted in NPS EN-1 Paragraph 4.13.5 that the “*aspects of energy infrastructure which are most likely to have a significantly detrimental impact on health are subject to separate regulation (for example for air pollution) which will constitute effective mitigation of them, so that it is unlikely that health concerns will either constitute a reason to refuse consents or require specific mitigation under the Planning Act 2008. However, the IPC [now the Planning Inspectorate] will want to take account of health concerns when setting requirements relating to a range of impacts such as noise.*”

22.2.7 The aspects of NPS EN-1 that relate to the health and well-being effects from noise, contaminated land and water, air quality (and dust), traffic and transport, and socio-economics are discussed in more detail in the ES **Chapter 10 Noise and Vibration, Chapter 11 Contaminated Land, Land Use and Hydrogeology, Chapter 12 Terrestrial Ecology, Chapter 13 Surface Water, Flood Risk and Drainage Strategy, Chapter 14 Air Quality, Chapter 17 Marine and Coastal Ecology, Chapter 19 Traffic and Transport and Chapter 20 Socio-Economics** respectively.

22.2.8 In Section 2.5 of NPS EN-3 biomass and waste combustion, it is noted that the combustion of waste can have significant adverse impacts on carbon dioxide (CO₂) emissions, as well as the other air emission impacts outlined in Section 5.2 of EN-1. The Industrial Emission Directive (IED) (Directive 2010/75/EU) (EC, 2010) is relevant to waste combustion plants, in addition to the air quality and emission legislation outlined in EN-1.

22.2.9 NPS EN-3 says at Paragraph 2.5.43 that where a “*proposed waste combustion generating station **meets the requirements** of the WID¹ [now contained in the IED], and will not exceed the local air quality standards”, the Secretary of State “should regard the proposed waste generating station as having **no adverse impacts on health.**”*

National Planning Policy

National Planning Policy Framework

22.2.10 The National Planning Policy Framework (NPPF) was updated on 19th February 2019 (Ministry of Housing Communities and Local Government (MHCLG),

¹ The Waste Incineration Directive (WID) (Directive 2000/76/EC) (EC, 2000), which has now been superseded by the Industrial Emission Directive (IED)

2019a). The NPPF acknowledges the importance of considering health impacts during the planning process.

22.2.11 Section 8 of the NPPF refers to ‘Promoting healthy and safe communities’.

22.2.12 The NPPF says in Paragraph 122 that planning policies and decisions should support development that makes efficient use of land and take into account *“the importance of securing well-designed, attractive and healthy places”*.

22.2.13 Paragraph 180 states that planning policies and decisions should ensure that new developments are appropriately located, taking into account

“the likely effects (including cumulative effects) of pollution on health, living conditions and the natural environment, as well as the potential sensitivity of the site or the wider area to impacts that could arise from the development. In doing so they should:

a) mitigate and reduce to a minimum potential adverse impact resulting from noise from new development – and avoid noise giving rise to significant adverse impacts on health and the quality of life²;

b) 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

c) limit the impact of light pollution from artificial light on local amenity, intrinsically dark landscapes and nature conservation.”

National Planning Policy for Waste (2014)

22.2.14 The National Planning Policy for Waste (NPPW) was published in October 2014 (DCLG, 2014). It sets out the detailed waste planning policies to achieve the Government’s plans to *“work towards a more sustainable and efficient approach to resource use and management”* as set out in the Waste Management Plan for England (Defra, 2013).

22.2.15 The NPPW acknowledges that planning can help deliver the national waste strategy through *“helping to secure the re-use, recovery or disposal of waste without endangering human health and without harming the environment”*.

A Green Future: Our 25 Year Plan to Improve the Environment (Defra, 2018)

22.2.16 The 25 Year Environment Plan was published in January 2018 (Defra, 2018) and sets out what is to be done to improve the environment, within a generation.

² See Explanatory Note to the Noise Policy Statement for England (Department for Environment, Food & Rural Affairs, 2010).

22.2.17 The Plan includes ten goals for environmental improvement over the next 25 years. The goals to be achieved include:

1. Clean air
2. Clean and plentiful water
3. Thriving plants and wildlife
4. Reducing the risks of harm from environmental hazards
5. Using resources from nature more sustainably and efficiently
6. Enhancing beauty heritage and engagement with the natural environment
7. Mitigating and adapting to climate change
8. Minimising waste
9. Managing exposure to chemicals
10. Enhancing biosecurity

Local Planning Policy

South-East Lincolnshire Local Plan 2011-2036

22.2.18 The South-East Lincolnshire Joint Strategic Planning Committee, consisting of Boston Borough, South Holland District and Lincolnshire County Councils, adopted the South-East Lincolnshire Local Plan on 8 March 2019 (South-East Lincolnshire Joint Strategic Planning Committee, 2019). The Local Plan will guide development and use of land in South-East Lincolnshire from 2011 to 2036.

22.2.19 Section 7 ‘A Distinctive, Greener, Cleaner, Healthier Environment’ of the Local Plan outlines that a development “*should seek to protect and enhance the site’s important features, and its relationship with other natural and built environment sites, in order to make the best use of the site... planning policies and decisions should address the connections between people and places and the community facilities they provide*”.

22.2.20 The Local Plan was reviewed for policies relevant to health and the following policies were identified.

“Policy 30: Pollution

Development proposals will not be permitted where, taking account of any proposed mitigation measures, they would lead to unacceptable adverse impacts upon:

1. **health** and safety of the public;

2. *the amenities of the area; or*
3. *the natural, historic and built environment;*
by way of:
4. *air quality, including fumes and odour;*
5. *noise including vibration;*
6. *light levels;*
7. *land quality and condition; or*
8. *surface and groundwater quality.”*

Joint Health and Wellbeing Strategy for Lincolnshire 2018

22.2.21 The health issues and priorities for south-east Lincolnshire are set out in the Lincolnshire Joint Strategic Needs Assessment (Lincolnshire County Council (LCC), 2020a) and Wellbeing Strategy for Lincolnshire (LCC, 2018).

22.2.22 The Joint Health and Wellbeing Strategy for Lincolnshire was published in June 2018 by the Lincolnshire Health and Wellbeing Board (LCC, 2018). The production of the Strategy is a legal requirement under the Health and Social Care Act 2012 (HMSO, 2012). The Strategy aims to inform and influence decisions about health and social care services in Lincolnshire, in addition to addressing factors that affect everyone’s health and wellbeing. The priorities identified in the Strategy focus on the areas included in the Joint Strategic Needs Assessment for Lincolnshire.

22.2.23 The Strategy identified the following priorities for Lincolnshire:

- Mental Health and Emotional Wellbeing (Children and Young People);
- Mental Health (Adults);
- Carers;
- Physical Activity;
- Housing and Health;
- Healthy Weight (previously known as Obesity); and
- Dementia.

Lincolnshire Minerals and Waste Local Plan

22.2.24 The Lincolnshire Mineral and Waste Local Plan (LMWLP) is made up of two documents: the Adopted Core Strategy (LCC, 2016); and the Adopted Site Locations (LCC, 2017).

22.2.25 Section 4 (under Spatial Vision) of the LMWLP states that LCC “*will provide a strategic planning framework to facilitate the sustainable supply and use of minerals and to manage waste sustainably in accordance with the waste hierarchy*”. It will ensure that “*the economic, environmental and social benefits of mineral and waste development are considered whilst... the health and amenity of local communities is protected*”.

22.2.26 The LMWLP, Paragraph 7.30, states that “*proposals, which may give rise to pollution and health issues, should be submitted with details of these issues, and where applicable the relevant health and pollution control authorities will be consulted.*”

Guidance

Planning Practice Guidance

22.2.27 Planning Practice Guidance (PPG) includes guidance on promoting healthy and safe communities (MHCLG, 2019b). A healthy community is defined in the PPG as one “*which supports and promotes healthy behaviours and environments and a reduction in health inequalities for people of all ages.*”

22.2.28 The other PPGs that are of relevance to other topics considered in this ES are discussed in further detail in relation to human health in **Chapter 10 Noise and Vibration, Chapter 11 Contaminated Land, Land Use and Hydrogeology, Chapter 12 Terrestrial Ecology, Chapter 13 Surface Water, Flood Risk and Drainage Strategy, Chapter 14 Air Quality, Chapter 17 Marine and Coastal Ecology, Chapter 19 Traffic and Transport; Chapter 20 Socio-Economics and Chapter 21 Climate Change.**

Other Relevant Guidance

22.2.29 The PPG on EIA (MHCLG, 2020) does not provide additional information on defining the scope or assessment of ‘*population and human health*’ in EIA (as is required to be considered in the amended 2017 EIA Regulations (HMSO, 2017)), therefore the following guidance (inclusive of relevant UK guidance on HIA outside of England) have also been considered in the production of this HIA:

- Institute of Environmental Management and Assessment (IEMA) – Health in Environment Assessment: A Primer for a Proportionate Approach (Cave *et al.*, 2017a);
- Health and Environmental Impact Assessment: A Briefing for Public Health Teams in England (Cave *et al.*, 2017b);

- Health Impact Assessment in spatial planning: A guide for local authority public health and planning teams (PHE, 2020a);
- Health Impact Assessment of Government Policy: A guide to carrying out a Health Impact Assessment of new policy as part of the Impact Assessment process (Department of Health, 2010);
- Healthy Urban Planning Checklist (London Health Urban Development Unit (HUDU), 2017b; 2019);
- Health Impact Assessment: A Practical Guide (Wales) (WHIASU, 2012);
- Health Impact Assessment Guidance (Northern Ireland) (Metcalf *et al.*, 2009); and
- Health Impact Assessment of Rural Development: A Guide. Scottish Health and Inequalities Impact Assessment Network and Scottish Public Health Network (ScotPHN) (Higgins *et al.*, 2015).

22.3 Consultation

22.3.1 Consultation undertaken throughout the pre-application phase informed the approach and the information provided in this Chapter. A summary of the consultation of particular relevance to health is detailed in **Table 22-1**.

Table 22-1 Consultation and Responses

Consultee and Date	Response	Chapter Section Where Consultation Comment is Addressed
Planning Inspectorate Scoping Opinion, 2018	The Inspectorate considers that in addition to the aspect assessments listed in this paragraph of the Scoping Report, human health aspects may also be relevant to soil handling and contaminated land. It is noted that in Section 6.5 the matter of human health is included. The ES should assess this matter and ensure consistency and cross reference between the health assessment and the contaminated land assessment chapter.	Noted. Section 11.7 of Chapter 11 Contaminated Land, Land Use and Hydrogeology details the assessment, and this is included in the HIA (see Section 22.7).
	The ES should assess cumulative effects on human health, from both multiple effects on individual receptors and from the combined effects of other developments with the Proposed Development.	The cumulative assessment for health is presented in Section 22.8 .
Section 42 Consultation Response – BBC	Concern about noise, odour and pollution and how this will be monitored, the impact on air quality on crops with regard to the agricultural industry and will “scrubbers” be utilised for pollutants.	Noise and odour impacts are assessed in Chapter 10 Noise and Vibration and Chapter 14 Air Quality respectively. The impact of air quality on crops, and the associated health impacts is discussed in

Consultee and Date	Response	Chapter Section Where Consultation Comment is Addressed
		Section 22.5 and Section 22.7.64. The use of scrubbers is addressed in Chapter 14 Air Quality .
Section 42 Consultation Response – LCC, 1 st August 2019	<p>The Council feels that as a preliminary, desktop human (health) impact assessment (HIA) the PEIR covers what would be expected. It is pleasing to see the HUDU checklist and potential positive impacts as well as the need to mitigate against negative ones.</p> <p>However, the Councils feels that there should be some enhancements to social infrastructure (community gain) for example enhancing access to open space, walking and cycling networks, lighting (safety), etc., in the vicinity of the plant – especially where existing rights of way are closed and diverted to.</p>	<p>Noted. The public footpath (BOST 14/11) will be improved to allow easier access than the footpath currently allows.</p>
	<p>It is right to say that holistically, maximising renewable energy production to contribute to long-term energy security is in the public (health) interest provided potential adverse health impacts are mitigated.</p>	Noted.
	<p>It is noted that there will be a further HIA as part of the Environmental Statement (ES) which will also be reviewed by the Council. It is also felt that a development of this magnitude should have a full HIA including public participation.</p>	<p>Health impacts were raised as part of the formal section 42 statutory consultation public information days in July 2019. This chapter provides the full HIA for the Facility in response to the request.</p>

22.4 Assessment Methodology

Impact Assessment Methodology

22.4.1 This HIA was guided by the Rapid Health Impact Assessment Tool (London HUDU, 2017a), Healthy Urban Planning Checklist (London HUDU, 2017b) and the Central Lincolnshire Health Impact Assessment for Planning Applications Guidance Note (Central Lincolnshire, 2017), as there is no guidance specific to HIA in South-East Lincolnshire and/or Boston. The Rapid Health Impact Assessment Tool is partly based on the World Health Organisation (WHO) Healthy Urban Planning publication (Barton & Tsourou, 2000). Particular attention was paid to the Cave *et al.* (2017a; 2017b) guidance. Other guidance that was used to guide this HIA are detailed in **Section 22.2**.

22.4.2 In general, there are five core steps of the HIA process (WHO, 2019; PHE, 2020a). These include:

1. Screening
2. Scoping
3. Assessment
4. Reporting and recommendations (decision making)
5. Monitoring and evaluation

Screening

22.4.3 Screening is the first stage of the HIA process and establishes the need for a HIA.

22.4.4 Amendments that were made to the 2017 EIA Regulations (HMSO, 2017) specify that “*population and human health*” must be considered as part of the one of the five main “*factors*” to be assessed in the EIA process. This chapter details the findings of the HIA for the Facility.

Scoping

22.4.5 A Scoping Report was submitted to the Planning Inspectorate on 30th May 2018 and a Scoping Opinion was received back from the Planning Inspectorate in July 2018.

22.4.6 It was proposed in the Scoping Report (Royal HaskoningDHV, 2018) that the HIA would be appended to **Chapter 14 Air Quality** and this method was generally accepted by the Planning Inspectorate in the Scoping Opinion (The Planning Inspectorate, 2018), with the addition that “*human health aspects may also be relevant to soil handling and contaminated land*” (see **Table 22-1**). The Planning Inspectorate also identified that “*cumulative effects on human health, from both multiple effects on individual receptors and from the combined effects of other development with the Proposed Development*” should be addressed.

22.4.7 However, it was subsequently decided that the HIA would be provided as a separate chapter in this ES and this chapter considers the approach to assessment and a summary of health impacts that are covered in detail in other chapters (as detailed below and in **Section 22.1**) within the ES.

22.4.8 The following topics associated with the HIA are addressed elsewhere in this ES:

- Noise (**Chapter 10 Noise and Vibration**);
- Dust and other emissions (including air) (**Chapter 14 Air Quality**);

- Hazardous waste and substances (**Chapter 11 Contaminated Land, Land Use and Hydrogeology**);
- Disruption to local road network (reduced access to services and amenities) (**Chapter 19 Traffic and Transport**); and
- Increase local employment and community assessment (**Chapter 20 Socio-Economics**).

22.4.9 The health determinants that are considered in the HIA are detailed in **Table 22-5. Assessment – General Approach**

22.4.10 This HIA utilised information gathered during the baseline studies of relevant topics (see above) in the ES to produce a list of potential health impacts associated with the Facility (**Table 22-5**). The planning checklist provided in the London HUDU (2017b) was used to structure the HIA and this checklist broadly aligns with the wider determinants of health and wellbeing included in new PHE guidance (PHE, 2020a), with the exception of potential climate change impacts on health which have now been added to the assessment.

22.4.11 The methods identify potential effects consistent with the objective of EIA (as set out in the EIA Directive 2014/52/EC) that provide, or are contrary to providing, a high level of protection to human health. This includes reasoned conclusions in relation to health protection and / or services.

22.4.12 The methods provide a framework to identify:

- The ‘likelihood’ of the Facility having an effect on health; and
- If an effect is likely, whether it may be ‘significant’ in terms of the EIA Regulations.

22.4.13 Effects are considered with regard to both the general population and vulnerable groups. Populations are considered at site-specific and local levels and compared with regional and national population statistics.

22.4.14 In line with industry guidance (PHE, 2020a; 2020b), ‘health determinants’ are considered, to describe the potential effects of human health and wellbeing (‘health’). The methodology applies best practice published by IEMA in line with the ‘Health in Environmental Impact Assessment: A Primer for a Proportionate Approach’ (Cave *et al.*, 2017a; 2017b).

Health Determinants

22.4.15 A wide variety of direct and indirect factors can influence human health. These vary from controllable factors (e.g. lifestyle) to uncontrollable factors (e.g. genetics). The influence and effects can be wide-ranging and are likely to vary between individuals. External contributory factors (known as ‘determinants’) are considered in determining ‘physical, mental and social wellbeing’ and reflect a mix of influences from an individual’s society and environment.

22.4.16 The ‘wider determinants of health’ model (**Plate 22-1**) is used to conceptualise how health spans environmental, social and economic aspects.

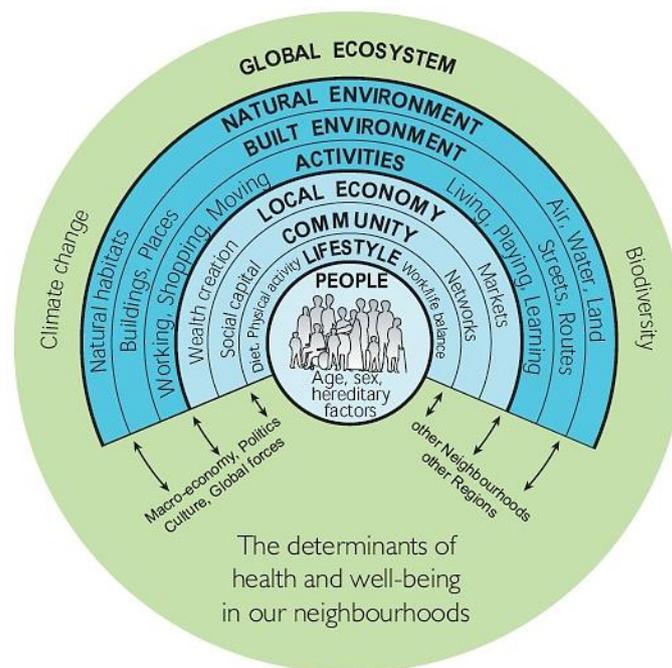


Plate 22-1 Wider Determinants of Health (Source: Based on the Dahlgren and Whitehead (1991) diagram as amended by Barton and Grant (2006) and advised by Cave *et al.* (2017a))

22.4.17 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.

Likelihood

22.4.18 The first issue to consider is the likelihood of the project having an effect. A likely effect should be both plausible and probable:

- Plausible means there is a relevant source, pathway and receptor; and

- 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 Facility's vulnerability to major accidents or disasters (as required by Part 1 paragraph 4(4) of the EIA Regulation 2017) as set out in **Chapter 24 Major Accidents and Risk Management**.

22.4.19 The term 'health pathways' describe how a specific activity of the project could change a determinant of health and potentially result in a change in health outcomes (an effect). Health pathways are considered with regard to the source, pathway, and impact as follows:

- 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).
- A 'receptor' is the recipient of an effect from the 'source', via the 'pathway'.

22.4.20 All three factors have to be present for a potential health effect to be manifested, and where this is the case, the pathway is considered, and the significance of the effect is determined.

Significance

22.4.21 A determination of significance is required when a potential effect of the project has been determined (by assessment) as likely to occur, and has two stages:

- Firstly, the sensitivity of the receptor affected, and the magnitude of the plausible health 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.

22.4.22 The final significance is provided based on a comparison of several factors following clear guiding questions, as set out in **Table 22-4**. This is a topic-specific variation from the general approach set out in **Chapter 6 Approach to EIA**. There is no overarching formal guidance for HIA within EIA for England, however, the methodology used in this assessment is in line with accepted best practice as set out in **Section 22.2**, under 'Other Relevant Guidance'.

Sensitivity and Magnitude

22.4.23 **Table 22-2** and **Table 22-3** set out factors characterising sensitivity and magnitude for human health. The table informs the professional judgement on scoring high, medium, low or negligible sensitivity and magnitude. In line with best practice (as per the guidance detailed in **Section 22.2**), a formulaic matrix approach to determining sensitivity has been avoided. The ‘higher’ and ‘lower’ sensitivity and magnitude characterisations represent instructive positions on a spectrum that would also include more extreme, as well as intermediate, positions. Most situations have a mix of higher and lower characterising factors, so a balanced expert view of sensitivity and magnitude is taken.

22.4.24 The assessment characterises the relevant populations for each health issue and the score is informed by details from one or more of the relevant factors in **Table 22-2** and **Table 22-3**.

Table 22-2 Factors Characterising Population Sensitivity (Cave et al., 2017a)

	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 project who may anticipate risks to their health and thus be affected by actual changes, but also by the possibility of change.
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 project. People are well informed of the issues and potential effects.

Table 22-3 Factors Characterising Magnitude (Cave *et al.*, 2017a)

	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 or vulnerable. Substantial population displacement or influx.	Continuous or daily effects with chronic (long term) changes in health outcomes.	Permanent change in health outcomes once the project change ceases. Inter-generational 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 project.
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. Little change in population.	Monthly or yearly affects with acute (short term) changes in health outcomes.	Change in health outcomes reverses once the project change ceases. No inter-generational effects.	A low concentration over a short time. Low exposure to a small population. A low degree of resource sharing with the project.

Judgement Framework for Significance

22.4.25 Having established that a source, pathway and receptor for a plausible health effect exist (as set out above), the magnitude/sensitivity methods are used to consider whether there is a relevant population to consider and a relevant change in health outcomes, a professional judgement is made as to whether or not the change in a population's health is significant or not.

22.4.26 The consideration of sensitivity and magnitude provides consistency between EIA topics. However, other relevant information sources (in addition to sensitivity and magnitude) also need to be evidenced for the professional judgement on significance to be a reasoned and robust conclusion on population health outcomes.

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

22.4.28 Guide questions set out in **Table 22-4** are used to inform professional judgement on whether an impact is significant or not. The professional judgement applied by using the guide questions in **Table 22.4** according to the sensitivity and magnitude identified above (**Table 22.2 and 22.3**) are applied to determine the outcome of significance of effect in **Table 22.7** to **Table 22.20** respectively. In line with best practice (see the guidance section of **Section 22.2**) a formulaic matrix approach to determining significance has been avoided.

Table 22-4 Human Health Guide Questions for Determining Significance (Cave et al., 2017a)

Evidence sources	Guide questions
Baseline conditions	<ul style="list-style-type: none"> • Are relevant sensitivities or inequalities identified 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	<ul style="list-style-type: none"> • 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	<ul style="list-style-type: none"> • Has a theme of local, regional or national consultation responses related to the relevant determinant of health or health outcome?
Regulatory standards (if appropriate)	<ul style="list-style-type: none"> • 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 set by regulators? • Are there relevant international advisory guideline limit values (e.g. by the World Health Organisation)?

Evidence sources	Guide questions
Policy context	<ul style="list-style-type: none"> • 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)?

22.4.29 These questions are discussed for the identified health issues. The discussion provides reasoned conclusions for the professional judgement as to whether in EIA terms an effect is significant, or not. Where appropriate, variation expressed in each evidence source has been reported.

22.4.30 For the purposes of the EIA, large and moderate effects are considered to be significant, whilst slight effects are not significant in their own right. It is important to distinguish these from other non-significant effects as they may contribute to significant cumulative effects.

22.4.31 Where significant adverse effects are identified, mitigation has been identified within each relevant topic area to reduce the significance of such effects (these assessments are detailed in each of the technical chapters referenced in this HIA, see **Section 22.1**), resulting in the residual effect.

22.4.32 This assessment takes as its starting point the residual effects as assessed and determined in other relevant EIA topic chapters. This includes taking into account relevant embedded and standard good practice mitigation.

Population Conclusions

22.4.33 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 (or for a defined area); and
- A second separate sub-population conclusion for relevant vulnerable group (as a single defined class of sensitivities for that issue).

Cumulative Impact Assessment (CIA)

22.4.34 The CIA considers the inter-relationships between health effects both from within the Facility and in combination with effects from other projects. These are considered for all aspects as set out in **Section 22.5**.

22.4.35 Cumulative effects are considered and, as with other chapters, Facility activities are screened as per the guidance set out in **Chapter 6 Approach to EIA**. These projects are then considered for cumulative effect at the Site and for different vulnerable populations.

22.5 Scope

Study Area

22.5.1 The Facility is located approximately 1.8 km south-east of Boston Town and is within Boston Borough Council (BBC) and Lincolnshire County Council (LCC) administrative areas. A full description of the Facility is provided in **Chapter 5 Project Description**.

22.5.2 The following geographic area classifications have been used within this HIA:

- Site-specific (location of the Facility);
- Local (Boston Borough);
- Regional (Lincolnshire or East Midlands, depending on the baseline statistics available); and
- National (England).

22.5.3 The site-specific level considers localised effects through statistics collected for Lower Super Output Areas (LSOAs) (see **Appendix 22.1 Health Baseline Statistics**). LSOAs are “a geographic hierarchy designed to improve the reporting of small area statistics in England and Wales”. Each LSOA has a similar population size (minimum population is 1,000 and the mean is 1,500) and the use of LSOA level statistics enables the identification of any areas of deprivation, that may otherwise be overlooked (National Health Service (NHS), 2020).

22.5.4 The Facility is located in the Boston 009A LSOA, with a very small portion of the south of the Site located within the Boston 008E LSOA. Boston 009A was selected as the most representative LSOA to characterise the population at the site-specific level as the majority of the Site (i.e. > 99 %) is located within this LSOA.

22.5.5 The assessment defines eight population groups within the study area. Four of the population groups are geographically defined, and the remaining four are defined in relation to reasons that a population may be sensitive (other than due to proximity) (see the **Study Population Section** below for further detail).

22.5.6 The study areas used in the other technical chapters of the ES referenced in the HIA are of relevance, however, do not necessarily define the boundaries of

potential health effects. Therefore, this chapter uses study areas to broadly define representative population groups instead of setting boundaries on the extent of potential effects.

Study Population

Geographic Population Groups

22.5.7 The four population groups identified based in the geographic study area comprise the:

- Population near the Facility (site-specific);
- Population of Boston (local);
- Population of Lincolnshire or East Midlands (based on where data is available for) (regional); and
- Population of England (national).

Potentially Vulnerable Groups

22.5.8 The four further population groups identified due to their potential sensitivity to changes associated with the Facility (beneficial or adverse) comprise:

- Children and young people;
- Older people (aged 65 and over);
- People with existing poor health (physical and mental health); and
- People living in deprivation, including those on low incomes.

22.5.9 These groups are intentionally broadly defined to facilitate a consistent discussion across health issues and as a basis to considering cumulative effects. The assessment section discusses detail relevant to particular health issues. People falling into more than one group may be especially sensitive.

Temporal Scope

22.5.10 The temporal scope has been defined as follows:

- 'Very short term' – effects measured in hours, days or weeks;
- 'Short term' – effects measured in months (e.g. workforce use of accommodation during construction);
- 'Medium term' – effects measured in years (e.g. local employment during construction); and
- 'Long term' – effects measured in decades (e.g. operational phase of the Facility).

Topic Scope

22.5.11 The topics scoped into the HIA have been informed by the Planning Inspectorate Scoping Opinion (The Planning Inspectorate, 2018) and the Section 42 responses to the PEIR (as discussed in **Section 22.3**). The Scoping opinion was based upon appending a health impact assessment to **Chapter 14 Air Quality**. Following Scoping Opinion, a desk based HIA was prepared for the PEIR for formal consultation. Following feedback from Boston Borough Council, a full HIA was recommended for the ES, and is presented in this document.

22.5.12 **Table 22-5** sets out the potential health effects (categorised under the Healthy Urban Planning Checklist Themes (London HUDU, 2017b)) that have been scoped into the HIA for assessment. The wider determinants of health described in **Table 22-5** broadly align with the wider determinants of health and wellbeing detailed in recent PHE guidance on HIA in spatial planning (PHE, 2020a), with the exception of climate change impacts on health which are included in the assessment.

22.5.13 No further consideration has been given to potential effects which were scoped out of the assessment, as detailed in the PEIR, and summarised below:

- Healthy Housing (all planning issues) – the Facility is not a housing development, and impacts on residents are identified and captured within the ‘Healthy Environment’ theme;
- Some planning issues of Healthy Environment (i.e. open space, play space, local food growing and overheating) – the Facility will have no effect on these aspects of health, or any significant ability to impact on them; and
- Majority of Vibrant Neighbourhoods planning issues (i.e. healthcare services, access to social infrastructure, access to local food shops, and public buildings and space) – the Facility will have no effect on these aspects of health, or any significant ability to impact on them.

Table 22-5 Scope of Health Determinants to be Considered in the HIA

Planning Issue	Potential Effect	Potential Pathway	Potential Receptor	Relevant Technical ES Chapter
HUDU Checklist Theme: Active Travel				
Promoting Walking and Cycling	Effects to Public Rights of Way (PRoW) causing changes in	Loss of access / diversions to access routes / PRoWs.	Site-specific and local populations	Chapter 11 Contaminated Land, Land Use and Hydrogeology
Safety				

Planning Issue	Potential Effect	Potential Pathway	Potential Receptor	Relevant Technical ES Chapter
Connectivity	accessing the footpath, etc.			Chapter 19 Traffic and Transport
Minimising Car Use	<p>Effects from promoting car-sharing and mini-buses to transport workers to the Facility from on-site construction car parks.</p> <p>Effects from increased traffic on safety/accidents, severance/ connectivity may arise due to construction.</p>	Disruption of access to services and amenities,		
HUDU Checklist Theme: Healthy Environment				
Construction	Construction of the Facility has the potential to cause impacts on health through stress and disturbance.	Temporary disturbance to lifestyle and routines.	Site-specific and local populations	Construction is considered as a phase of the Facility and is therefore considered in all technical assessments.
Air Quality	The Facility has the potential to impact air quality during the construction (i.e. from construction dust, traffic and vessel emissions) and operational (i.e. from stack, traffic and vessel emissions) phases.	Inhalation of particulates or exposure to stack, traffic or vessel emissions.	Site-specific and local populations	Chapter 14 Air Quality
Noise	The Facility has the potential to impact noise levels in the area surrounding the	Temporary inconvenience (construction) or long-term	Site-specific and local populations	Chapter 10 Noise and Vibration

Planning Issue	Potential Effect	Potential Pathway	Potential Receptor	Relevant Technical ES Chapter
	Application Site in both the construction and operational phases, predominantly through the operation of the Facility and Facility-generated traffic.	inconvenience (operation of the Facility).		
Contaminated Land (and Water)	The Facility has the potential to disturb any existing contamination within the Principal Application Site, which could result in further contamination of land and waterways and lead to human exposure to contamination via inhalation and ingestion.	Emissions to ground or surface water including accidental spillages.	Site-specific populations	<p>Chapter 11 Contaminated Land, Land Use and Hydrogeology</p> <p>Chapter 13 Surface Water, Flood Risk and Drainage Strategy</p>
Biodiversity	The Facility has the potential to disturb terrestrial and marine species.	Changes to outdoor amenity (including access to biodiversity).	Site-specific and local populations	<p>Chapter 12 Terrestrial Ecology</p> <p>Chapter 17 Marine and Coastal Ecology</p>
Flood Risk	Flooding is an issue that affects the wellbeing of local residents and businesses.	Likelihood of flooding.	Site-specific population	Chapter 13 Surface Water, Flood Risk and Drainage Strategy
Climate Change	Climate change is an issue that affects the wellbeing of local residents and businesses.	Greenhouse gas (GHG) emissions.	Site-specific and local populations	Chapter 21 Climate Change
HUDU Checklist Theme: Vibrant Neighbourhoods				

Planning Issue	Potential Effect	Potential Pathway	Potential Receptor	Relevant Technical ES Chapter
Education	The Facility has potential to offer a pathway to employment in engineering roles. Boston College offers engineering courses and apprenticeship schemes via their Engineering, Manufacturing and Technology Centre (EMAT) that could be relevant to construction and operation of the Facility. The project team will work with Boston College to identify courses that are likely to promote this.	Increasing the number of apprenticeship scheme places available to Boston College.	Site-specific and local populations	Chapter 20 Socio-Economics
Local Employment and Healthy Workplaces	The Facility has the potential to impact on local employment during both the construction and operational phases. This is likely to be a beneficial impact by creation of jobs.	Increased wealth in populations.	Local and Greater Lincolnshire Local Enterprise Partnership (GLLEP) (i.e. regional) populations	Chapter 20 Socio-Economics

Assumptions and Limitations

22.5.14 The latest available baseline data (e.g. 2019 Index of Multiple Deprivation (IMD) (MHCLG, 2019c), mid-2019 population estimates (where available) (ONS, 2020), Public Health Outcomes Framework (majority of data is from 2018 or newer) (PHE, 2020b), etc.) were used for the HIA; however, it should be noted that data sources may have been updated and could be subject to change during the Development Consent Order (DCO) application process. Furthermore, the most recent census data is from 2011 and while it is probable that this baseline information may have undergone some change, the broad characteristics have likely remained the same.

22.5.15 As the HIA is based on findings from other ES chapters, the assumptions and limitations stated in the relevant topic chapters referenced in this chapter also apply.

22.6 Existing Environment

Data Sources

22.6.1 Details of the data sources (ONS, 2013; PHE, 2019; 2020a-e), relating to human health receptors, that were used in this assessment are discussed below in the **Baseline Conditions Section**. Additional data sources (from the specific assessments of the topics considered in relation to health) can be found in the relevant technical chapters of the ES that have informed this HIA (i.e. **Chapter 10 Noise and Vibration; Chapter 11 Contaminated Land, Land Use and Hydrogeology; Chapter 12 Terrestrial Ecology; Chapter 13 Surface Water, Flood Risk and Drainage Strategy; Chapter 14 Air Quality; Chapter 17 Marine and Coastal Ecology; Chapter 19 Traffic and Transport; Chapter 20 Socio-Economics and Chapter 21 Climate Change**).

22.6.2 The human health assessment, and determination of significance, were informed by the following evidence sources (as described in **Table 22-4**), relevant data for which is summarised in the sections below:

- Baseline conditions;
- Health priorities;
- Project-specific consultation responses; and
- Policy context.

22.6.3 The review of evidence sources and topics identified in **Table 22-5** has identified the following seven themes that apply across the construction, operational and decommissioning phases of the Facility:

- Outdoor amenity (i.e. physical activity and access to biodiversity);
- Journey times and/or reduced access and/or safety;
- Air quality;
- Noise;
- Ground and/or water contamination;
- Climate Change and flood risk; and
- Employment and education.

Baseline Conditions

22.6.4 The following data sources have been used to inform the baseline for this HIA:

- Public Health Outcomes Framework (PHE, 2020b);
- Wider Determinants of Health (2020c) and Health Profiles (PHE, 2020d; 2020e);
- Office of National Statistics (ONS) (ONS, 2013; 2019; 2020); and
- Nomis official labour market statistics (Nomis, 2020).

22.6.5 Details of the statistics used in this assessment are provided in **Appendix 22.1**.

22.6.6 Whilst more recent statistics have been collected for some socio-economic variables, the 2011 census (**Table A22.1-1 in Appendix 22.1**) is considered an appropriate baseline for use in this HIA as it is the most recent census date and provides consistent comparative data across the population groups used in the assessment.

22.6.7 The Index of Multiple Deprivation (IMD) 2019 has been consulted and referenced as appropriate, including sub-domains and underlying indicators (MHCLG, 2019c); the 2019 Index is the most recent information available.

22.6.8 Population growth projections indicate that by 2041 the population of Lincolnshire will have grown by 11 %, this is lower than the projected national growth rate (of 12 %) over the same time period. The population in Lincolnshire trends towards an ageing population profile, and it is predicted that the proportion of people over 75 years of age will increase by 88 % between 2016 and 2041 (LCC, 2020b). In 2019, the proportion of people aged over 65 in Lincolnshire was 23.6 %, which is much higher than the national average (18.4 %), while the proportion of people under 18 was lower than nationally (19.2 % and 21.4 % respectively) (**Table A22.1-2, Appendix 22.1**).

22.6.9 The population growth rate in Boston between mid-2013 and mid-2018 was 5.4 % (Nomis, 2020). In 2019, the proportion of people in Boston under 18 was similar to the national average (21.2 % and 21.4 % respectively), but there were a higher proportion of people aged over 65 than nationally (20.9 % and 18.4 % respectively) (**Table A22.1-2, Appendix 22.1**), which correlates with an ageing population in Lincolnshire. Boston also has a much lower proportion of the population from ethnic minorities (2.1 %), than nationally (13.6 %).

22.6.10 In Lincolnshire, the healthy life expectancy at birth for males and females is similar to the national average; however, the life expectancy at birth for both males and

females in Boston is less than the regional and national averages (**Table A22.1-2, Appendix 22.1**). The inequalities in life expectancy at birth is lower than the national average for both males (8.2 and 9.5 years respectively) and females (5.7 and 7.5 years respectively).

22.6.11 The overall health of people in Boston is varied compared with the England average (PHE, 2020d, see **Appendix 22.1**). The health priorities identified in the Joint Health and Wellbeing Strategy for Lincolnshire (LCC, 2018) are:

- Mental Health and Emotional Wellbeing (Children and Young People);
- Mental Health (Adults);
- Carers;
- Physical Activity;
- Housing and Health;
- Healthy Weight (previously known as Obesity); and
- Dementia.

22.6.12 Health deprivation can increase sensitivity to change and can affect all the topics detailed in the following sections. Deprivation statistics for site-specific, local and national level are provided in **Table 22-6** (these statistics are not available at a regional level).

Table 22-6 2019 Health Deprivation Statistics (MHCLG, 2019c)

	Site-specific	Local	National
<i>Representative LSOA</i>	<i>Boston 009A</i>	<i>Boston average</i>	<i>England average</i>
For overall deprivation* where 1 is the most deprived LSOA/District	20,909	85	32,844 LSOAs 317 Districts
Relative deprivation by neighbourhoods in England**	Among the 40 % least deprived LSOAs	Among the 30 % most deprived Districts	-
Income deprivation in children (IDACI)	24,072	105	32,844 LSOAs 317 Districts
Relative IDACI by neighbourhoods in England	Among the 30 % least deprived LSOAs	Among the 30 % most deprived Districts	-
Income deprivation in older people (IDAOPi)	17,817	89	32,844 LSOAs 317 Districts

	Site-specific	Local	National
<i>Representative LSOA</i>	<i>Boston 009A</i>	<i>Boston average</i>	<i>England average</i>
Relative IDAOPI by neighbourhoods in England	Among the 50 % least deprived LSOAs	Among the 30 % most deprived Districts	-
<p>*IMD is an overall relative measure of deprivation constructed by combining seven domains of deprivation according to their respective weights:</p> <ol style="list-style-type: none"> 1. Income Deprivation (22.5 %) 2. Employment Deprivation (22.5 %) 3. Education, Skills and Training Deprivation (13.5 %) 4. Health Deprivation and Disability (13.5 %) 5. Crime (9.3 %) 6. Barriers to Housing and Services (9.3 %) 7. Living Environment Deprivation (9.3 %) 			

22.6.13 For overall deprivation, the site-specific LSOA is among the 40 % least deprived LSOAs, IDACI and IDAOPI are among the 30 % and 50 % least deprived LSOAs respectively. The district of Boston is more deprived in comparison to the site-specific level. 13 of the 36 LSOAs within the Boston District are within the 50 % least deprived, therefore the remaining 23 LSOAs are within the 50 % most deprived LSOAs (MHCLG, 2019c).

22.6.14 While Boston has a higher deprivation score than nationally (23.0 and 21.7 respectively), the deprivation score for Boston has improved since the IMD 2015 (23.0 and 24.4 in 2019 and 2015 respectively), which is a better improvement than in Lincolnshire (20.3 and 20.6 in 2019 and 2015 respectively) and nationally (21.7 and 21.8 in 2019 and 2015 respectively) (**Table A22.1-2, Appendix 22.1**).

Topic 1: Outdoor Amenity (i.e. Physical Activity and Access to Biodiversity)

22.6.15 As stated in **Table 22-5**, potential effects to limit or reduce physical activity and access to biodiversity are considered at site-specific (i.e. Boston LSOA 009A) and local (i.e. Boston District) levels. Baseline data are discussed accordingly, including reference to regional indicators as appropriate. The human health baseline relevant to this topic is provided in **Appendix 22.1**.

22.6.16 The Principal Application Site is predominantly disused agricultural land, with areas of non-agricultural land use where soils have been stripped during the development of the adjacent environs.

22.6.17 On a site-specific level, the proportion of people reporting their health as very good or good is similar to the national average and higher than the local and regional averages. The proportion of people reporting their day-to-day activities

as not limited or limited a little is similar at site-specific level to the local/regional/national average (**Table A22.1-1, Appendix 22.1**).

22.6.18 At a local level (i.e. Boston), there are a lower proportion of physically active adults (58.3 %) than at a regional (64.8 % in Lincolnshire and 66.4 % in the East Midlands) and national (67.2 %) level, this is consistent with an ageing/older population. However, the proportion of active children/young adults is similar (47.0 %) to the national (46.8 %) average, but slightly lower than the regional (50.6 % in Lincolnshire and 47.9 % in the East Midlands) averages. The proportion of people using outdoor space for exercise/health reasons is higher in Lincolnshire (19 %) than in the East Midlands (18.5 %) or nationally (17.9 %) (this statistic is not available at the local level) (**Table A22.1-2, Appendix 22.1**), while the percentage of people in Lincolnshire (aged over 16) with a sports club membership is lower than nationally (19.4 % and 22.0 %), but this may be as a result of access to these type of facilities.

22.6.19 The representative population considered in this assessment is among the 40 % least deprived LSOAs. However as a result of a larger proportion of Boston LSOAs falling within the 50 % most deprived districts (i.e. 23 of the 36 Boston LSOAs are among the 50 % most deprived districts), Boston as a district is among the 30 % most deprived districts (see **Table 22-6**). The proportion of people with access to a car (or van) at a site-specific level is much higher (90 %) than local (79 %), regional (78 %) and national (74 %) level (**Table A22.1-1, Appendix 22.1**), which would allow them to access wider physical activity opportunities.

Topic 2: Journey Times, Reduced Access and/or Safety

22.6.20 The environmental baseline for traffic and transport is provided in **Chapter 19 Traffic and Transport**. As stated in **Table 22-5**, potential effects to journey times, reduced access and/or safety are considered at site-specific and local levels. Baseline data are discussed accordingly, including reference to regional indicators as appropriate. The human health baseline relevant to this topic is provided in **Appendix 22.1**.

22.6.21 On average, populations at the site-specific and local level travel a shorter distance to work (12.1 km and 13.4 km respectively) than the regional (15.4 km) and national (14.9 km) average distances (**Table A22.1-1, Appendix 22.1**). The proportion of people killed or seriously injured (KSI) on roads at a local level is higher than both the regional and national average, and the local populations access to health assets is similar to the national average and better than the regional average (**Table A22.1-2, Appendix 22.1**). Lower proportions of people in Boston walk to work (at least three days a week) than nationally (16.4 % and

23.1 % respectively), however, a slightly higher proportion of people cycle to work (at least three days a week) than nationally (4.4 % and 3.2 % respectively).

Topic 3: Air Quality

22.6.22 Air pollution can have adverse effects on the health of humans. Poor air quality is the largest environmental risk to public health in the UK. Long-term exposure to poor air quality can result in reduction in life expectancies, predominantly due to cardiovascular and respiratory disease and lung cancer. Short-term exposure can result in effects on lung function, exacerbation of asthma, increases in respiratory and cardiovascular hospital admissions and mortality (PHE, 2018).

22.6.23 The environmental baseline for air quality is provided in **Chapter 14 Air Quality**. As stated in **Table 22-5**, air quality effects are considered at a site-specific and local level. Baseline data are discussed accordingly, including reference to local and regional indicators as appropriate. The human health baseline relevant to this topic is provided in **Appendix 22.1**.

22.6.24 People who spend extended periods of time at home may experience greater exposure duration (to air pollutants associated with the Facility) than those who are absent during normal working hours. Baseline environment data show that at a site-specific (and local) level, less people work mainly at or from home in comparison to the national average (4 % in comparison to 9 %), and the estimated population aged over 65 is slightly higher at a local level (mid-2019 population estimate: 21 %) compared to the national level (mid-2019 population estimates: 18 %) (only mid-2018 estimates were available at a site-specific level which was the same as the mid-2019 national level population estimate (18 %)). At a site-specific level, a smaller proportion of household have one person with a long-term health problem or disability (22 %) than at a regional or national level (both 26 %), however, a greater number of households have dependent children (34 %) than locally, regionally or nationally (28 %, 29 % and 29 % respectively) (**Table A22.1-1, Appendix 22.1**).

22.6.25 The fraction of mortality attributed to particulate air pollution in Boston (5.1 %) is similar to that of Lincolnshire (5.0 %), the East Midlands (4.9 %) and England (5.2 %). Background air quality concentrations of PM_{2.5} in Boston are “*well below*” (i.e. less than 75 % of) the UK air quality fine particulate matter (PM_{2.5}) target value or 25 µg.m⁻³, at 8.5 µg.m⁻³ (**Table A22.1-2, Appendix 22.1**), however, two statutory designated Air Quality Management Areas (AQMAs) (Haven Bridge and Bargate Bridge AQMAs) have been declared in Boston by BBC for exceedances of the annual mean air quality Objective for nitrogen dioxide (NO₂).

Topic 4: Noise

22.6.26 The environmental baseline for noise is provided in **Chapter 10 Noise and Vibration**. The baseline and assessment for noise takes account of the existing rural and industrial nature of much of the surrounding environment. As stated in **Table 22-5**, noise effects are considered at a site-specific level. Baseline data are discussed accordingly, including reference to local and regional indicators as appropriate. The human health baseline relevant to this topic is provided in **Appendix 22.1**. As for air quality, people who spend extended periods at home may experience greater exposure duration (to Facility-related noise) than those who are absent during normal working hours, therefore some of the information provided in the section above is also of relevance to noise.

22.6.27 The following measure indicators that are available for noise effects are not available at site-specific level, therefore, the regional level (i.e. Lincolnshire) was considered to be representative. Rates of complaints about noise (per 1,000 people) in Boston were significantly less (4.3) than nationally (6.8) (**Table A22.1-2, Appendix 22.1**). The indicator for day-time exposure to road, rail and air transport noise of 65 dB(A) or more during the daytime indicates that only 2.4 % of people at a regional level are exposed, which is less than half the proportion of people exposed at the national (5.5 %) level. The indicator for night-time exposure to road, rail and air transport noise of 55 dB(A) or more indicates that 3.3 % of people at a regional level are exposed, also much lower than the 8.5 % of people who are exposed at the national level (**Table A22.1-2, Appendix 22.1**).

Topic 5: Ground and/or Water Contamination

22.6.28 The environmental baseline for ground conditions and water contamination is provided in **Chapter 11 Contaminated Land, Land Use and Hydrogeology** and **Chapter 13 Surface Water, Flood Risk and Drainage Strategy**, respectively. The human health baseline relevant to this topic is provided in **Appendix 22.1**.

22.6.29 The potential for ground disturbance of historic contamination or new spills of pollutants (such as fuel or oil) to affect communities is dependent on proximity and behavioural exposure influences. This may include use of bathing waters or encountering in situ or mobilised contamination (dust or aerosols) whilst in the outdoor environment.

22.6.30 Children are more vulnerable to water contamination compared to adults as, in proportion to their body weight, they would ingest comparatively more contaminant than adults. Thus, the proportion of the population who are children and the overall population density is considered.

22.6.31 The proportion of the population at the site-specific level who are under the age of 16 (20 %) is slightly higher than at the local (18 %), regional (18 %) and national (19 %) levels and the mid-2018 population estimate continues to show that the densities at the site-specific level (22 %) are higher than the local, regional and national (all 19 %) levels. The population density (persons per hectare) is higher at the site-specific level (9.5) than at the local (1.8), regional (2.9) and national (4.1) levels (**Table A22.1-1, Appendix 22.1**).

Topic 6: Climate Change and Flood Risk

22.6.32 The environmental baseline for climate change and flood risk are provided in **Chapter 21 Climate Change** and **Chapter 13 Surface Water, Flood Risk and Drainage Strategy** respectively. As stated in **Table 22-5**, effects are considered at a site-specific and local level. The human health baseline relevant to this topic is provided in **Appendix 22.1**.

22.6.33 As detailed in **Chapter 21 Climate Change**, carbon dioxide (CO₂) emissions from the BBC region in 2018 contributed to less than 0.1 % towards the UK's total. Transport was the largest contributing sector to greenhouse gas (GHG) emissions within the Boston region in 2018 (with 38 % of total emissions), with the domestic and 'industrial and commercial' sectors contributing to 32 % and 30 % respectively of total GHG emissions.

22.6.34 As detailed in **Chapter 13 Surface Water, Flood Risk and Drainage Strategy**, the primary source of flooding that may affect the Principal Application Site is from tidal flooding, with a minimal risk of surface water flooding. The population density (persons per hectare) is higher at the site-specific level (9.5) than at the local (1.8), regional (2.9) and national (4.1) levels (**Table A22.1-1, Appendix 22.1**).

Topic 7: Employment and Education

22.6.35 The environmental baseline for this topic is provided in **Chapter 20 Socio-Economics**. As stated in **Table 22-5**, effects are considered at the local and GLLEP area level. Baseline data are discussed accordingly, including reference to local or regional indicators as appropriate. The human health baseline relevant to this topic is provided in **Appendix 22.1**.

22.6.36 There are a larger proportion of people (aged between 16 and 64) in employment in Boston (78.2 %), compared to regional (76.1 %) and national (75.6 %) averages. Average GCSE attainment is lower (41.8 %) in Boston than the regional (45.8 %) and national (46.9 %) averages (in 2018/2019), while the proportion of 16-17 year olds not in education, employment or training (NEET) in Lincolnshire (statistic not available for Boston) is the same as the national average (both 5.5

%) (**Table A22.1-2, Appendix 22.1**). A lower proportion of people have higher level of qualifications (i.e. level 3 and level 4 qualifications) at the site-specific (10 % and 17 % respectively) and local (9 % and 15 % respectively) level compared with the national average (15 % and 33 % respectively), however, a higher proportion of people are skilled in manual occupations (27 %, 26 % and 22 % for site-specific, local and national level respectively) (**Table A22.1-1, Appendix 22.1**).

22.6.37 In terms of the gender pay gap, the local average (3.8 %) is better than the regional (14.1 % in Lincolnshire and 19.2 % in East Midlands) and national (18.8 %) averages. It is worth noting that the Boston district has the smallest gender pay gap in the East Midlands (PHE, 2020c). The proportion of children (under 16) living in low income families is much lower (14.6 %) than regionally (16.3 % and 16.6 % in Lincolnshire and East Midlands respectively) and nationally (17.0 %).

22.6.38 A slightly higher proportion of people in Boston (12.0 %) are living in fuel poverty than nationally (10.3 %), and the excess winter deaths index is higher than the national average (46.1 % and 30.1 % respectively). Rates of statutory homelessness in Boston (per 1,000 people) is similar (0.73) to the national rate (0.79) (**Table A22.1-2, Appendix 22.1**).

22.7 Potential Impacts

Embedded Mitigation

22.7.1 Any embedded mitigation measures discussed in other ES chapters relevant to this HIA will also apply to the HIA and these are provided in the text below, where impacts are assessed.

Potential Impacts during Construction

22.7.2 This section outlines the potential effects on health during the construction of the Facility. The following sections discuss potential impacts that have been scoped into assessments for the relevant ES technical chapters, unless otherwise stated.

22.7.3 In the tables presented in the following sections, the 'Sensitivity of general population and vulnerable groups' detailed is regarded as the most conservative sensitivity (i.e. worst case), unless otherwise stated.

22.7.4 Further detail on the temporal scope (construction timeframes, etc. is provided in **Chapter 5 Project Description**). The sensitivity and magnitude is determined based on the method detailed in **Section 22.4**, with significance informed by guide questions in **Table 22-4**.

Impact 1: Outdoor Amenity (i.e. Physical Activity and Accessed to Biodiversity) Effects

- 22.7.5 Outdoor amenity has been considered as there is the potential for physical activity to be affected, through the closure of Public Rights of Way (PRoW), and the potential for people's access to biodiversity. Further information relating to these topics can be found in **Chapter 19 Traffic and Transport**, **Chapter 12 Terrestrial Ecology** and **Chapter 17 Marine and Coastal Ecology**, respectively.
- 22.7.6 Sections Bost/14/4, Bost/14/5 and Bost/14/10 of the Boston Public Footpath no. 14 would be permanently closed during construction. The closure would also affect the England Coast Path route, which follows these footpaths, as does the Macmillan Way (which follows a series of interconnected footpaths between Boston and Dorset). The diversion for these route closures would follow the route of an existing footpath, which follows the route of Roman Bank (also known as 'Sea Bank') along footpath sections Bost/14/11 and Bost/14/9. See **Chapter 5 Project Description**, **Figure 5.3** which shows the footpath network and identifies the footpath sections to be closed.
- 22.7.7 People's access to terrestrial biodiversity could potentially be impacted during construction through habitat loss at the Principal Application Site and potential impact on species (e.g. badgers, water voles, otters, bats, reptiles, birds and terrestrial invertebrates). People's access to marine biodiversity could also be impacted as a result of the potential for loss of and/or change to estuarine habitats and associated marine species within the footprint of the wharf and dredging area. However, material removed will be restricted to a minimum and the design of the quay wall and wharf has been set to minimise the volume of capital dredging required.
- 22.7.8 The relevant population groups considered in the assessment, due to proximity or sensitivity, were site-specific, local and vulnerable (children and young people, older people, people with existing poor health and groups who regularly use the affected areas for leisure and exercise).
- 22.7.9 The key health outcomes relevant to outdoor amenity, and therefore physical activity, as a determinant of health are physical health conditions (e.g. cardiovascular health) and mental health conditions (e.g. stress, anxiety and depression) associated with levels of physical activity and obesity and these were taken into consideration in the assessment provided in **Table 22-7**.
- 22.7.10 **Table 22-7** outlines the health assessment with respect to potential outdoor amenity effects and includes a summary of the conclusions of the assessment on PRoW. Based on the methods described in **Section 22.4**, using professional

judgement to assign sensitivity, magnitude and significance (in accordance with **Tables 22.2, 22.3 and 22.4**) there is a plausible source-pathway-receptor relationship, as follows:

- The source is construction activity and vehicles/plant operations and/or disturbance to outdoor amenity;
- The pathway is the perceived change in outdoor amenity; and
- The receptors are people who use the area (e.g. users of the PRow), resulting in a lower level of active travel or outdoor recreation.

Table 22-7 Potential Outdoor Amenity (i.e. Physical Activity and Access to Biodiversity) Effects on Health (during Construction)

Temporal Scope	Likelihood	Sensitivity of general population and vulnerable groups	Magnitude	Significance
<p>Sections of the Boston Public Footpath No.14 will be closed permanently, therefore the temporal scope is long term.</p>	<p>Conclusion of Chapter 19 Traffic and Transport:</p> <ul style="list-style-type: none"> Minor adverse residual effect (i.e. not significant in EIA terms) on PRoW closure, once appropriate mitigation (detailed in Chapter 19) is applied <p>Conclusion of Chapter 12 Terrestrial Ecology (with the implementation of appropriate mitigation as detailed in Chapter 12):</p> <ul style="list-style-type: none"> No impacts to badgers, water voles or otters. Minor adverse (i.e. not significant in EIA terms) residual effect on statutory and non-statutory designated sites (acid/nitrogen deposition), habitats, reptiles, bird populations and terrestrial invertebrates. Minor adverse residual effect to foraging and commuting bats. <p>Conclusion of Chapter 17 Marine and Coastal Ecology</p>	<p>Low sensitivity, based on:</p> <ul style="list-style-type: none"> <u>Inequalities</u>: at the site-specific level, more households have access to a vehicle, than the local, regional and national level, which indicates the ability to access alternative physical activity or biodiversity. <u>Deprivation</u>: Boston 009A LSOA is among the 40 % least deprived LSOAs, however, locally Boston is among the 30 % most deprived Districts (Table 22-6). <u>Health status</u>: local activity levels in adults are lower than the regional and national averages, however a higher proportion of people use outdoor spaces for exercise/health reasons regionally than nationally. The proportion of active 	<p>Medium magnitude, based on:</p> <ul style="list-style-type: none"> <u>Severity</u>: The Residual effect on PRoW, habitats (including some marine habitats), reptiles, bird populations, terrestrial invertebrates and harbour seal haul out sites is of minor adverse significance (i.e. not significant in EIA terms). Mitigation measures to mitigate the potential impact on bats are detailed in Chapter 12. <u>Extent</u>: effects would be localised and experienced by users of the 	<p>Not significant, based on:</p> <ul style="list-style-type: none"> <u>Baseline conditions</u>: The Principal Application Site is disused agricultural land, within an area allocated for industrial development. At a site-specific level, more people have access to a vehicle and therefore the ability to access alternative outdoor amenities. <u>Sensitivity/magnitude</u>: the sensitivity of the population is considered low, and magnitude is characterised as medium. <u>Health priorities</u>: ‘physical activity’ is one of the health priorities identified in the Joint Health and Wellbeing Strategy for Lincolnshire, listed in Paragraph 22.6.11. The diversion proposed for the closure of the PRoW has been agreed with Lincolnshire County Council and the diversion proposed will mean physical activity is not being prevented by the Facility. <u>Consultation responses</u>: permanent closures have been discussed and agreed with LCC and Natural England, as well as the England Coast Path team and the Macmillan Trust were contacted and consulted on the diversion route and footpath strategy

Temporal Scope	Likelihood	Sensitivity of general population and vulnerable groups	Magnitude	Significance
	<p>(with the implementation of appropriate mitigation as detailed in Chapter 17):</p> <ul style="list-style-type: none"> Minor adverse (i.e. not significant in EIA terms) residual effects on the 'loss and/or change to estuarine habitats and associated species within the footprint of the wharf and dredging area' and 'disturbance at harbour seal haul-out sites' 	<p>children and young adults is similar to the national average.</p> <ul style="list-style-type: none"> <u>Life stage</u>: population demographics indicate a higher proportion of people aged under 16 at a site-specific level compared to the national average, however, locally in Boston, there is a higher proportion of people aged over 65 than nationally. 	<p>recreational assets.</p> <ul style="list-style-type: none"> <u>Frequency and reversibility</u>: any potential impacts would be long term; however, this route will be permanently diverted to follow the route of an existing footpath, along sections Bost/14/11 and Bost/14/9. A fenced public footbridge will be provided across the existing gap in the Roman Bank, which will allow for increased pedestrian safety. Again, mitigation of potential biodiversity impacts is detailed in Chapter 12 and Chapter 17 respectively. 	<p>respectively. See Table 12-3 of Chapter 12, Table 17-2 of Chapter 17 and Table 19-3 of Chapter 19 for further consultation responses.</p> <ul style="list-style-type: none"> <u>Regulatory standards (if appropriate)</u>: there are no relevant regulatory standards. <u>Policy context</u>: in line with NPS EN-1 (DECC, 2011a), it is considered the Facility (based on the assessment in Chapter 19 Traffic and Transport) has avoided significant impacts for obstruction to recreational activities, has proposed mitigation in place where impacts are predicted, and will put in place measures to effectively manage and control the closure/diversion.

Impact 2: Journey Times, Reduced Access and/or Safety Effects

22.7.11 During construction, there is the potential for journey times, access and/or safety to be temporarily affected by an increase in the number of Heavy Good Vehicles (HGVs) or employee vehicles on the road and temporary traffic management at certain locations. These have the potential to lead to temporary delays and temporarily reduce access to local services. Full details of the traffic assessment are provided in **Chapter 19 Traffic and Transport**.

22.7.12 The relevant population groups considered in the assessment, due to proximity or sensitivity, are site-specific, local and vulnerable (people living in deprived areas, older people and people with existing poor health).

22.7.13 Travelling to, or accessing health care, underpins management of illness or injury. The key health outcomes relevant to this topic as a determinant of health are:

- Emergency response times; or
- Non-emergency treatment outcomes associated with delays; or
- Non-attendance caused by increase traffic and journey times arising from the Facility construction activities.

22.7.14 These health outcomes were taken into consideration in the assessment presented in **Table 22-8**.

22.7.15 **Table 22-8** outlines the health assessment with respect to potential journey times, access and/or safety effects. Based on the methods described in **Section 22.4**, there is a plausible source-pathway-receptor relationship, as follows:

- The source relates to the potential for increased temporary traffic disturbance locally, as a result of an increased number of vehicles on the road network;
- The pathway is journey times, accessibility to amenities/services (particularly healthcare, both emergency and non-emergency) or road safety; and
- The receptors are local road users.

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

22.7.17 Design updates to the Facility since consultation on the Preliminary Environmental Impact Assessment in June – August 2019 have reduced the number of traffic movements during construction (e.g. installation of a concrete batching plant on-site, aggregate brought in via ship, etc.) (see **Chapter 5 Project Description**).

22.7.18 A Construction Traffic Management Plan (CTMP) sets out the standards and procedures for managing the impact of HGV traffic during construction (as identified in **Chapter 19 Traffic and Transport**) and is secured by a requirement of the DCO (document reference 2.1). An Outline CTMP (document reference 7.2) forms part of the DCO application.

Table 22-8 Potential Journey Time, Reduced Access and/or Safety Effects on Health (during Construction)

Temporal Scope	Likelihood	Sensitivity of general population and vulnerable groups	Magnitude	Significance
Construction of the Facility will be medium term (i.e. no more than 48 months).	<p>Conclusion of Chapter 19 Traffic and Transport:</p> <ul style="list-style-type: none"> As a worst-case scenario, minor adverse (i.e. not significant in EIA terms) residual effects on pedestrian severance and amenity, road safety and driver delay 	<p>Medium sensitivity, based on:</p> <ul style="list-style-type: none"> <u>Inequalities</u>: at the site-specific level, more households have access to a vehicle, than the local, regional and national level. The KSI rate in Boston is higher than the national average. <u>Deprivation</u>: Boston 009A LSOA is among the 40 % least deprived LSOAs, however, locally Boston is among the 30 % most deprived Districts (Table 22-6). <u>Health status</u>: life expectancy of males and females in Boston is lower than the national average. Health of people is varied but is generally the same as nationally. A lower proportion of households report one person with a long-term disability or health problem at a site-specific level than nationally. <u>Life stage</u>: population demographics indicate a higher proportion of people aged under 16 at a site-specific level compared to the national average, however, locally in Boston, there are a higher proportion of people aged over 65 than nationally. 	<p>Small magnitude, based on:</p> <ul style="list-style-type: none"> <u>Severity</u>: residual effects are of a minor adverse significance (i.e. not significant in EIA terms) at worst. <u>Extent</u>: effects would be localised and mitigated as identified in Chapter 19 Traffic and Transport. <u>Frequency</u>: medium term. <u>Reversibility</u>: effects related to construction of the Facility would end once construction is completed. 	<p>Not significant, based on:</p> <ul style="list-style-type: none"> <u>Baseline conditions</u>: more households have access to a car (site-specific level), and locally the KSI rate is higher than nationally. <u>Sensitivity/magnitude</u>: the sensitivity of the population is considered medium, but magnitude is characterised as small. <u>Health priorities</u>: ability to travel to or access healthcare is important for maintaining health and wellbeing. The Facility will have a not significant effect on pedestrian severance and amenity, road safety and driver delay, thus will not cause a significant adverse effect on people's ability to travel or access healthcare. <u>Consultation responses</u>: see Table 19-3 of Chapter 19 <u>Regulatory standards (if appropriate)</u>: there are no relevant regulatory standards with regard increased traffic delaying access to health services. Regulatory standards with regard traffic impacts in general are detailed in Chapter 19 Traffic and Transport. <u>Policy context</u>: in line with NPS EN-1 (DECC, 2011a), it is considered the Facility (based on the assessment in Chapter 19 Traffic and Transport) has avoided significant impacts for obstruction to health services. Chapter 19 has proposed mitigation in place where impacts are predicted and will put in place measures to effectively manage and control temporary obstruction.

Impact 3: Air Quality Effects

22.7.19 **Chapter 14 Air Quality** details the air quality assessment and has provided the results for this assessment.

22.7.20 The relevant population groups considered in the assessment, due to proximity or sensitivity, were site-specific, local and vulnerable (children and young people, older people and people with existing poor health).

22.7.21 The key health outcomes relevant to air quality as a determinant of health are:

- Increased risk of cardiovascular diseases; and
- Exacerbation of asthma and other pre-existing respiratory conditions.

22.7.22 These key health outcomes were taken into consideration in the assessment provided in **Table 22-9**.

22.7.23 **Table 22-9** outlines the health assessment with respect to potential air quality effects and summarises the conclusions of the air quality assessment. Based on the methods described in **Section 22.4**, there is a plausible source-pathway-receptor relationship, as follows:

- The sources of dust and particulates/emissions are excavated material and construction traffic or vessel exhaust emissions, respectively;
- The pathway is dispersion through air; and
- The receptors are communities of people.

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

Table 22-9 Potential Air Quality Effects on Health (during Construction)

Temporal Scope	Likelihood	Sensitivity of general population and vulnerable groups	Magnitude	Significance
<p>Construction of the Facility will be medium term (i.e. no more than 48 months), shipping vessel emission will be of short-medium term as vessels will only be used during construction for an 18-month period.</p>	<p>Conclusion of Chapter 14 Air Quality:</p> <ul style="list-style-type: none"> Construction dust and particulate matter residual effects were not significant Construction phase road traffic and vessel emission residual effects were minor adverse (i.e. not significant in EIA terms) Odour emissions from capital dredge residual effects were not significant 	<p>Medium sensitivity, based on:</p> <ul style="list-style-type: none"> Inequalities: two statutory designated AQMAs have been declared in Boston for exceedances of the annual mean air quality Objective for NO₂. Locally in Boston there are a higher proportion of people in employment (2018/19), compared to the national average, with a lower proportion of people reporting working from home. At a site-specific level, a lower proportion of household report having one person with a long-term health problem/disability than the national average, however, locally in Boston this proportion is similar to the national average. Deprivation: Boston 009A LSOA is among the 40 % least deprived LSOAs, however, locally Boston is among the 30 % most deprived Districts (Table 22-6). Health status: life expectancy of males and females in Boston is lower than the national average. Health of people is varied but is generally the same as nationally. The fraction of mortality attributed to particulate air pollution is similar locally to the national average. Life stage: population demographics indicate a higher proportion of people aged under 16 at a site-specific level compared to the national average, however, locally in Boston, there are a 	<p>Small magnitude, based on:</p> <ul style="list-style-type: none"> Severity: The Residual effect on localised air quality as a result of construction is not significant. Extent: effects would be localised. Mitigation measures for dust will be detailed in an outline CoCP and mitigation of any traffic related effects is identified in Chapter 19 Traffic and Transport. Frequency: short to medium term. Reversibility: effects related to construction of the Facility would end one construction is completed. 	<p>Not significant, based on:</p> <ul style="list-style-type: none"> Baseline conditions: two AQMAs are declared in Boston, but a lower proportion of people work from home locally than nationally and the fraction of deaths attributed to particulate air pollution is similar to the national average. Sensitivity/magnitude: the sensitivity of the population is considered medium, but magnitude is expected to be small (i.e. short to medium term, localised and fully reversible). Consultation responses: the air quality assessment methodology was agreed with the relevant stakeholders (see Section 14.3 of Chapter 14 Air Quality). Regulatory standards (if appropriate): Compliance with regulatory standards is detailed in Chapter 14 Air Quality. Policy context: in line with NPS EN-1 (DECC, 2011a), it is considered the Facility (based on the assessment in Chapter 14 Air Quality) has avoided significant impacts for dust, vehicle and vessel emissions, has proposed mitigation in place

Temporal Scope	Likelihood	Sensitivity of general population and vulnerable groups	Magnitude	Significance
		higher proportion of people aged over 65 than nationally.		where impacts are predicted, and will put in place measures to effectively manage and control temporary dust and emissions.

Impact 4: Noise Effects

22.7.25 **Chapter 10 Noise and Vibration** details the noise assessment and has provided the results for this assessment.

22.7.26 The relevant population groups considered in the assessment, due to proximity or sensitivity, were site-specific and vulnerable (children and young people, older people and people with existing poor health).

22.7.27 The key health outcomes relevant to noise as a determinant of health are:

- Cardiovascular health (as a result of chronic noise effects);
- Mental health (including stress, anxiety or depression as a result of chronic noise effect); and
- Cognitive performance in children.

22.7.28 These key potential health outcomes were taken into consideration in the assessment provided in **Table 22-10**.

22.7.29 **Table 22-10** outlines the health assessment with respect to potential noise effects and summarises the conclusions of the noise assessment. Based on the methods described in **Section 22.4**, there is a plausible source-pathway-receptor relationship, as follows:

- The source is construction plant and operations;
- The pathway is noise transmission through the air; and
- The receptors are communities of people.

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

Table 22-10 Potential Noise Effects on Health (during Construction)

Temporal Scope	Likelihood	Sensitivity of general population and vulnerable groups	Magnitude	Significance
<p>Construction of the Facility will be medium term (i.e. no more than 48 months).</p>	<p>Conclusion of Chapter 10 Noise and Vibration:</p> <ul style="list-style-type: none"> Residual effect of increased noise on sensitive receptors from on-site construction and construction vibration was negligible (i.e. not significant in EIA terms). Residual effect of increased noise on sensitive receptors from off-site construction traffic was minor adverse (i.e. not significant in EIA terms). 	<p>Low sensitivity, based on:</p> <ul style="list-style-type: none"> Inequalities: locally in Boston there are a higher proportion of people in employment (2018/19), compared to the national average, with a lower proportion of people reporting working from home. At a site-specific level, a lower proportion of household report having one person with a long-term health problem/disability than the national average, however, locally in Boston this proportion is similar to the national average. Deprivation: Boston 009A LSOA is among the 40 % least deprived LSOAs, however, locally Boston is among the 30 % most deprived Districts (Table 22-6). Health status: life expectancy of males and females in Boston is lower than the national average. Health of people is varied but is generally the same as nationally. Life stage: population demographics indicate a higher proportion of people aged under 16 at a site-specific level compared to the national average, however, locally in Boston, there are a higher proportion of people aged over 65 than nationally. 	<p>Medium magnitude, based on:</p> <ul style="list-style-type: none"> Severity: The Residual effect on localised noise as a result of construction is not significant. Extent: effects would be localised and mitigated of any traffic related effects is identified in Chapter 19 Traffic and Transport. Frequency: short to medium term. Reversibility: effects related to construction of the Facility would end once construction is completed. 	<p>Not significant, based on:</p> <ul style="list-style-type: none"> Baseline conditions: a lower proportion of people work from home locally than nationally and rates of complaints about noise in Boston are significantly less than nationally. Sensitivity/magnitude: the sensitivity of the population is considered low, and the magnitude is expected to be medium. Health priorities: noise can impact on cardiovascular and mental health as well as cognitive performance in children. Consultation responses: the noise and vibration assessment methodology was discussed and agreed with BBC in a meeting in November 2018 (see Table 10.2 of Chapter 10 Noise and Vibration for further details). Regulatory standards (if appropriate): Compliance with regulatory standards is detailed in Chapter 10 Noise and Vibration. Policy context: in line with NPS EN-1 (DECC, 2011a), it is considered the Facility (based on the assessment in Chapter 10 Noise and Vibration) has avoided significant impacts for noise and vibration, has proposed mitigation in place where impacts are predicted, and will put in place measures to effectively manage and control temporary noise.

Impact 5: Ground and/or Water Contamination Effects

22.7.31 **Chapter 11 Contaminated Land, Land Use and Hydrogeology** and **Chapter 13 Surface Water, Flood Risk and Drainage Strategy** detail the land and water contamination assessments respectively, and these have provided the results for this assessment.

22.7.32 The relevant population groups considered in the assessment, due to proximity or sensitivity, were site-specific and vulnerable (children and young people, and people with existing poor health).

22.7.33 The key health outcomes (after assessment) relevant to ground/water contamination as a determinant of health are potential exposure associated with contaminated bathing water, and effects may relate to biological or chemical contaminants and these were taken into consideration in the assessment provided in **Table 22-11**.

22.7.34 **Table 22-11** outlines the health assessment with respect to potential land/water contamination effects and summarises the conclusions of the assessments. Based on the methods described in **Section 22.4**, there is a plausible, but unlikely, source-pathway-receptor relationship, as follows:

- The source the potential for increased water turbidity, accidental fuel spill, or mobilisation of historic contamination;
- The pathway would be mobilisation or remobilisation of contaminants into bathing waters or the air; and
- Receptors include users of watercourses.

22.7.35 The plausibility of the potential effect occurring largely depends on unusual conditions to make the source-pathway-receptor linkage. The sources relate to accidental releases of pollutants or the unexpected encountering of historic contamination in combination with a failure of the outlined mitigation measures (detailed in **Chapter 11 Contaminated Land, Land Use and Hydrogeology** and **Chapter 13 Surface Water, Flood Risk and Drainage Strategy**). Embedded mitigation is in place to ensure that the construction of the Facility will not lead to the release of contaminants or contaminated water into surface/groundwater bodies.

Table 22-11 Potential Land/Water Contamination Effects on Health (during Construction)

Temporal Scope	Likelihood	Sensitivity of general population and vulnerable groups	Magnitude	Significance
<p>Construction of the Facility will be medium term (i.e. no more than 48 months). Any impacts relating to shipping vessels will be short to medium term as vessels will only be used during construction for an 18-month period.</p>	<p>Conclusion of Chapter 11 Contaminated Land, Land Use and Hydrogeology:</p> <ul style="list-style-type: none"> Residual effect on human health, including construction workers and general public during any excavations and construction related activities was minor adverse (i.e. not significant in EIA terms). <p>Conclusion of Chapter 13 Surface Water, Flood Risk and Drainage Strategy:</p> <ul style="list-style-type: none"> Residual effect of all potential impacts was negligible (i.e. not significant) 	<p>Low sensitivity, based on:</p> <ul style="list-style-type: none"> <u>Inequalities</u>: population demographics indicate a higher proportion of people aged under 16 at a site-specific level compared to the national average. In Boston, fewer children live in low income families than the national average. <u>Deprivation</u>: Boston 009A LSOA is among the 40 % least deprived LSOAs, however, locally Boston is among the 30 % most deprived Districts (Table 22-6). <u>Health status</u>: the health of young people in Boston (i.e. prevalence of obesity in Year 6) is worse than both the regional and national averages, however, the proportion of physically active children and young people in Boston is similar to the national average. <u>Life stage</u>: there are more households with dependent children than the national average, suggesting a population with a high proportion of young people. <p>However, sensitivity is considered low due to the limited likelihood that people would interact with waterbodies for recreation purposes, due to the busy nature of The Haven, or be able to access the construction site.</p>	<p>Small magnitude, based on:</p> <ul style="list-style-type: none"> <u>Severity</u>: impacts were considered to be not significant. <u>Extent</u>: highly localised to the associated accidental spillage/historical contamination. <u>Frequency</u>: highly infrequent. <u>Reversibility</u>: in the event of a spillage, any material would be disposed of and any residual material is likely to be small and diluted in the water body. <u>Exposure</u>: low exposure by a very small population. 	<p>Not significant, based on:</p> <ul style="list-style-type: none"> <u>Baseline conditions</u>: greater levels of children live at the site-specific level than nationally, but fewer live in low income families in Boston than the national average. <u>Sensitivity/magnitude</u>: the sensitivity of population is considered medium and the magnitude is considered small (i.e. highly infrequent and low exposure by a very small population). <u>Consultation responses</u>: see Table 11-4 of Chapter 11 and Table 13-2 of Chapter 13. <u>Regulatory standards (if appropriate)</u>: Compliance with regulatory standards is detailed in Chapter 11 Contaminated Land, Land Use and Hydrogeology and Chapter 13 Surface Water, Flood Risk and Drainage Strategy. <u>Policy context</u>: in line with NPS EN-1 (DECC, 2011a), it is considered the Facility (based on the assessment in Chapter 11 Contaminated Land, Land Use and Hydrogeology and Chapter 13 Surface Water, Flood Risk and Drainage Strategy) has avoided significant impacts for contamination, has proposed mitigation in place where impacts are predicted, and will put in place measures to effectively manage and control contamination.

Impact 6: Climate Change and Flood Risk Effects

22.7.36 **Chapter 21 Climate Change** and **Chapter 13 Surface Water, Flood Risk and Drainage Strategy** detail the GHG and the flood risk assessments respectively and have provided the results for this assessment.

22.7.37 The relevant population groups considered in the assessment, due to proximity or sensitivity, were site-specific and vulnerable (old people, people living in deprived areas and people with existing poor health).

22.7.38 The key health outcomes relevant to climate change and flood risk as a determinant of health include heat related illnesses and respiratory infections and the potential risk to life, as a result of drowning and/or waterborne diseases. Flood damage to property and/or financial loss could also have impacts on mental health. These health outcomes were taken into consideration in the assessment provided in **Table 22-12**.

22.7.39 **Table 22-12** outlines the health assessment with respect to potential flood risk effects and summarises the conclusions of the assessments. Based on the methods described in **Section 22.4**, there is a plausible source-pathway-receptor relationship, as follows:

- The source is the potential for increased GHG emissions and flooding events;
- The pathway would be the atmosphere and flood water; and
- Receptors include people living near the Facility or in Boston.

Table 22-12 Potential Climate Change and Flood Risk Effects on Health (during Construction)

Temporal Scope	Likelihood	Sensitivity of general population and vulnerable groups	Magnitude	Significance
<p>Construction of the Facility will be medium term (i.e. no more than 48 months).</p>	<p>Conclusion of Chapter 21 Climate Change:</p> <ul style="list-style-type: none"> Not significant Residual effect as a result of GHG emissions during construction <p>Conclusion of Chapter 13 Surface Water, Flood Risk and Drainage Strategy:</p> <ul style="list-style-type: none"> Negligible Residual effect on changes to surface water runoff and flood risk 	<p>Low sensitivity, based on:</p> <ul style="list-style-type: none"> <u>Inequalities</u>: there is a higher density of people at a site-specific level, but a lower density locally, than nationally. <u>Deprivation</u>: Boston 009A LSOA is among the 40 % least deprived LSOAs, however, locally Boston is among the 30 % most deprived Districts (Table 22-6). <u>Health status</u>: life expectancy of males and females in Boston is lower than the national average. Health of people is varied but is generally the same as nationally. A lower proportion of household report on person with a long-term disability or health problem at a site-specific level than nationally. <u>Life stage</u>: population demographics indicate a higher proportion of people aged under 16 at a site-specific level compared to the national average, however, locally in Boston, there are a higher proportion of people aged over 65 than nationally. 	<p>Small magnitude, based on:</p> <ul style="list-style-type: none"> <u>Severity</u>: impacts were considered to be not significant. GHG emissions were not likely to represent a significant net CO₂ emissions contribution. <u>Extent and exposure</u>: flooding effects would be localised and experienced by people living within the tidal flood range of The Haven. <u>Frequency and reversibility</u>: any potential impacts would be short (flooding) to medium (climate change) term. However, flooding effects are unlikely as a result of the presence of primary defences which provide a 1 in 150-year standard of protection, and ongoing work as part of the Boston Combined Strategy will provide 1 in 300-year standard of protection from tidal flooding once complete. 	<p>Not significant, based on:</p> <ul style="list-style-type: none"> <u>Baseline conditions</u>: the primary source of flooding that may affect the Principal Application Site is tidal, however, the Site currently as a 1 in 150-year standard of protection and will eventually have a 1 in 300-year standard of protection once ongoing works are complete. <u>Sensitivity/magnitude</u>: the sensitivity is considered low and magnitude is considered small. <u>Consultation responses</u>: see Table 21-2 in Chapter 21 and Table 13-2 of Chapter 13 for further details. <u>Regulatory standards (if appropriate)</u>: Compliance with regulatory standards is detailed in Chapter 21 Climate Change and Chapter 13 Surface Water, Flood Risk and Drainage Strategy. <u>Policy context</u>: in line with NPS EN-1 (DECC, 2011a), it is considered the Facility (based on the assessment in Chapter 21 Climate Change and Chapter 13 Surface Water, Flood Risk and Drainage Strategy) has avoided significant impacts for GHG emissions and flooding, has proposed mitigation in place where impacts are predicted, and will put in place measures to effectively manage and control GHG emissions and flood risk.

Impact 7: Employment and Education Effects

22.7.40 **Chapter 20 Socio-Economics** details the socio-economic assessment, and this has provided the results for this assessment.

22.7.41 The population group relevant to this assessment, as a result of proximity or sensitivity, are the population of Boston and the GLLEP area.

22.7.42 **Table 22-13** outlines the health assessment with respect to potential employment and/or education effects and summarises the conclusions of the socio-economic assessment. Based on the methods described in **Section 22.4**, there is a likely source-pathway-receptor relationship, as follows:

- The source is direct, indirect and induced job creation due to construction of the Facility;
- The pathway is through employment and education; and
- The receptors are people of working age in the regional labour markets (and consequently their dependents).

Table 22-13 Potential Employment Effects on Health (during Construction)

Temporal Scope	Likelihood	Sensitivity of general population and vulnerable groups	Magnitude	Significance
Construction of the Facility will be medium term (i.e. no more than 48 months).	<p>Conclusion of Chapter 20 Socio-economics:</p> <ul style="list-style-type: none"> Residual effects range from negligible to moderate beneficial (for employment) 	<p>Medium sensitivity, based on:</p> <ul style="list-style-type: none"> <u>Inequalities and life stage</u>: the percentage of people aged 16-64 in employment is similar in Boston (78.2 %) and Lincolnshire (76.1 %) to nationally (75.6 %). In Lincolnshire, the proportion of 16-17 year old NEET is the same as nationally (5.5 %). <u>Deprivation</u>: Boston 009A LSOA is among the 40 % least deprived LSOAs, however, locally Boston is among the 30 % most deprived Districts (Table 22-6). In Boston, a higher proportion of people are living in fuel poverty and there are similar levels of statutory homelessness as nationally. <u>Health status</u>: life expectancy of males and females in Boston is lower than the national average. Health of people is varied but is generally the same as nationally. 	<p>Medium (beneficial) magnitude, based on:</p> <ul style="list-style-type: none"> <u>Severity</u>: Chapter 20 concluded that construction of the Facility would have moderate beneficial Residual effect on employment. <u>Extent</u>: there will be a large construction workforce, much of it will be drawn from local and regional resources. <u>Frequency</u>: medium term (years). <u>Reversibility</u>: benefits would be maintained, through knowledge and transferable skills gained. <u>Exposure</u>: the general exposure profile would be one of high exposure to a medium population due to direct or indirect employment and low exposure to a large population due to induced employment. 	<p>Not significant (or beneficial), based on:</p> <ul style="list-style-type: none"> <u>Baseline conditions</u>: there is a labour market that would benefit from increased demand for employment. <u>Sensitivity/magnitude</u>: the sensitivity of population is considered medium and the magnitude is considered medium (beneficial). <u>Health priorities</u>: overall improvements in socio-economic status associated with employment are likely to lead to improvements in general well-being. <u>Consultation responses</u>: see Table 20-1 in Chapter 20. <u>Regulatory standards (if appropriate)</u>: there are no relevant regulatory standards with regard to increased employment opportunities. <u>Policy context</u>: in line with NPS EN-1 (DECC, 2011a), it is considered the Facility has identified benefit from potential employment and proposes enhancement measures with the aim of retaining benefit in the regional economy.

Potential Impacts during Operation

Impact 1: Outdoor Amenity (i.e. Physical Activity and Access to Biodiversity) Effects

- 22.7.43 Outdoor amenity has been considered as there is the potential for physical activity to be affected, through the closure of PRoW, and the potential for people's access to biodiversity. Further information relating to these topics can be found in **Chapter 19 Traffic and Transport**, **Chapter 12 Terrestrial Ecology** and **Chapter 17 Marine and Coastal Ecology**, respectively.
- 22.7.44 Sections Bost/14/4, Bost/14/5 and Bost/14/10 of the Boston Public Footpath no. 14 would be permanently closed and diverted during operation. The closure would also affect the England Coast Path route, which follows these footpaths, as does the Macmillan Way (which follows a series of interconnected footpaths between Boston and Dorset). The diversion for these route closures would follow the route of an existing footpath, which follows the route of Roman Bank (also known as 'Sea Bank') along footpath sections Bost/14/11 and Bost/14/9. See **Chapter 5 Project Description, Figure 5.3** which shows the footpath network and identifies the footpath sections to be closed.
- 22.7.45 People's access to terrestrial biodiversity could potentially be impacted during operation as a result of disturbance to habitats and species from maintenance activities or disturbance to fauna from operational lighting and noise.
- 22.7.46 People's access to marine biodiversity could potentially be impacted as a result of habitat alteration due to hydrodynamic changes, changes in vessel traffic and movement leading to increased ship wash/underwater noise/disturbance/collision risk, increased levels of suspended sediments due to maintenance dredging, beaching of vessels at low tide and increased emissions to air and deposition on marine and estuarine habitats.
- 22.7.47 The relevant population groups considered in the assessment, due to proximity or sensitivity, were site-specific, local and vulnerable (children and young people, older people, people with existing poor health and groups who regularly use the affected areas for leisure and exercise).
- 22.7.48 The key health outcomes relevant to outdoor amenity, and therefore physical activity, as a determinant of health are physical health conditions (e.g. cardiovascular health) and mental health conditions (e.g. stress, anxiety and depression) associated with levels of physical activity and obesity. These were taken into consideration in the assessment provided in **Table 22-14**.

22.7.49 **Table 22-14** outlines the health assessment with respect to potential outdoor amenity effects and includes a summary the conclusions of the assessment on PRow and biodiversity. Based on the methods described in **Section 22.4**, there is a plausible source-pathway-receptor relationship, as follows:

- The source is operational activities and/or vehicles/plant operations increasing emissions and/or disturbance to outdoor amenity;
- The pathway is the perceived change in outdoor amenity; and
- The receptors are people who use the area (e.g. users of the PRow), resulting in a lower level of active travel or outdoor recreation.

Table 22-14 Potential Outdoor Amenity (i.e. Physical Activity and Access to Biodiversity) Effects on Health (during Operation)

Temporal Scope	Likelihood	Sensitivity of general population and vulnerable groups	Magnitude	Significance
<p>The temporal scope is long term as the Facility will be operational for decades.</p>	<p>Conclusion of Chapter 19 Traffic and Transport:</p> <ul style="list-style-type: none"> Minor adverse Residual effect on PRoW closures, once appropriate mitigation (detailed in Chapter 19) is applied (i.e. not significant in EIA terms) <p>Conclusion of Chapter 12 Terrestrial Ecology (with the implementation of appropriate mitigation as detailed in Chapter 12):</p> <ul style="list-style-type: none"> Minor adverse residual effects (i.e. not significant in EIA terms) for disturbance effects associated maintenance activities and disturbance to fauna from operational lighting and noise <p>Conclusion of Chapter 17 Marine and Coastal Ecology (with the implementation of appropriate mitigation as detailed in Chapter 17):</p>	<p>Low sensitivity, based on:</p> <ul style="list-style-type: none"> <u>Inequalities</u>: at the site-specific level, more households have access to a vehicle, than the local, regional and national level, which indicates the ability to access alternative outdoor amenities. <u>Deprivation</u>: Boston 009A LSOA is among the 40 % least deprived LSOAs, however, locally Boston is among the 30 % most deprived Districts (Table 22-6). <u>Health status</u>: local activity levels in adults are lower than the regional and national averages, however a higher proportion of people use outdoor spaces for exercise/health reasons regionally than nationally. The proportion of active children and young adults is similar to the national average. <u>Life stage</u>: population demographics indicate a 	<p>Medium magnitude, based on:</p> <ul style="list-style-type: none"> <u>Severity</u>: The Residual effect on PRoW and biodiversity is of minor adverse significance (i.e. not significant in EIA terms) as a worst case. <u>Extent</u>: effects would be localised and experienced by users of the recreational assets. <u>Frequency and reversibility</u>: any potential impacts would be long term; however, the PRoW route will be permanently diverted to follow the route of an existing footpath, along sections Bost/14/11 and Bost/14/9. A fenced public footbridge will be provided across the existing gap in the Roman Bank, which will allow for increased pedestrian safety. 	<p>Not significant, based on:</p> <ul style="list-style-type: none"> <u>Baseline conditions</u>: at a site-specific level, more people have access to a vehicle and therefore the ability to access alternative outdoor amenities. <u>Sensitivity/magnitude</u>: the sensitivity of the population is considered low, and magnitude is characterised as small. <u>Health priorities</u>: 'physical activity' is one of the health priorities identified in the Joint Health and Wellbeing Strategy for Lincolnshire, listed in Paragraph 22.6.11. The Facility will not have a significant effect because of the alternative route for the PRoW, thus will not impact on people's physical activity. <u>Consultation responses</u>: permanent closures have been discussed and agreed with LCC and Natural England, for the England Coast Path team. The Macmillan Trust were contacted about the diversion route and footpath strategy.

Temporal Scope	Likelihood	Sensitivity of general population and vulnerable groups	Magnitude	Significance
	<ul style="list-style-type: none"> Minor adverse (i.e. not significant in EIA terms) residual effects as a worst case on marine biodiversity 	<p>higher proportion of people aged under 16 at a site-specific level compared to the national average, however, locally in Boston, there is a higher proportion of people aged over 65 than nationally.</p>		<ul style="list-style-type: none"> <u>Regulatory standards (if appropriate)</u>: there are no relevant regulatory standards. <u>Policy context</u>: in line with NPS EN-1 (DECC, 2011a), it is considered the Facility (based on the assessment in Chapter 19 Traffic and Transport) has avoided significant impacts for obstruction to recreational activities, has proposed mitigation in place where impacts are predicted, and will put in place measures to effectively manage and control the closure/diversion.

Impact 2: Journey Times, Reduced Access and/or Safety Effects

22.7.50 During operation, there is the potential for journey times, access and/or safety to be affected by an increase in the number of HGVs or employee vehicles on the road. These have the potential to lead to temporary delays and temporarily reduce access to local services. Full details of the traffic assessment are provided in **Chapter 19 Traffic and Transport**.

22.7.51 The relevant population groups considered in the assessment, due to proximity or sensitivity, are site-specific, local and vulnerable (people living in deprived areas, older people and people with existing poor health).

22.7.52 Travelling to, or accessing health care, underpins management of illness or injury. The key health outcomes relevant to this topic as a determinant of health are:

- Emergency response times; or
- Non-emergency treatment outcomes associated with delays; or
- Non-attendance caused by increase traffic and journey times arising from the Facility construction activities.

22.7.53 The above health outcomes were taken into consideration in the assessment provided in **Table 22-15**.

22.7.54 **Table 22-15** outlines the health assessment with respect to potential journey times, access and/or safety effects. Based on the methods described in **Section 22.4**, there is a plausible source-pathway-receptor relationship, as follows:

- The source relates to the potential for increased traffic disturbance locally, as a result of an increased number of vehicles on the road network;
- The pathway is journey times, accessibility to amenities/services (particularly healthcare, both emergency and non-emergency) or road safety; and
- The receptors are local road users.

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

22.7.56 Embedded mitigation as part of the design of the Facility includes a proposed new wharf which would allow ships to transport materials (i.e. RDF feedstock and sediment and clay (used in the LWA plant)) and significantly reduces the operational impact of the Facility on the local road network (see **Chapter 5 Project Description** for further details).

Table 22-15 Potential Journey Time, Reduced Access and/or Safety Effects on Health (during Operation)

Temporal Scope	Likelihood	Sensitivity of general population and vulnerable groups	Magnitude	Significance
Operation of the Facility will be long term (i.e. decades).	<p>Conclusion of Chapter 19 Traffic and Transport:</p> <ul style="list-style-type: none"> As a WCS, minor adverse (i.e. not significant in EIA terms) residual effects on road safety and driver delay. Negligible Residual effect on pedestrian severance and amenity. 	<p>Medium sensitivity, based on:</p> <ul style="list-style-type: none"> <u>Inequalities</u>: at the site-specific level, more households have access to a vehicle, than the local, regional and national level. The KSI rate in Boston is higher than the national average. <u>Deprivation</u>: Boston 009A LSOA is among the 40 % least deprived LSOAs, however, locally Boston is among the 30 % most deprived Districts (Table 22-6). <u>Health status</u>: life expectancy of males and females in Boston is lower than the national average. Health of people is varied but is generally the same as nationally. A lower proportion of household report on person with a long-term disability or health problem at a site-specific level than nationally. <u>Life stage</u>: population demographics indicate a higher proportion of people 	<p>Small magnitude, based on:</p> <ul style="list-style-type: none"> <u>Severity</u>: residual effects are of a minor adverse significance (i.e. not significant in EIA terms) at worst. <u>Extent</u>: effects would be localised and mitigated as identified in Chapter 19 Traffic and Transport. <u>Frequency</u>: long term. <u>Reversibility</u>: effects related to operation of the Facility would be permanent until decommissioning. 	<p>Not significant, based on:</p> <ul style="list-style-type: none"> <u>Baseline conditions</u>: more households have access to a vehicle (site-specific level) and the KSI rate is higher locally than nationally. <u>Sensitivity/magnitude</u>: the sensitivity of the population is considered medium, but magnitude is characterised as small. <u>Health priorities</u>: ability to travel to or access healthcare is important for maintaining health and wellbeing. The Facility will have a not significant effect on pedestrian severance and amenity, road safety and driver delay, thus will not impact on people's ability to travel or access healthcare. <u>Consultation responses</u>: see Table 19-3 in Chapter 19. <u>Regulatory standards (if appropriate)</u>: there are no relevant regulatory standards with regard increased traffic delaying access to health services. Regulatory standards with regard traffic impacts in general are detailed in Chapter 19 Traffic and Transport. <u>Policy context</u>: in line with NPS EN-1 (DECC, 2011a), it is considered the Facility (based on the assessment in Chapter 19 Traffic and Transport) has avoided significant impacts for obstruction

Temporal Scope	Likelihood	Sensitivity of general population and vulnerable groups	Magnitude	Significance
		aged under 16 at a site-specific level compared to the national average, however, locally in Boston, there are a higher proportion of people aged over 65 than nationally.		to health services. Chapter 19 has proposed mitigation in place where impacts are predicted and will put in place measures to effectively manage and control temporary obstruction.

Impact 3: Air Quality Effects

22.7.57 **Chapter 14 Air Quality** details the air quality assessment and has provided the results for this assessment.

22.7.58 The relevant population groups considered in the assessment, due to proximity or sensitivity, were site-specific, local and vulnerable (children and young people, older people and people with existing poor health).

22.7.59 The key health outcomes relevant to air quality as a determinant of health are:

- Increased risk of cardiovascular diseases; and
- Exacerbation of asthma and other pre-existing respiratory conditions.

22.7.60 These key health outcomes were taken into consideration in the assessment provided in **Table 22-16**.

22.7.61 **Table 22-16** outlines the health assessment with respect to potential air quality effects and summarises the conclusions of the air quality assessment. Based on the methods described in **Section 22.4**, there is a plausible source-pathway-receptor relationship, as follows:

- The sources are emissions from operational traffic, the Facility stacks and/or vessel exhaust emissions;
- The pathway is dispersion through air; and
- The receptors are communities of people.

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

22.7.63 As detailed in **Chapter 14 Air Quality** and summarised in **Table 22-16** below, it is anticipated that the requirements of NPS EN-3 have been met. This states that where a “*proposed waste combustion generating station meets the requirements of the WID [now contained in the Industrial Emission Directive (IED)] and will not exceed the local air quality standards*”, the Secretary of State “*should regard the proposed waste generating station as having no adverse impacts on health*”. All pollutants were below the relevant standards, with the exception of (hexavalent) Cr(VI), which exceeded the Environmental Assessment Level (EAL). However, this is caused by a high local background concentration and the contribution of Cr(VI) from the Facility is predicted to be small (see **Chapter 14 Air Quality** for more details and further discussion).

- 22.7.64 In response to the comment received from BBC on air quality (specifically dioxins) and crops (see **Table 22-1**), dioxins uptake is the primary issue of concern with regard to crops. BAT-AELs for energy from waste (EfW) plants are set at very stringent levels for these substances in order to protect human health and EfW plants in the UK are very minor sources of these emissions.
- 22.7.65 The predominant human exposure route for dioxins is through ingestion of food, rather than by inhalation, and 90 % of the exposure through the food chain comes from meat, dairy and fish, with the remainder largely from water, vegetables and soil. Dioxin emissions have decreased by 87% from 1990 to 2018 (National Atmospheric Emissions Inventory (NAEI), 2020) and the World Health Organisation (WHO) do not recommend air quality guidelines for dioxins as direct inhalation is only a small proportion of total exposure, “*generally less than 5% of the daily intake from food*” (WHO, 2000). Therefore, the exposure of the population to dioxins emitted from the Facility is considered unlikely, therefore the effect will be negligible and not significant.”
- 22.7.66 Embedded mitigation in the design of the Facility have mitigated many potential air quality effects. These include constructing higher stacks to achieve better dispersion of air emissions (i.e. stack sensitivity analysis) and stringent emission limit values (i.e. BAT-Associated Emission Levels) which industrial installations (including waste incineration plants) are required to meet.

Table 22-16 Potential Air Quality Effects on Health (during Operation)

Temporal Scope	Likelihood	Sensitivity of general population and vulnerable groups	Magnitude	Significance
Operation of the Facility will be long term (i.e. decades).	<p>Conclusion of Chapter 14 Air Quality:</p> <ul style="list-style-type: none"> Residual effects from stack, road traffic and vessel emissions were minor adverse (i.e. not significant in EIA terms) Residual effects from odour emission from RDF processing were not significant 	<p>Low sensitivity, based on:</p> <ul style="list-style-type: none"> Inequalities: locally in Boston there are a higher proportion of people in employment (2018/19), compared to the national average, with a lower proportion of people reporting working from home. At a site-specific level, a lower proportion of household report having one person with a long-term health problem/disability than the national average, however, locally in Boston this proportion is similar to the national average. Deprivation: Boston 009A LSOA is among the 40 % least deprived LSOAs, however, locally Boston is among the 30 % most deprived Districts (Table 22-6). Health status: life expectancy of males and females in Boston is lower than the national average. Health of people is varied but is generally the same as nationally. The fraction of mortality attributed to particulate air pollution is similar locally to the national average. Life stage: population demographics indicate a higher proportion of people aged under 16 at a site-specific level compared to the national average, however, locally in Boston, there are a higher proportion of people aged over 65 than nationally. 	<p>Medium magnitude, based on:</p> <ul style="list-style-type: none"> Severity: The Residual effect on localised air quality as a result of operation is not significant. Extent: effects would be localised and mitigated of any traffic related effects is identified in Chapter 19 Traffic and Transport. Frequency and reversibility: long term and permanent. 	<p>Not significant, based on:</p> <ul style="list-style-type: none"> Baseline conditions: a lower proportion of people work from home locally than nationally and the health of people is varied but generally the same as nationally. Sensitivity/magnitude: the sensitivity of the population is considered low and magnitude is considered medium. Consultation responses: the air quality assessment methodology was agreed with the relevant stakeholders (see Section 14.3 of Chapter 14 Air Quality). Regulatory standards (if appropriate): Compliance with regulatory standards is detailed in Chapter 14 Air Quality. Policy context: in line with NPS EN-1 (DECC, 2011a), it is considered the Facility (based on the assessment in Chapter 14 Air Quality) has avoided significant impacts for stack, vehicle and vessel emissions, has proposed mitigation in place where impacts are predicted, and will put in place measures to effectively manage and control emissions.

Impact 4: Noise Effects

22.7.67 **Chapter 10 Noise and Vibration** details the noise assessment and has provided the results for this assessment.

22.7.68 The relevant population groups considered in the assessment, due to proximity or sensitivity, were site-specific and vulnerable (children and young people, older people and people with existing poor health).

22.7.69 The key health outcomes relevant to noise as a determinant of health are:

- Cardiovascular health (as a result of chronic noise effects);
- Mental health (including stress, anxiety or depression as a result of chronic noise effect); and
- Cognitive performance in children.

22.7.70 These key health outcomes were taken into consideration in the assessment provided in **Table 22-17**.

22.7.71 **Table 22-17** outlines the health assessment with respect to potential noise effects and summarises the conclusions of the noise assessment. Based on the methods described in **Section 22.4**, there is a plausible source-pathway-receptor relationship, as follows:

- The source is plant and operations;
- The pathway is noise transmission through the air; and
- The receptors are communities of people.

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

Table 22-17 Potential Noise Effects on Health (during Operation)

Temporal Scope	Likelihood	Sensitivity of general population and vulnerable groups	Magnitude	Significance
Operation of the Facility will be long term (i.e. decades).	<p>Conclusion of Chapter 10 Noise and Vibration:</p> <ul style="list-style-type: none"> Minor adverse Residual effect (i.e. not significant in EIA terms) as a worst case on increased daytime and night-time noise on sensitive receptors from the Facility. See Chapter 10 for recommended mitigation measures. Negligible Residual effect of increased noise from off-site operational traffic, operational vessel and operational vibration. 	<p>Low sensitivity, based on:</p> <ul style="list-style-type: none"> Inequalities: locally in Boston there are a higher proportion of people in employment (2018/19), compared to the national average, with a lower proportion of people reporting working from home. At a site-specific level, a lower proportion of household report having one person with a long-term health problem/disability than the national average, however, locally in Boston this proportion is similar to the national average. Deprivation: Boston 009A LSOA is among the 40 % least deprived LSOAs, however, locally Boston is among the 30 % most deprived Districts (Table 22-6). Health status: life expectancy of males and females in Boston is lower than the national average. Health of people is varied but is generally the same as nationally. Life stage: population demographics indicate a higher proportion of people aged under 16 at a site-specific level compared to the national average, however, locally in Boston, there are a higher proportion of people aged over 65 than nationally. 	<p>Medium magnitude, based on:</p> <ul style="list-style-type: none"> Severity: The Residual effect on localised noise as a result of operation are not significant (i.e. minor adverse as a worst case). Extent: effects would be localised and mitigated by measures detailed in Chapter 10. Frequency: long term. Reversibility: permanent. 	<p>Not significant, based on:</p> <ul style="list-style-type: none"> Baseline conditions: a lower proportion of people work from home locally than nationally and rates of complaints about noise in Boston are significantly less than nationally. Sensitivity/magnitude: the sensitivity of the population is considered low and magnitude is expected to be medium. Health priorities: noise can impact on cardiovascular and mental health as well as cognitive performance in children. Consultation responses: the noise and vibration assessment methodology were discussed and agreed with BBC in a meeting in November 2018 (see Table 10-2 of Chapter 10 for more details). Regulatory standards (if appropriate): Compliance with regulatory standards is detailed in Chapter 10 Noise and Vibration. Policy context: in line with NPS EN-1 (DECC, 2011a), it is considered the Facility (based on the assessment in Chapter 10 Noise and Vibration) has avoided significant impacts for noise and vibration, has proposed mitigation in place where impacts are predicted, and will put in place measures to effectively manage and control temporary noise.

Impact 5: Ground and/or Water Contamination Effects

22.7.73 **Chapter 11 Contaminated Land, Land Use and Hydrogeology** and **Chapter 13 Surface Water, Flood Risk and Drainage Strategy** detail the land and water contamination assessments respectively, and these have provided the results for this assessment.

22.7.74 The relevant population groups considered in the assessment, due to proximity or sensitivity, were site-specific and vulnerable (children and young people, and people with existing poor health).

22.7.75 The key health outcomes (after assessment) relevant to ground/water contamination as a determinant of health are potential exposure associated with contaminated bathing water, and effects may relate to biological or chemical contaminants and were taken into consideration in the assessment provided in **Table 22-18**.

22.7.76 **Table 22-18** outlines the health assessment with respect to potential land/water contamination effects and summarises the conclusions of the assessments. Based on the methods described in **Section 22.4**, there is a plausible, but unlikely, source-pathway-receptor relationship, as follows:

- The source is the potential for increased water turbidity, accidental fuel spill, or mobilisation of historic contamination;
- The pathway would be mobilisation or remobilisation of contaminants into bathing waters or the air; and
- Receptors include users of watercourses.

22.7.77 The plausibility of the potential effect occurring largely depends on unusual conditions to make the source-pathway-receptor linkage. The sources relate to accidental releases of pollutants or the unexpected encountering of historic contamination in combination with a failure of the outlined mitigation measures (detailed in **Chapter 11 Contaminated Land, Land Use and Hydrogeology** and **Chapter 13 Surface Water, Flood Risk and Drainage Strategy**).

Table 22-18 Potential Land/Water Contamination Effects on Health (during Operation)

Temporal Scope	Likelihood	Sensitivity of general population and vulnerable groups	Magnitude	Significance
<p>Operation of the Facility will be long term (i.e. decades).</p>	<p>Conclusion of Chapter 11 Contaminated Land, Land Use and Hydrogeology:</p> <ul style="list-style-type: none"> Residual effects on human health (and groundwaters), during 'operational and maintenance activities as a result of residual contaminants' and 'operation as a result of new sources of contamination being introduced' were negligible to minor adverse (i.e. not significant in EIA terms). <p>Conclusion of Chapter 13 Surface Water, Flood Risk and Drainage Strategy:</p> <ul style="list-style-type: none"> Residual effect of all potential impacts was negligible (i.e. not significant) 	<p>Low sensitivity, based on:</p> <ul style="list-style-type: none"> Inequalities: population demographics indicate a higher proportion of people aged under 16 at a site-specific level compared to the national average. In Boston, fewer children live in low income families than the national average. Deprivation: Boston 009A LSOA is among the 40 % least deprived LSOAs, however, locally Boston is among the 30 % most deprived Districts (Table 22-6). Health status: the health of young people in Boston (i.e. prevalence of obesity in Year 6) is worse than both the regional and national averages, however, the proportion of physically active children and young people in Boston is similar to the national average. Life stage: there are more households with dependent children than the national average, suggesting a population with a high proportion of young people. <p>However, sensitivity is considered low due to the limited likelihood that people would interact with waterbodies for recreation purposes, due to the busy nature of The Haven, or be able to access the construction site.</p>	<p>Small magnitude, based on:</p> <ul style="list-style-type: none"> Severity: impacts were considered to be not significant. Extent: highly localised to the associated accidental spillage/historical contamination. Frequency: highly infrequent. Reversibility: in the event of a spillage, any material would be disposed of and any residual material is likely to be small and diluted in the water body. <p>Exposure: low exposure by a very small population.</p>	<p>Not significant, based on:</p> <ul style="list-style-type: none"> Baseline conditions: greater levels of children live at the site-specific level than nationally, but fewer live in low income families in Boston than the national average. Sensitivity/magnitude: the sensitivity of population is considered low and the magnitude is considered small (i.e. highly infrequent and low exposure by a very small population). Consultation responses: see Table 11.4 of Chapter 11 and Table 13-2 of Chapter 13. Regulatory standards (if appropriate): Compliance with regulatory standards is detailed in Chapter 11 Contaminated Land, Land Use and Hydrogeology and Chapter 13 Surface Water, Flood Risk and Drainage Strategy. Policy context: in line with NPS EN-1 (DECC, 2011a), it is considered the Facility (based on the assessment in Chapter 11 Contaminated Land, Land Use and Hydrogeology and Chapter 13 Surface Water, Flood Risk and Drainage Strategy) has avoided significant impacts for contamination, has proposed mitigation in place where impacts are predicted, and will put in place measures to effectively manage and control contamination.

Impact 6: Climate Change and Flood Risk Effects

22.7.78 **Chapter 21 Climate Change** and **Chapter 13 Surface Water, Flood Risk and Drainage Strategy** detail the GHG and flood risk assessments respectively and have provided the results for this assessment.

22.7.79 The relevant population groups considered in the assessment, due to proximity or sensitivity, were site-specific and vulnerable (old people, people living in deprived areas and people with existing poor health).

22.7.80 The key health outcomes relevant to climate change and flood risk as a determinant of health include heat related illnesses and respiratory infections and the potential risk to life, as a result of drowning and/or waterborne diseases. Flood damage to property and/or financial loss could also have impacts on mental health. These health outcomes have been taken into consideration in the assessment provided in **Table 22-19**.

22.7.81 **Table 22-19** outlines the health assessment with respect to potential flood risk effects and summarises the conclusions of the assessments. Based on the methods described in **Section 22.4**, there is a plausible source-pathway-receptor relationship, as follows:

- The source the potential for increased GHG emissions and flooding events;
- The pathway would be the atmosphere and flood water; and
- Receptors include people living near the Facility or in Boston.

Table 22-19 Potential Climate Change and Flood Risk Effects on Health (during Operation)

Temporal Scope	Likelihood	Sensitivity of general population and vulnerable groups	Magnitude	Significance
Operation of the Facility will be long term (i.e. decades).	<p>Conclusion of Chapter 21 Climate Change:</p> <ul style="list-style-type: none"> Not significant residual effects as a result of GHG emissions from the Facility <p>Conclusion of Chapter 13 Surface Water, Flood Risk and Drainage Strategy:</p> <ul style="list-style-type: none"> Negligible Residual effect on changes to surface water runoff and flood risk 	<p>Low sensitivity, based on:</p> <ul style="list-style-type: none"> Inequalities: there is a higher density of people at a site-specific level, but a lower density locally, than nationally. Deprivation: Boston 009A LSOA is among the 40 % least deprived LSOAs, however, locally Boston is among the 30 % most deprived Districts (Table 22-6). Health status: life expectancy of males and females in Boston is lower than the national average. Health of people is varied but is generally the same as nationally. A lower proportion of household report on person with a long-term disability or health problem at a site-specific level than nationally. Life stage: population demographics indicate a higher proportion of people aged under 16 at a site-specific level compared to the national average, however, locally in Boston, there are a higher proportion of people aged over 65 than nationally. 	<p>Small magnitude, based on:</p> <ul style="list-style-type: none"> Severity: impacts were considered to be not significant. Operation of the Facility does not represent a significant net CO₂ emissions contribution, therefore does not affect the UK's ability to meet 2050 carbon targets. Extent and exposure: effects would be localised and experienced by people living within the tidal flood range of The Haven. Frequency and reversibility: climate change impacts would be long term and any potential flooding impacts would be short term, however, unlikely as a result of the presence of primary defences which provide a 1 in 150-year standard of protection, and ongoing work as part of the Boston Combined Strategy will provide 1 in 300-year standard of 	<p>Not significant, based on:</p> <ul style="list-style-type: none"> Baseline conditions: the primary source of flooding that may affect the Principal Application Site is tidal, however, the Site currently as a 1 in 150-year standard of protection and will eventually have a 1 in 300-year standard of protection once ongoing works are complete. Sensitivity/magnitude: the sensitivity is considered low and magnitude is considered small. Consultation responses: see Table 21-2 in Chapter 21 and Table 13-2 of Chapter 13 for further details. Regulatory standards (if appropriate): Compliance with regulatory standards is detailed in Chapter 21 Climate Change and Chapter 13 Surface Water, Flood Risk and Drainage Strategy. Policy context: in line with NPS EN-1 (DECC, 2011a), it is considered the Facility (based on the assessment in Chapter 21 Climate Change and Chapter 13 Surface Water, Flood Risk and Drainage Strategy) has avoided significant effects for climate

Temporal Scope	Likelihood	Sensitivity of general population and vulnerable groups	Magnitude	Significance
			protection from tidal flooding once complete.	change and flooding, has proposed mitigation in place where impacts are predicted, and will put in place measures to effectively manage and control GHG emissions and flood risk.

Impact 7: Employment and Education Effects

22.7.82 **Chapter 20 Socio-Economics** details the socio-economic assessment, and this has provided the results for this assessment.

22.7.83 The population group relevant to this assessment, as a result of proximity or sensitivity, are the population of Boston and the GLLEP area.

22.7.84 **Table 22-20** outlines the health assessment with respect to potential employment and/or education effects and summarises the conclusions of the socio-economic assessment. Based on the methods described in **Section 22.4**, there is a likely source-pathway-receptor relationship, as follows:

- The source is direct, indirect and induced job creation due to operation of the Facility;
- The pathway is through employment (or education); and
- The receptors are people of working age in the regional labour markets (and consequently their dependents).

Table 22-20 Potential Employment Effects on Health (during Operation)

Temporal Scope	Likelihood	Sensitivity of general population and vulnerable groups	Magnitude	Significance
Operation of the Facility will be long term (i.e. decades).	<p>Conclusion of Chapter 20 Socio-economics:</p> <ul style="list-style-type: none"> Residual effects range from negligible to minor beneficial (employment) to moderate-substantial beneficial (energy security/reliability) 	<p>Medium sensitivity, based on:</p> <ul style="list-style-type: none"> <u>Inequalities and life stage</u>: the percentage of people aged 16-64 in employment is similar in Boston and Lincolnshire to nationally. In Lincolnshire, the proportion of 16-17 year old NEET is the same as nationally (5.5 %). <u>Deprivation</u>: Boston 009A LSOA is among the 40 % least deprived LSOAs, however, locally Boston is among the 30 % most deprived Districts (Table 22-6). In Boston, a higher proportion of people are living in fuel poverty and there are similar levels of statutory homelessness as nationally. 	<p>Medium (beneficial) magnitude, based on:</p> <ul style="list-style-type: none"> <u>Severity</u>: Chapter 20 concluded that operation of the Facility would have minor beneficial Residual effect on employment and a moderate-substantial beneficial Residual effect on energy security/reliability. <u>Extent</u>: The Facility is anticipated to provide approximately 108 FTE jobs during operation, with an increase in the proportion of workers sourced from the local area over time once the necessary training capability has been embedded (approx. 47 FTE jobs). The Facility also represents a long-term sustainable source of renewable energy. <u>Frequency</u>: long term (decades). <u>Reversibility</u>: permanent, benefits would be maintained, through full-time jobs, knowledge and transferable skills gained. <u>Exposure</u>: the general exposure profile would be one of high exposure to a medium population due to direct or indirect employment and low exposure to a large population due to induced employment. 	<p>Not significant (beneficial), based on:</p> <ul style="list-style-type: none"> <u>Baseline conditions</u>: there is a labour market that would benefit from increased demand for employment. <u>Sensitivity/magnitude</u>: the sensitivity of population is considered medium and the magnitude is considered medium (beneficial). <u>Health priorities</u>: overall improvements in socio-economic status associated with employment are likely to lead to improvements in general well-being. <u>Consultation responses</u>: see Table 20-1 in Chapter 20. <u>Regulatory standards (if appropriate)</u>: there are no relevant regulatory standards with regard to increased employment opportunities. <u>Policy context</u>: in line with NPS EN-1 (DECC, 2011a), it is considered the Facility has identified benefit from potential employment, and energy security and reliability, and proposes enhancement measures with the aim of retaining benefit in the regional economy.

Potential Impacts During Decommissioning

22.7.85 The decommissioning of the Facility would form part of an overall Decommissioning Plan for the Application Site. Health impacts associated with the decommissioning programme would be similar, but over a shorter period of time, to those identified in the construction programmes, and appropriate controls and management approaches would be expected to be in place. Details on the topic specific decommissioning impacts are provided in the other technical chapters referenced in this chapter.

22.8 Cumulative Impacts

22.8.1 An assessment was undertaken to determine the potential for cumulative health impacts with other projects. A list of cumulative projects, which comprise major applications, was provided by BBC for consideration in the ES; this list was combined with projects already identified at PEIR stage. The total list of cumulative projects which required consideration is provided in **Appendix 6.1**.

22.8.2 The HIA takes a different topic-specific approach to the methodology used for the Cumulative Impact Assessment (CIA) as described in **Chapter 6 Approach to EIA** and is detailed further in **Section 22.4**. Commentary specific to each of the EIA receptor topics is also detailed in the technical chapters referenced in this chapter.

22.8.3 Sub-regional growth in housing and employment, as adopted in the region's Local Plans has been captured within TEMPro future year growth factors applied to the forecast traffic flows (further detail is provided in **Section 19.4 of Chapter 19 Traffic and Transport**). Therefore, the cumulative effect of housing and employment projects is inherent in the traffic and transport impact assessment, and consequently also within the traffic-related aspects of the air quality and noise impact assessments (as traffic flows from the traffic and transport impact assessment were used in the impact assessments for air quality and noise (see **Chapter 14 Air Quality** and **Chapter 10 Noise and Vibration** respectively for further details)). Therefore, the cumulative health effects on journey times, reduced access and/or safety, air quality or noise for any remaining housing and employment projects listed in **Appendix 6.1** have been included within the impact assessments provided in **Chapter 10 Noise and Vibration, Chapter 14 Air Quality Chapter** and **Chapter 19 Traffic and Transport**.

22.8.4 Any cumulative project identified and included in the CIA of the technical chapters referenced in this chapter have been considered in the HIA cumulative assessment, with the exception of potential cumulative effects that have been

determined to be insignificant when compared to the same health criterion as in this chapter. For example, the cumulative effects of projects on air quality screened into the air quality CIA have been compared against health based Objectives (i.e. the same as in this HIA), and if the cumulative effect has been determined to be not significant as a result, the potential cumulative effect has not been included in the HIA CIA (**Table 22-21**) as it has been considered already. This is the case for the 'Gas fired peaking power plant' (Application No. B/19/0474) (see **Chapter 14 Air Quality** for further details). Other potential cumulative effects on air quality (i.e. construction dust) were included in the HIA CIA, where applicable.

- 22.8.5 The CIA is based on information available on each potential project and it is noted that the project details available may either change in the period up to construction or may not be available in detail at all. The assessment presented here is therefore considered to be conservative (i.e. worst case), with the level of impacts expected to be reduced compared to those presented here.
- 22.8.6 No cumulative projects were included in the CIA for **Chapter 10 Noise and Vibration** (due to the separation distance between proposed cumulative projects and the Facility), **Chapter 11 Contaminated Land, Land Use and Hydrogeology** (because all projects were considered to be a sufficient distance from the Site to not result in impacts of a direct or indirect nature) and **Chapter 13 Surface Water, Flood Risk and Drainage Strategy** (due to the lack of any significant impacts arising as a result of the Facility and no mechanism for cumulative impacts to occur with other projects). Therefore, no cumulative health effects as a result of noise, contaminated land (and water) or flood risk were anticipated.
- 22.8.7 Twelve projects listed in **Appendix 6.1** were included in the CIA in **Chapter 20 Socio-Economics** (see **Table 20-15** of **Chapter 20 Socio-Economics** for further details). This was as a result of labour market competition for construction/operational employment, and associated impacts on community/housing infrastructure and/or energy security/reliability. To avoid repetition and for a proportionate assessment, these schemes are not listed in **Table 22-21** because the CIA for **Chapter 20 Socio-Economics** concluded that the cumulative impact of the schemes assessed would be negligible during both construction and operation. Therefore, no cumulative health effects as a result of employment were anticipated.

Table 22-21 Cumulative Impact Assessment for Health

Project	Status	Rationale	Discussion	Likelihood and Significance of Cumulative Effects
Boston Barrier Flood Defence	<p><u>Status</u>: Transport and Works Act Order consented</p> <p><u>Development Period</u>: 2017 – ongoing (completed August 2021)</p> <p><u>Distance from the Facility</u>: Boston Barrier at closest point to the Application Site is 500 m</p>	Potential for cumulative impacts on outdoor amenity (through biodiversity (i.e. The Wash and terrestrial ecology))	Considered as a worst-case scenario, cumulative impacts between the Facility and the Boston Barrier Flood Defence may arise due to simultaneous operation. The terrestrial impacts would be upon habitat loss and noise and lighting impacts on bats and birds.	If the construction windows overlap, there is a potential for cumulative terrestrial impacts, however this is considered very unlikely. This is considered as worst case only because the Barrier will be in operation prior to the construction of the Facility.
Battery Energy Storage Plant (Marsh Lane) B/17/0467	<p><u>Status</u>: Application approved</p> <p><u>Development Period</u>: 2017 – ongoing</p> <p><u>Distance from the Facility</u>: Beeston Farm is less than 10 m from Application Site</p>	Potential for cumulative impacts on journey times/reduced access/safety	The peak traffic period of the battery energy storage plant is predicted to last a total of eight weeks; thus, it is proposed that a commitment is to be contained within the Facility OCTMP for the Applicant and its contractors to engage with the battery energy storage plant contractors. Liaison between both projects would enable opportunities in programming project peak construction activities so that they do not coincide together thus avoiding significant impacts of cumulative peak traffic.	As traffic impacts would be managed collaboratively, any potential for a significant cumulative journey times/reduced access/safety and associated emissions would be identified in advance, and sufficient mitigation measures would be implemented to prevent their occurrence. As such, it is not anticipated that any significant cumulative effects on journey times/reduced

Project	Status	Rationale	Discussion	Likelihood and Significance of Cumulative Effects
				access/safety would occur.
Triton Knoll Offshore Wind Farm	<p><u>Status</u>: DCO consented</p> <p><u>Development Period</u>: 2008 – ongoing</p> <p><u>Distance from the Facility</u>: Onshore cable corridor and construction compound at Langrick 9.7 km from the Application Site</p>	Potential for cumulative impacts on outdoor amenity (through biodiversity (i.e. harbour seal))	There are a very low number of harbour seals potentially at risk and mitigation put in place (where appropriate) (see Chapter 17 Marine and Coastal Ecology) would further reduce the potential for impact to harbour seals (and thus outdoor amenity through biodiversity).	Unlikely to result in a significant cumulative effect to harbour seal populations, and therefore on outdoor amenity.
Viking Link Interconnector B/17/0340	<p><u>Status</u>: Application approved</p> <p><u>Development Period</u>: 2014 – 2023</p> <p><u>Distance from the Facility</u>: Bicker Fen substation 14.4 km from the Application Site</p>	Potential for cumulative impacts on journey times/reduced access/safety	As the duration of the peak period (in terms of traffic) for the Viking Link Interconnector is not known, it is proposed that a commitment is to be contained within the Facility OCTMP for the Applicant and its contractors to engage with National Grid. Liaison between both projects would enable opportunities in programming project peak construction activities so that they do not coincide together thus avoiding significant impacts of cumulative peak traffic.	As traffic impacts would be managed collaboratively, any potential for a significant cumulative journey times/reduced access/safety and associated emissions would be identified in advance, and sufficient mitigation measures would be implemented to prevent their occurrence. As such, it is not anticipated that any significant cumulative effects on journey times/reduced access/safety would occur.

22.8.8 None of the CIAs included in the respective technical chapters referenced in this HIA, identified any reasonably foreseeable projects or developments where significant cumulative effects on individual environmental aspects would arise. In respect of potential cumulative effects on local population health, this HIA CIA (presented in **Table 22-21**) has not identified impacts that are considered to be of any greater significance than those identified for the Facility itself, and no significant cumulative health effects are predicted.

22.8.9 The overall conclusions set out in **Table 22-21** are that there are no likely significant health effects when the construction and operation of the Facility is considered cumulatively with other relevant development projects. Each of those relevant projects has no material cumulative effect in respect of the environmental aspects which were assessed, and so in consideration of those aspects in-combination, there would be no associated cumulative health impact on local population or vulnerable groups.

22.9 Transboundary Impacts

22.9.1 As there is no international border near to the Facility, there are no transboundary impacts related to health for this Facility.

22.10 Inter-Relationships with Other Topics

22.10.1 There is an inter-relationship between health and the following topics as described above:

- **Chapter 10 Noise and Vibration;**
- **Chapter 11 Contaminated Land, Land Use and Hydrogeology;**
- **Chapter 12 Terrestrial Ecology;**
- **Chapter 13 Surface Water, Flood Risk and Drainage;**
- **Chapter 14 Air Quality;**
- **Chapter 17 Marine and Coastal Ecology;**
- **Chapter 19 Traffic and Transport;**
- **Chapter 20 Socio-Economics;** and
- **Chapter 21 Climate Change.**

22.11 Summary

22.11.1 The summary of potential impacts identified for health are detailed in **Table 22-22**.

Table 22-22 Summary of Potential Impacts Identified for Health

Potential Impact	Receptor	Temporal Scope	Probability of Effect	Sensitivity (of Population)	Magnitude (of Change)	Significance
Construction						
Outdoor Amenity (i.e. physical activity and access to biodiversity)	Site-specific and local populations	Long	Plausible	Low	Medium	Not significant
Journey times, reduced access and/or safety	Site-specific and local populations	Medium	Probable	Medium	Small	Not significant
Air quality	Site-specific and local populations	Short-to-medium	Probable	Medium	Small	Not significant
Noise	Site-specific and local populations	Medium	Probable	Low	Medium	Not significant
Ground and/or water contamination	Site-specific populations	Short-to-medium	Plausible (but unlikely)	Low	Small	Not significant
Climate change and flood risk	Site-specific and local populations	Medium	Plausible	Low	Small	Not significant
Employment and Education	Site-specific, local and GLLEP populations	Medium	Likely	Medium	Medium (beneficial)	Not significant (or beneficial)

Potential Impact	Receptor	Temporal Scope	Probability of Effect	Sensitivity (of Population)	Magnitude (of Change)	Significance
Operation						
Outdoor Amenity (i.e. physical activity and access to biodiversity)	Site-specific and local populations	Long	Plausible	Low	Medium	Not significant
Journey times, reduced access and/or safety	Site-specific and local populations	Long	Probable	Medium	Small	Not significant
Air quality	Site-specific and local populations	Long	Probable	Low	Medium	Not significant
Noise	Site-specific and local populations	Long	Probable	Low	Medium	Not significant
Ground and/or water contamination	Site-specific populations	Long	Plausible (but unlikely)	Low	Small	Not significant
Climate change and flood risk	Site-specific and local populations	Long	Plausible	Low	Small	Not significant
Employment and Education	Site-specific, local and GLLEP populations	Long	Likely	Medium	Medium (beneficial)	Not significant (or beneficial)

22.12 References

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