REPORT

# Boston Alternative Energy Facility – Preliminary Environmental Information Report

## Chapter 11 Contaminated Land, Land Use and Hydrogeology

Client: Alternative Use Boston Projects Ltd

Reference: PB6934-RHD-01-ZZ-RP-N-2011

Status: 0.1/Final

Date: 17 June 2019

baef
Boston Alternative Energy Facility

Royal HaskoningDHV
Enhancing Society Together

**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 – Preliminary Environmental Information Report |
| Document short title: | Contaminated Land, Land Use, Hydrogeology |
| Reference: | PB6934-RHD-01-ZZ-RP-N-2011 |
| Status: | 0.1/Final |
| Date: | 17 June 2019 |
| Project name: | Boston Alternative Energy Facility |
| Project number: | PB6934-RHD-01-ZZ-RP-N-2011 |
| Author(s): | Phil Garvey |

| | |
|---|---|
| Drafted by: | Phil Garvey |
| Checked by: | Darren Banner-Perry |
| Date / initials: | DB-P 06/06/2019 |
| Approved by: | Gary Bower |
| Date / initials: | GB 17/06/2019 |

| Classification |
|---|
| Project related |

## Disclaimer

## Table of Contents



## Table of Tables

## Non-Technical Summary

This chapter focused on the potential environmental impacts associated with the interaction of the Boston Alternative Energy Facility ('the Facility') with potential contaminated land and the subsequent impacts to sensitive receptors, as well the direct impacts on land use including the degradation of soil resources. An assessment of the potential impacts during the construction, operation, and decommissioning phases of the Facility was carried out, and sensitive receptors (hydrology, hydrogeology, human health, land use and soil quality as an agricultural resource) were considered in relation to potential impacts arising from the Facility. This assessment identified mitigation measures required to eliminate or reduce predicted impacts.

The chapter also sets out the required embedded mitigation measures for the Facility to minimise potential impacts. The impacts identified will require further investigation of contaminated land sources and nature of the soils present at the Application Site, to develop appropriate mitigation measures if required prior to development of the Facility.

The impacts identified for the Facility were not considered to be significant.

The following impacts were identified for the construction phase of the Facility:

- Impact on human health, including construction workers and general public during any excavations and construction related activities;
- Impact on groundwater quality from construction related activities;
- Impact on surface water quality from construction related activities;
- Impacts to soil quality because of degradation; and
- Impacts to land use from loss of best most versatile (BMV) agricultural land.

The following impacts were identified for the operational phase of the Facility:

- Impact on human health and controlled waters including workers and public during operational and maintenance activities because of residual contaminants present within the ground; and
- Impact on human health and controlled waters during operation of the Facility from new sources of contamination being introduced.

Impacts for the decommissioning phase of the Facility were considered to be similar to the impacts considered during the construction phase.

# 11 Contaminated Land, Land Use and Hydrogeology

## 11.1 Introduction

11.1.1 This chapter provides a description of the anticipated physical environment baseline conditions in contaminated land, land uses and hydrogeology. This chapter then consider how alteration to the baseline environment from the Boston Alternative Energy Facility ('the Facility') will impact sensitive receptors (agricultural land, human health, and controlled waters).

11.1.2 Baseline conditions were identified for the defined Study Area as shown in **Figure 11.1**. For contaminated land and hydrogeology this is the Application Site and a 1 km buffer and for agricultural land only the baseline environment for the Application Site have been developed.

11.1.3 This chapter details the assessment of potential impacts likely to occur during the construction, operation, and decommissioning phases of the Facility. The impact assessment was developed based on how the Facility will interact with the identified receptors (land use, human health and controlled waters) and contaminated land to create potential impacts. Additionally, impacts to agricultural land, and soil quality were also considered as part of this assessment. Where appropriate, cross references were used to highlight the interrelationship between the identified receptors and impacts. In particular, this was carried out where impacts or receptors were considered in more detail within other chapters. The direct impacts to surface water and drainage are considered in **Chapter 13 Surface Water, Flood Risk and Drainage Strategy**, and the impacts from contaminated sediments is considered in **Chapter 15 Marine Sediment and Water Quality.**

## 11.2 Legislation, Policy and Guidance

### Legislation

11.2.1 The following sections provide detail on key UK legislation, policy and guidance which are relevant to this chapter.

### National Planning Policy

National Policy Statements

11.2.2 National Policy Statements (NPSs) form a principal part of the decision-making process for Nationally Significant Infrastructure Projects (NSIPs); the policy statements of relevance to the Facility are:

- The overarching NPS for Energy (**EN-1**) (Department of Energy and Climate Change (DECC) 2011a), and
- NPS for Renewable Energy Infrastructure (**EN-3**).

11.2.3 Sections of the NPSs relevant to this chapter are summarised in **Table 11.1**.

**Table 11.1 National Policy Statement Requirements**

| National Policy Statement Requirements | Reference | Chapter Reference |
|---|---|---|
| **Overarching NPS for Energy (EN-1)** | | |
| The ES should identify existing and proposed land uses near the project, any effects of replacing an existing development or use of the site with the proposed project or preventing a development or use on a neighbouring site from continuing. Applicants should also assess any effects of precluding a new development or use proposed in the development plan. | **EN-1 Section 5.10.5** | A review of historical map information was undertaken during the scoping stage of the project and presented in the A Preliminary Risk Assessment (PRA), considering contaminated land, and was included as an appendix to the scoping report. For ease of reference, the PRA is provided as **Appendix 11.1.** |
| During any pre-application discussions with the Applicant the LPA (Local Planning Authority) should identify any concerns it has about the impacts of the application on land use, having regard to the development plan and relevant applications and including, where relevant, whether it agrees with any independent assessment that the land is surplus to requirements. | **EN-1 Section 5.10.7** | The local planning considerations of relevance to the Application Site are outlined in **Section 11.2** and **Table 11.3**<br><br>The PRA (**Appendix 11.1**) considered the previous land uses for the Application Site and has been used to development the baseline conditions for the Application Site in **Section 11.6** and the potential impacts from the Facility to agricultural land use and agricultural land classification are considered in **Section 11.7.** |
| Applicants should seek to minimise impacts on the best and most versatile agricultural land (defined as land in grades 1, 2 and 3a of the Agricultural Land Classification) and preferably use land in areas of poorer quality (grades 3b, 4 and 5) except where this would be inconsistent with other sustainability considerations. | **EN-1 Section 5.10.8** | The baseline conditions for soil quality and agricultural land classification (ALC) are presented in **Section 11.6** and the potential impacts from the Facility |

| National Policy Statement Requirements | Reference | Chapter Reference |
|---|---|---|
| Applicants should also identify any effects and seek to minimise impacts on soil quality taking into account any mitigation measures proposed. For developments on previously developed land, Applicants should ensure that they have considered the risk posed by land contamination. | | considered in **Section 11.7.**<br><br>Land contamination is considered in the PRA (**Appendix 11.1**). The current baseline for land contamination (land quality) is addressed in **Section 11.6** and the potential impacts from the Facility considered in **Section 11.7.** |
| Ensure that Applicants do not site their scheme on the best and most versatile agricultural land without justification. It should give little weight to the loss of poorer quality agricultural land (in grades 3b, 4 and 5). | **EN-1 Section 5.10.15** | The baseline conditions for soil quality and ALC are presented in **Section 11.6** and the potential impacts from the Facility considered in The justification for the facilities location is addressed in **Section 11.7.** |

## National Planning Policy Framework (NPPF)

11.2.4 The NPPF (Ministry of Housing, Communities and Local Government (MHCLG), 2019) does not contain specific policies relating to NSIPs. However, some policy requirements detailed in the NPPF may be of relevance; the policies relating to this chapter are detailed in **Table 11.2**Table ***11.2***.

**Table 11.2 National Planning Policy Framework Requirements**

| National Policy Statement Requirements | Reference | Chapter Reference |
|---|---|---|
| **National Planning Policy Framework** | | |
| The planning system should contribute to and enhance the natural and local environment by inter alia preventing both new and existing development from contributing to or being put at unacceptable risk from, or being adversely affected by unacceptable levels of soil, air, water or noise pollution or land instability; and remediating and mitigating despoiled, degraded, derelict, contaminated and unstable land, where appropriate. | NPPF15-170 | Land contamination is considered in the PRA (**Appendix 11.1**). The current baseline for land contamination (land quality) is addressed in **Section 11.6** and the potential impacts from the Facility considered in **Section 11.7.** |
| Planning policies and decisions should also ensure that:<br>A site is suitable for its proposed use taking account of ground conditions and any risks arising from land instability and contamination. | NPPF15-178 | Land contamination is considered in the PRA (**Appendix 11.1**). The current baseline for land contamination (land |

| National Policy Statement Requirements | Reference | Chapter Reference |
|---|---|---|
| This includes risks arising from natural hazards or former activities such as mining, and any proposals for mitigation including land remediation (as well as potential impacts on the natural environment arising from that remediation);<br>After remediation, as a minimum land should not be capable of being determined as contaminated land under Part IIA of the Environmental Protection Act 1990;<br>Adequate site investigation information, prepared by a competent person, is available to inform these assessments. | | quality) is addressed in **Section 11.6** and the potential impacts from the Facility considered in **Section 11.7.** |
| Where a site is affected by contamination or land stability issues, responsibility for securing a safe development rests with the developer and/or landowner. | NPPF15-179 | Land contamination is considered in the PRA (**Appendix 11.1**). The current baseline for land contamination (land quality) is addressed in **Section 11.6** and the potential impacts from the Facility considered in **Section 11.7.** |
| To prevent unacceptable risks from pollution and land instability, planning policies and decisions should ensure that new development is appropriate for its location. The effects (including cumulative effects) of pollution on health, the natural environment or general amenity, and the potential sensitivity of the area or proposed development to adverse effects from pollution, should be taken into account. | NPPF15-180 | Land contamination is considered in the PRA (**Appendix 11.1**). The current baseline for land contamination (land quality) is addressed in **Section 11.6** and the potential impacts from the Facility considered in **Section 11.7.** |
| The focus of planning policies and decisions should be on whether the proposed development is an acceptable use of land, rather than the control of processes or emissions (where these are subject to separate pollution control regimes). Planning decisions should assume that these regimes will operate effectively. Equally, where a planning decision has been made on a particular development, the planning issues should not be revisited through the permitting regimes operated by pollution control authorities. | NPPF15-183 | Land contamination is considered in the PRA (**Appendix 11.1**). The current baseline for land contamination (land quality) is addressed in **Section 11.6** and the potential impacts from the Facility considered in **Section 11.7.** |

## Local Planning Policy

11.2.5 The Overarching NPS for Energy (**EN-1**) states that the Planning Inspectorate will consider Development Plan Documents or other documents in the Local Development Framework to be relevant to its decision making. The specific reference, in paragraph 4.1.5 states that:

*"Other matters that the IPC (now the Planning Inspectorate) may consider important and relevant to its decision-making may include Development Plan Documents or other documents in the Local Development Framework. In the event of a conflict between these or any other documents and an NPS, the NPS prevails for the purposes of IPC decision making given the national significance of the infrastructure."*

11.2.6 The Application Site is located within the jurisdiction of Lincolnshire County Council (LCC) and Boston Borough Council (BCC) local planning authority. BBC in partnership with South Holland District and Lincolnshire County Council have developed a local plan for South East Lincolnshire. The South-East Lincolnshire Local Plan (2011-2036) was adopted on Friday 8th March 2019. Policies of relevance to this chapter are detailed in **Table 11.3**.

11.2.7 This chapter also considered the Lincolnshire Minerals and Waste Local Plan (LCC, 2016). Policies of relevance to this chapter are detailed in **Table 11.3**

**Table 11.3 Local Planning Policies**

| Local Planning Policy Requirements | Reference | Chapter Reference |
|---|---|---|
| **South-East Lincolnshire Local Plan (2011-2036)** | | |
| "Development proposals will demonstrate how the following issues, where they are relevant to the proposal, will be secured…13. the use of locally sourced building materials, minimising the use of water and minimising land take, to protect best and most versatile soils…" | 3.4 Design of New Development<br><br>Policy 3 | The baseline conditions for soils quality and ALC are presented is addressed in **Section 11.6** and the potential impacts from the Facility considered in **Section 11.7.** |
| "Development proposals will not be permitted where, taking account of any proposed mitigation measures, they would lead to unacceptable adverse impacts upon:<br>1. health and safety of the public;<br>2. the amenities of the area; or<br>3. the natural, historic and built environment;<br>by way of:<br>[…]<br>7. land quality and condition; or<br>8. surface and groundwater quality<br>[…]<br>Development proposals on contaminated land, or where there is reason to suspect contamination, must include an assessment of the extent of contamination and any possible risks. Proposals will not be considered favourably unless the land is, or can be made, suitable for the proposed use." | 7.4 Pollution<br><br>Policy 30 | Land contamination is considered in the PRA (**Appendix 11.1**). The current baseline for land use, land contamination (land quality), hydrology and hydrogeological conditions are addressed in **Section 11.6** and the potential impacts from the Facility considered in **Section 11.7.** |

| Local Planning Policy Requirements | Reference | Chapter Reference |
|---|---|---|
| **Lincolnshire Minerals and Waste Local Plan (2016)** | | |
| Proposals for minerals and waste development should protect and, wherever possible, enhance soils.<br><br>Proposals for minerals and waste development should take into account their impact on soil resources, agricultural land quality and farming, and other established rural land uses. This assessment should be informed by a soil and land quality survey and a soil handling and replacement strategy, where appropriate.<br><br>Soil is a finite resource which takes many years to develop but which can be quickly lost or degraded. Good soil management and conservation are therefore critical to sustainable land management practices in minerals and waste development. The NPPF states that soils should be protected and enhanced.<br><br>Where soil is not required for restoration purposes on the site, other options for the sustainable use of the soil include using it for restoring other nearby sites (subject to planning permission for the areas involved) or storing the soil "permanently" on site in appropriately designed bunds – potentially allowing its use at a later date if the need arises. | Agricultural land and Soils 7.67 to 7.69.<br><br>Policy DM11: Soils | The Application site is located within the Riverside Industrial Estate (WA22-BO). This area has been allocated for industrial use and consideration for waste developments.<br><br>This allocation was reviewed by relevant stakeholders and allocated in 2016.<br><br>The baseline conditions for soils quality and ALC are presented in **Section 11.6** and the potential impacts from the Facility are considered in **Section 11.7.** |
| Proposals for minerals and waste development that include significant areas of best and most versatile agricultural land will only be permitted where it can be demonstrated that:<br>• no reasonable alternative exists; and<br>• for mineral sites, the site will be restored to an after-use that safeguards the long-term potential of the best and most versatile agricultural land. | Policy DM12 Best and Most Versatile Agricultural Land \ | The Application site is located within the Riverside Industrial Estate (WA22-BO). This area has been allocated for industrial use and consideration for waste developments.<br><br>This allocation was reviewed by relevant stakeholders and allocated in 2016.<br><br>The baseline conditions for soils classified as BMV are presented in **Section 11.6** and the potential impacts from the Facility considered in **Section 11.7.** |
| The proposed after-use should be designed in a way that is not detrimental to the local economy and conserves and where possible enhances the | Policy R2: After-use | The Application site is located within the Riverside Industrial Estate (WA22-BO). This area |

| Local Planning Policy Requirements | Reference | Chapter Reference |
|---|---|---|
| landscape character and the natural and historic environment of the area in which the site is located.<br><br>After-uses should enhance and secure a net gain in biodiversity and geological conservation interests, conserve soil resources, safeguard the potential of the best and most versatile agricultural land, and decrease the risk of adverse climate change effects. Such after-uses could include: agriculture, nature conservation, leisure, recreation/sport, and woodland.<br><br>Where appropriate, the proposed restoration should provide improvements for public access to the countryside including access links to surrounding green infrastructure. Restoration proposals should be designed to ensure that they do not give rise to new or increased hazards to aviation. | | has been allocated for industrial use and consideration for waste developments.<br><br>This allocation was reviewed by relevant stakeholders and allocated in 2016.<br><br>The baseline conditions for soils classified as BMV are presented in **Section 11.6** and the potential impacts from the Facility considered in **Section 11.7** |
| Planning permission will be granted for minerals and waste development provided that it does not generate unacceptable adverse impacts arising from: ……<br>the migration of contamination, to occupants of nearby dwellings and other sensitive receptors.<br><br>And in respect of waste development is well designed and contributes positively to the character and quality of the area in which it is to be located. Where unacceptable impacts are identified, which cannot be addressed through appropriate mitigation measures, planning permission will be refused. | Policy DM3: Quality of Life and Amenity | Land contamination, hydrology and hydrogeological conditions of the Application Site are considered in the PRA (**Appendix 11.1**). The current baseline for land use, land contamination (land quality), hydrology and hydrogeological conditions are addressed in **Section 11.6** and the potential impacts from the Facility considered in **Section 11.7.** |
| Proposals for new waste facilities, including extensions to existing waste facilities, in and around the main urban areas set out in Policy W3 will be permitted provided that they would be located on:<br>• previously developed and/or contaminated land; or<br>• existing or planned industrial/employment land and buildings; or<br>• land already in waste management use; or<br>• sites allocated in the Site Locations Document; or<br>• in the case of biological treatment the land identified in Policy W5. | Policy W4: Locational Criteria for New Waste Facilities in and around main urban areas. | Land contamination, hydrology and hydrogeological conditions of the Application site are considered in the PRA (**Appendix 11.1**). The current baseline for land use, land contamination (land quality), hydrology and hydrogeological conditions are addressed in **Section 11.6** and the potential impacts from the Facility considered in **Section 11.7.** |

| Local Planning Policy Requirements | Reference | Chapter Reference |
|---|---|---|
| Proposals for the recycling of construction and demolition waste and/or the production of recycled aggregates in and around the main urban areas set out in Policy W3 will also be permitted at existing Active Mining Sites. In the case of large extensions to existing waste facilities, where the proposals do not accord with the main urban areas set out in Policy W3, proposals will be permitted where they can demonstrate they have met the above criteria. Small scale facilities that are not in and around the main urban areas will be considered under Policy W7. Proposals must accord with all relevant Development Management Policies set out in the Plan. | | |

## Guidance

11.2.8 The following UK guidance is considered the most relevant to this chapter and has been considered:

- Defra, Environmental Protection Act 1990: Part 2A, Contaminated Land Statutory Guidance;
- Environment Agency Model Procedures for the Management of Land Contamination, Contaminated Land Report 11 (CLR11);
- British Standard BS10175 Investigation of Potentially Contaminated Sites – Code of Practice;
- British Standard BS5930 Code of Practice for Site Investigations;
- CIRIA Environment Agency Technical Report P5-065/TR (Technical Aspects of Site Investigations);
- Publication C532 Control of water pollution from construction sites;
- CIRIA publication C650 Environmental good practice on site;
- CIRIA publication C503 Environmental good practices working on site;
- CIRIA publication C502 Environmental good practices on site;
- CIRIA publication C665 Assessing risks posed by hazardous ground gases to buildings;
- Defra Construction Code of Practice for the Sustainable Use of Soil on Construction Sites;
- Defra Biosecurity Guidance to Prevent the Spread of Animal Diseases.

- Environment Agency Managing Invasive Non-native Plants;
- MAFF Agricultural land classification of England and Wales - revised guidelines and criteria for grading the quality of agricultural land;
- MAFF Good Practice Guide for Handling Soils;
- MAFF Practical Guide to Preventing the Spread of Plant and Animal Diseases; and
- Natural England (2018) Guide to assessing development proposals on agricultural land.

## 11.3 Consultation

11.3.1 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 contaminated land, land use and hydrogeology is detailed in **Table 11.4**.

**Table 11.4 Consultation and Responses**

| Consultee and Date | Response | Chapter Section Where Consultation Comment is Addressed |
|---|---|---|
| The Planning Inspectorate July 2018 | **Soil classification and management**<br>The Applicant should be aware that loss of Agricultural Land Classification (ALC) Grade 1 (excellent) land may require specific mitigation to protect what is a recognised valuable resource. The ES should include information about the specific measures necessary for soil management and handling. The Applicant should make effort to seek agreement with relevant consultation bodies regarding the soil management measures required. The ES should state the likely dimensions and locations applicable to the spoil heaps required during the construction phase. The ES should also describe any mitigation measures required to prevent spoil heaps leaching contaminants to the surrounding area. | The impacts to agricultural land and soils were assessed as shown in **Section 11.7.** The likely dimensions and location of any potential spoil will be developed further as the design of the Facility progresses and was not included at this stage. The specific mitigation measures are discussed in **Table 11.13**. |
| The Planning Inspectorate July 2018 | **Baseline - Borehole locations**<br>The Scoping Report indicates the intent to inform the assessment in the ES using information derived from the Boston Biomass borehole data. The study area used in the ES and on which the assessment is based must be adequate to encompass the full extent of likely significant effects. The locations of the boreholes outlined in Table 6.5 of the Scoping Report and used to inform the baseline assessment should be clearly stated within the | The Study Area used to assess potential impacts is shown in **Figure 11.1**. The locations of borehole information used to inform the impact assessment are shown in **Figure 11.6**. The boreholes used to inform the baseline are listed in **Table 11.12**. |

| Consultee and Date | Response | Chapter Section Where Consultation Comment is Addressed |
|---|---|---|
| | ES. The ES should also include a figure to depict the location of boreholes. | |
| The Planning Inspectorate July 2018 | **Baseline - Groundwater**<br>The Inspectorate notes that groundwater levels stated within the Scoping Report are derived from existing information from the Boston Biomass plc plant. The ES should explain the extent to which this data is relevant to the receiving environment for the Proposed Development. The Scoping Report states that the British Geological Society (BGS) flood risk information indicates that the site is not located within an area with potential ground water flooding. To aid the reader the ES should include the BGS groundwater flood risk map. The ES should include a ground water risk assessment to assess the potential effects that accidental spills of pollutants may have on the groundwater. Furthermore, if de-watering is required during the construction phase of the Proposed Development, the environmental effects of de-watering should be assessed and presented within the ES. | The flood risk information has been incorporated into a figure to aid the reader (**Figure 11.7**). The environmental effects of dewatering and accidental spillages have been assessed in **Section 11.7**. Impacts to groundwater quality and quantity have been considered. |
| The Planning Inspectorate July 2018 | **Scope - Unlicensed water suppliers**<br>The Scoping Report proposes to exclude consideration of unlicensed water supplies abstracting less than 20m$^3$ from the assessment. No justification in support of this approach has been provided. The assessment in the ES should take these activities into account where significant effects are likely to occur. | Private water supply records were obtained from Boston Borough Council and the baseline hydrogeological conditions were evaluated, considering all likely abstractions, as described in **Section 11.6.** Determination of baseline hydrogeological sensitivity, taking into account all likely abstractions is presented in **Section 11.7** |
| The Planning Inspectorate July 2018 | **Methodology – Further investigation**<br>If further investigations and/or surveys will be undertaken to determine the potential for contaminated land and groundwater to cause significant effects as outlined within Table 6.9 of the Scoping Report, the ES should include a full description, location, methods used, and the results of the investigations. The ES must assess the effects of potential contaminants having regard to the likely impact pathways to sensitive receptors as well as impacts to the Proposed Development during construction. | Further investigations into contaminated land have not been proposed at this stage. Further geo-environmental testing will be completed as part of the detailed design stage of the Facility, post consent. Should any further investigation works be carried out prior to consent, full details of the methodology and testing carried out will be included within the ES. The assessment of impacts of contaminated land is outlined in **Section 11.7**<br><br>A PRA, considering contaminated land, was included as an appendix to the scoping report. Since the submission of the scoping report, the Facility design |

| Consultee and Date | Response | Chapter Section Where Consultation Comment is Addressed |
|---|---|---|
| | | has evolved. Therefore there are minor changes to the proposed footprint for the Application Site from what was reported in the original PRA. However, the conclusions drawn in the PRA about existing baseline conditions at the Application Site remain valid. For ease of reference, the PRA is provided as **Appendix 11.1**. |
| The Planning Inspectorate July 2018 | **Potential effects – Receptors and study area**<br>A full description of the methodology used to determine the sensitivity of receptors and the significance of effect should be included within the ES. The Inspectorate notes that interrelated impacts between aspects have not been addressed within this aspect of the Scoping Report. The ES should assess the interrelated impacts from this aspect that may result in significant effects when considered with other applicable aspects, for example ecology and landscape effects. The ES should explain the study area applied to the assessment which should be applicable to the extent of the anticipated impacts and the likely significant effects. | A full description of the methodology used to determine the sensitivity of receptors is outlined in **Table 11.7**. Interrelated impacts were cross referenced within the assessment and throughout this chapter and addressed specifically within **Section 11.11.** The rational for the Study Area is addressed in **Section 11.5** |
| The Planning Inspectorate July 2018 | **Mitigation – Monitoring**<br>**Table 6.9** of the Scoping Report indicates that the build-up and migration of ground gas and vapours will be monitored during construction to prevent potential significant effects. A full description of the monitoring measures and how they will be implemented should be included within the ES, with reference to a CEMP as appropriate. | Consideration of the ground gas risk and associated outline mitigation measures are detailed in **Table 11.12,** which would be incorporated into a Code of Construction Practice (CoCP) at a later stage**.** |
| The Planning Inspectorate July 2018 | **Mitigation**<br>The ES should include a full description of the proposed mitigation measures (including embedded mitigation and any 'appropriate working practices' as referred to in the Scoping Report) as well as an assessment of the efficacy of the mitigation measures, and how these measures will be secured in the DCO or by other suitable agreement. | Embedded mitigation was included in **Table 11.13.** Details of further mitigation requirements were provided within the impact assessment sections, where appropriate. |
| The Planning Inspectorate July 2018 | **Potential effects – Piling**<br>This aspect chapter of the Scoping Report does not state if piling is required, however it is noted in other aspect chapters of the Scoping Report. | The impacts from any potential piling were assessed in **Section 11.7** |

| Consultee and Date | Response | Chapter Section Where Consultation Comment is Addressed |
|---|---|---|
| | If piling is required during the construction phase, the location of piling, and a full assessment of the impacts that may result in potentially significant environmental effects be included within the ES. | |
| The Planning Inspectorate July 2018 | **Potential effects –Wharf construction and operation**<br>The Inspectorate advises that an assessment of the potential land contamination and hydrogeological effects that may arise from the construction of the wharf including the disturbance of sediment within the River Witham should be included within the ES. The ES should include a full assessment of the potentially significant environmental effects that may arise from the construction and operation of the wharf and fully describe any required mitigation measures and their efficacy. | Impacts from hydrogeological risk were assessed in this chapter. Impacts from sediment disturbance were assessed within **Chapter 15 Marine Water and Sediment Quality** and **Chapter 16 Estuarine Processes**. |
| Public Health England July 2018 | **Land Quality**<br>We would expect the promoter to provide details of any hazardous contamination present on site (including ground gas) as part of the site condition report. Emissions to and from the ground should be considered in terms of the previous history of the site and the potential of the site, once operational, to give rise to issues. Public health impacts associated with ground contamination and/or the migration of material off-site should be assessed and the potential impact on nearby receptors and control and mitigation measures should be outlined. Relevant areas outlined in the Government's Good Practice Guide for EIA include:<br>effects associated with ground contamination that may already exist<br>effects associated with the potential for polluting substances that are used (during construction / operation) to cause new ground contamination issues on a site, for example introducing / changing the source of contamination<br>Impacts associated with re-use of soils and waste soils, for example, re-use of site-sourced materials on-site or offsite, disposal of site-sourced materials offsite, importation of materials to the site, etc. | Impacts associated with land quality were considered as described in in **Section 11.7** Future environmental management, waste, and soil management plans would be informed by further chemical testing to be carried out at the detailed design stage of the project, post consent.<br><br>Waste management, including the potential for use of excavated material on site is described in **Chapter 23 Waste.** |
| Marine Management Organisation (MMO), July 2018 | The MMO welcomes the intention to assess the potential for contamination but would expect that disturbance of the river bed sediment (both during construction and operation) is considered within the ES. | The impacts associated with river sediments were considered within **Chapter 15 Marine Water and Sediment Quality.** This was informed by **Chapter 16 Estuarine Processes**. |

| Consultee and Date | Response | Chapter Section Where Consultation Comment is Addressed |
|---|---|---|
| Environment Agency July 2018 | A preliminary risk assessment (PRA) has been competed, which has revealed the site to be historically farmland and on unproductive strata (Non-Aquifer). Consequently, we consider this to be a low risk site in respect to groundwater. Furthermore, investigations are proposed in the EIA with the aim to refine the environmental setting of the site, but these will be predominately for geotechnical and human health risks. I can therefore confirm that we are satisfied with the finding of the PRA and the EIA scope of works in this respect. | Noted. The PRA assessment was included as appendix to the scoping report, and is included as **Appendix 11.1** |

## 11.4 Assessment Methodology

11.4.1 The overall approach of assessment will consider impacts to how the Facility will interact with the identified receptors (land use, human health and controlled waters) and contaminated land to create potential impacts. The approach to this assessment is outlined below. Additionally, the impacts to land use by the consideration of agricultural land classification and soils is considered in this chapter and the approach to this assessment is set out below.

11.4.2 The assessment of potentially contaminated land followed a phased risk-based approach and considered potential sources, pathways and receptors to identify potential pollutant linkages that may result in unacceptable risks to receptors from ground contamination. For a risk to exist, all three elements (defined below) must be present:

- **Source:** A potentially polluting activity or existing ground contamination. A contaminant is a substance which is in or on the land and which has the potential to cause significant harm.
- **Pathway:** A route or means by which a receptor could be exposed to contamination.
- **Receptor:** Something which could be adversely affected by contamination.

11.4.3 The PRA for the Facility was carried out by Royal HaskoningDHV to support the scoping stage of the project and is presented in **Appendix 11.1**. Outlined within the PRA is a preliminary Conceptual Site Model (CSM) for the Facility. The CSM was used as the baseline for this assessment. The baseline comprises a description of the current ground conditions and potential receptors. The impact assessment compared the baseline to a CSM describing feasible pollutant linkages associated with the construction and operational phases of the Facility.

11.4.4 Development activities or features that materially affect the baseline CSM may increase or decrease the level of risk, compared with the baseline. The assessment considered what impact the Facility would have on the baseline level of risk. Creation of a new pollutant linkage or increase in the likelihood that an existing linkage would occur (e.g. by exposing contaminated ground during construction), would increase risk, resulting in an adverse impact. Reducing the risk to a receptor (e.g. by remediating any ground contamination at a site) would result in a beneficial impact.

## Receptor Sensitivity

11.4.5 The sensitivity of receptors will be assessed according to the criteria set out in **Table 11.5.** This is based on the capacity of receptors for adaptability, tolerance, recoverability and the acceptability of risks.

**Table 11.5 Sensitivity Criteria for Receptors**

| Sensitivity | Definition |
|---|---|
| High | Has very limited or no capacity to accommodate physical or chemical changes.<br>Increased risk of exposure / pollution would be unacceptable. |
| Medium | Has limited capacity to accommodate physical or chemical changes or influences.<br>Increased risk of exposure/ pollution may be acceptable. |
| Low | Has moderate capacity to accommodate physical or chemical changes.<br>Increased risk of exposure / pollution likely to be acceptable. |
| Negligible | Is generally tolerant of physical or chemical changes.<br>Insensitive to increased risk of exposure / pollution. |

## Value

11.4.6 The sensitivity assessment for each receptor considers how 'acceptable' changes to the availability, quality or condition of a particular resource as a whole would be would be. This approach is dependent on the value of that resource, which is assessed based on its strategic or geographic importance (**Table 11.6**). The degree of change that is considered to be acceptable is dependent on the value of a receptor, which is discussed further below.

**Table 11.6 Value Criteria for Receptors**

| Value | Definition |
|---|---|
| High | Is an international or nationally important resource. |
| Medium | Is a regionally important resource |
| Low | Is a locally important resource |

| Value | Definition |
|---|---|
| Negligible | Is of no significant value |

11.4.7 The definition of the different sensitivity levels for the receptors are presented in **Table 11.7**.

**Table 11.7 Receptor Sensitivity Criteria**

| Sensitivity Criteria | Definition Examples |
|---|---|
| **High**<br>Has very limited or no capacity to accommodate physical or chemical changes; or,<br>Is an international or nationally important resource. | **Human Health**<br>Construction Workers<br>Site Operatives<br>General Public |
| | **Controlled Waters**<br>Groundwater Source Protection Zone 1 / 2 (including unpublished abstraction wells)<br>Unlicensed groundwater abstractions<br>Surface water or groundwater supporting internationally designated or nationally important conservation site (e.g. Special Areas of Conservation, Special Protection Area, Ramsar site / Site of Special Scientific Interest) or fishery. |
| | **Agricultural Land Quality**<br>ALC Grade 1 or 2 land<br>Farming practices with specific requirements;<br>Land with notifiable weeds (risk of spread);<br>Land with notifiable scheduled diseases (risk of spread), or soil vulnerable to structural damage and erosion or unrecoverable or not adaptable to changes. |
| **Medium**<br>Has limited capacity to accommodate physical or chemical changes or influences.<br>Is a regionally import resource. | **Controlled Waters**<br>Principal Aquifer (resource potential)<br>Groundwater Source Protection Zone Total Catchment<br>Licenced groundwater / surface water abstractions<br>Surface water or groundwater supporting regionally important wildlife sites (Local Nature Reserve, Site of Nature Conservation Interest) or commercial aquaculture. |
| | **Agricultural Land Quality**<br>ALC Grade 3; or Seasonally susceptible to structural damage or erosion. |
| **Low**<br>Has moderate capacity to accommodate physical or chemical changes. Is a locally important resource. | **Controlled Waters**<br>Secondary B Aquifers / Undifferentiated Aquifer<br>Surface waters with WFD Status / Potential objective 'Moderate' / 'Poor'<br>Surface water or groundwater supporting locally important wildlife or amenity site |
| | **Agricultural Land Quality**<br>ALC Grade 4. |
| **Negligible** | **Controlled Waters**<br>Unproductive strata<br>Surface waters with WFD status “Bad” |

| Sensitivity Criteria | Definition Examples |
|---|---|
| Is generally tolerant of physical or chemical changes. Is of no significant resource value | **Agricultural Land Quality**<br>Urban ALC |

## Magnitude

11.4.8 Potential effects may be adverse, beneficial or neutral. The magnitude of an effect was assessed qualitatively, according to the criteria set out in **Table 11.8**. The following definitions apply to time periods used in the magnitude assessment:

- Long-term: >5 years;
- Medium-term: 1 to 5 years; and
- Short-term: <1 year.

11.4.9 For human health, magnitude reflects the likely increase or decrease in exposure risk for a receptor. For controlled waters, magnitude represents the likely effect that an activity would have on resource usability or value, at the receptor. Magnitude is therefore affected by the distance and connectivity between an impact source and the receptor. For Agricultural land and Soils the magnitude of effect relates to the size and amount of agricultural land which will be taken out of use from the proposed development, as outlined in **Table 11.8.**

**Table 11.8 Magnitude of Effect Criteria**

| Criteria | Examples - Proposed development are "likely" to result in: |
|---|---|
| **High**<br>Permanent or large-scale change affecting usability, risk or, value over a wide area, or certain to affect regulatory compliance | **Human Health**<br>Permanent or major change to existing risk of exposure (Adverse / Beneficial).<br>Unacceptable risks to one or more receptors over the long-term or permanently (Adverse).<br>Prosecution e.g. under health and safety legislation (Adverse).<br>Remediation and complete source removal (Beneficial).<br>Construction workers at risk due to lack of appropriate personal protective equipment (Adverse). |
| | **Controlled Waters**<br>Permanent, long-term or wide scale effects on water quality or availability (Adverse / Beneficial).<br>Permanent loss or long-term derogation of a water supply source resulting in prosecution (Adverse).<br>Change in WFD water body status / potential or its ability to achieve WFD status objectives in the future (Adverse / Beneficial). |

| Criteria | Examples - Proposed development are "likely" to result in: |
|---|---|
| | Permanent habitat creation or complete loss (Adverse / Beneficial).<br>Measurable habitat change that is sustainable / recoverable over the long-term (Adverse / Beneficial). |
| | **Soil and Agricultural Land Quality**<br>The proposed development would lead to the loss of 50 ha or more of agricultural land. The proposed development would lead to the loss of more than one of soils primary functions and a reduction in the primary functions of soils off-site. |
| **Moderate**<br>Permanent or long-term reversible change affecting usability, value, or risk, over the medium-term or local area; possibly affecting regulatory compliance | **Human Health**<br>Medium-term or moderate change to existing risk of exposure (Adverse / Beneficial). Unacceptable risks to one or more receptors over the medium-term (Adverse). Serious concerns or opposition from statutory consultees (Adverse). |
| | **Controlled Waters**<br>Medium-term or local scale effects on water quality or availability (Adverse / Beneficial).<br>Medium-term derogation of a water supply source, possibly resulting in prosecution (Adverse).<br>Observable habitat change that is sustainable / recoverable over the medium-term (Adverse / Beneficial).<br>Temporary change in status / potential of a WFD waterbody or its ability to meet objectives (Adverse / Beneficial). |
| | **Soil and Agricultural Land Quality**<br>The proposed development would lead to the loss of 20 – 50 ha of agricultural land. A reduction in the primary function of soils on site would occur. |
| **Low**<br>Temporary change affecting usability, risk or value over the short-term or within the site boundary; measurable permanent change with minimal effect usability, risk or value; no effect on regulatory compliance | **Human Health**<br>Short-term temporary or minor change to existing risk of exposure (Adverse / Beneficial).<br>Unacceptable risks to one or more receptors over the short-term (Adverse). |
| | **Controlled Waters**<br>Short-term or very localised effects on water quality or availability. (Adverse / Beneficial).<br>Short-term derogation of a water supply source (Adverse).<br>Measurable permanent effects on a water supply source that do not impact on its operation (Adverse).<br>Observable habitat change that is sustainable / recoverable over the short-term (Adverse / Beneficial).<br>No change in status / potential of a WFD waterbody or its ability to meet objectives (Neutral). |
| | **Soil and Agricultural Land Quality** |

| Criteria | Examples - Proposed development are "likely" to result in: |
|---|---|
| | The proposed development would lead to the loss of 5 – 20 ha of agricultural land. Soil displacement will still allow the primary functions of soil to occur onsite. |
| **Negligible**<br>Minor permanent or temporary change, indiscernible over the medium- to long-term short-term, with no effect on usability, risk or value | **Human Health**<br>Negligible change to existing risk of exposure.<br>Activity is unlikely to result in unacceptable risks to receptors (Neutral). |
| | **Controlled Waters**<br>Very minor or intermittent impact on local water quality or availability (Adverse / Beneficial).<br>Usability of a water supply source will be unaffected (Neutral).<br>Very slight local changes that have no observable impact on dependent receptors (Neutral).<br>No change in status / potential of a WFD waterbody or its ability to meet objectives (Neutral). |
| | **Soil and Agricultural Land Quality**<br>The proposed development would lead to the loss of 5 ha or less of agricultural land. Soil would retain all pre-existing functions. |

## Evaluation of Significance

11.4.10 The impact significance assessment combined receptor sensitivity (**Table 11.7**) with effect magnitude (**Table 11.8**). Assessment of impact significance is qualitative and reliant on professional experience, interpretation and judgement. The matrix should therefore be viewed as a framework to aid understanding of how a judgement has been reached, rather than as a prescriptive, formulaic tool.

11.4.11 Effects that result in Major or Moderate impacts are considered to be 'significant' in EIA terms. The impact significance matrix used in this assessment is shown in **Table 11.9**.

**Table 11.9 Significance of Impact**

| Magnitude | Sensitivity | | | |
|---|---|---|---|---|
| | High | Medium | Low | Negligible |
| High | Major | Major | Moderate | Minor |
| Moderate | Major | Moderate | Minor | Minor |
| Low | Moderate | Minor | Minor | Negligible |
| Negligible | Minor | Minor | Negligible | Negligible |

### Cumulative Impact Assessment

11.4.12 Cumulative impacts were assessed through consideration of the extent of influence of changes or effects upon contaminated land, land use and hydrogeology and associated sensitive receptors arising from the Facility cumulatively.

11.4.13 The main potential for cumulative impacts is expected to be associated with the remediation of contaminated land during the construction process.

### Transboundary Impact Assessment

11.4.14 There are no transboundary impacts regarding contaminated land, land use and hydrogeology because the Facility is not sited in proximity to any international boundaries. Therefore, transboundary impacts on contaminated land, land use and hydrogeology were scoped out of this assessment and were not considered further.

## 11.5 Scope

### Study Area

11.5.1 The Study Area for contaminated land and hydrogeology comprises the Application Site and an environmental data search area extending 1 km from the boundary, as shown in **Figure 11.1.** It is unlikely that receptors outside this area could be affected by the Facility due to distance from the Application site.

11.5.2 Contaminated land sources were assessed only where reasonable migration pathways beyond the Application Site were identified. This was carried out across a maximum limit of 1 km from the Facility, which is considered the maximum reasonable limit for any pathways to the Facility to exist.

11.5.3 For agricultural land classification and soils, the Study Area encompasses all of the land being considered within the Application Site. The rationale for this is that agricultural land quality is impacted by the direct deterioration and loss of the resource itself. This predominately occurs by direct actions on soil quality via construction related activities.

### Data Sources

11.5.4 The assessment was undertaken with reference to several information sources, as detailed in **Table 11.10**.

**Table 11.10 Key Information Sources**

| Data | Reference/ Data Source |
|---|---|
| Local Plan | http://www.southeastlincslocalplan.org/ |
| Private Water Supplies | Boston Borough Council |
| Groundwater Source Protection Zones | www.environemnt.data.gov.uk/catchment-planning |
| Historical Maps | Landmark Envirocheck Report |
| Regulatory information (Contemporary trade directories, waste licences, discharge consents etc..) | Landmark Envirocheck Report |
| Historic Landfills | www.environment.data.gov.uk |
| Pollution incidents | https://data.gov.uk/dataset/f/environmental-pollution-incidents |
| Solid Geology | British Geological Survey Onshore Geoindex: http://www.bgs.ac.uk/GeoIndex/ |
| Superficial Geology | British Geological Survey Onshore Geoindex: http://www.bgs.ac.uk/GeoIndex/ |
| ALC and agri-environment schemes | Natural England.<br>Site specific request for data. |
| Soil Survey of England and Wales | National Soil Resources Institute.<br>Site specific request for data |
| Animal Burials | Animal and Plant Health Agency.<br>Site specific request for data |
| Soil-Boren Diseases | Animal and Plant Health Agency.<br>Site specific request for data |

## Assumptions and Limitations

11.5.5 The direct assessments and judgements given in this chapter were limited by both the finite data on which they were based and the proposed works to which they are addressed. The assessment utilised a variety of publicly available data sources; therefore, the study was limited by the age and limitations inherent in the data.

11.5.6 Conditions at the Application Site will change over time due to natural variations and may be affected by human activities. In particular, groundwater, surface water and soil gas conditions should be anticipated to change with diurnal, seasonal and meteorological variations. Soil and water chemistry may change due to the actions of, for example, groundwater flows and microbiological activity.

The likely variations in the data with time can be assessed following extended periods of measurement and statistical analyses. Unless specifically discussed in the text, such extended measurement and analysis was not carried out and the data collected were taken to be representative.

11.5.7 The opinions included herein were based on the information obtained from the published information, investigations undertaken at the adjacent site and professional experience. The following reports have been considered the PRA (**Appendix 11.1**) produced during the scoping stage of the Facility. Two ground investigation report completed Biomass UK No. 3 Ltd Project adjacent to the Application Site have been used to support this assessment. The location of boreholes and trial pits undertaken during these investigations are detailed in **Figure 11.6**. The relevance and finding of these reports are set out below.

## 11.6 Existing Environment

11.6.1 This section sets out the environmental baseline and, where appropriate, defines the existing sensitivity of the receptors (specifically geology, hydrogeology, hydrology, and human health, insofar as it relates to exposure to land contamination) in the Study Area. Land quality is not considered to be a receptor but is discussed in the context of the potential for contamination to be present in the soils and groundwater.

11.6.2 The PRA (**Appendix 11.1**) completed as part of the Scoping Report for the Facility forms the basis of the baseline environmental information that was utilised to assess the environmental impacts associated with the Facility.

11.6.3 Baseline environmental information with regard to agricultural land use classification was also utilised to assess land use impacts associated with the Facility.

### Site Setting

11.6.4 The Application Site comprises mostly semi-improved grassland, situated between an industrial estate and The Haven. The main land uses near the site include a recycling centre (operated by Mick George Ltd), a household waste recycling centre, several warehouses, several footpaths along the boundary of the Application Site and overhead powerlines crossing the Application Site.

### Land Use

11.6.5 The land use within the Application Site is predominately disused agricultural land with areas of non-agricultural land use where soils have been stripped during the development of the adjacent environs.

## Sensitive Land Uses

11.6.6 The Havenside Local Nature Reserve is located directly east of the Application Site on the opposite bank of The Haven. No other sensitive land uses were identified within the Study Area.

## Geology

11.6.7 The geology beneath the Application Site is comprised of Oxfordian Age Ampthill Clay Formation of the Ancholme Clay Group, which is a mudstone (BGS, 2017). The superficial deposits are described as Tidal Flat deposits (**Table 11.11**). Maps of the Application Site's bedrock geology and superficial geology are provided in **Figure 11.4** and **Figure 11.5** respectively.

**Table 11.11 Summary of Geological Conditions**

| Stratum | Unit | Description |
|---|---|---|
| Superficial Deposits | Tidal Flat Deposits | Normally a consolidated soft silty clay, with layers of sand, gravel and peat. |
| Solid Geology | Ampthill Clay Formation | Mudstone, mainly smooth or slightly silty, pale to medium grey with argillaceous limestone (cementstone) nodules; some rhythmic alternations of dark grey mudstone in the lower part; topmost beds are typically pale grey marls with cementstone. |

**Table 11.12 Subdivision of Solid Geology**

| Geological Unit | Description |
|---|---|
| Ampthill Clay | Mudstone |
| Diamicton | Firm to very stiff gravelly (chalk and flint) clay |
| Glaciofluvial Deposits | Medium to coarse sand and gravel |
| Barroway Drove / Terrington Beds | Soft clayey silt to silty very fine sand |

11.6.8 Several ground investigations have been undertaken close to the Facility. During ground investigations undertaken in 2011 six boreholes adjacent to the boundary of the Facility were drilled (Lincs Laboratory, 2011) . They recovered up to 9.45 m (but mostly 5.8 m to 6.7 m thick) of silt and clay (with occasional silty fine sand layers) on top of glacial diamicton or sand and gravel. The base of the Pleistocene deposits was reached in one borehole at a depth of 23.4 m (thickness of 16.7 m) where Ampthill Clay was recovered. The boreholes were not reduced to a datum

so only thicknesses are available.

11.6.9 T.L.P Ground Investigations (2012) recovered four boreholes approximately 500 m to the south of the Facility. They found 4.75 to 4.8 m of silty clay, underlain by 0 to 0.6 m of peat, underlain by 0.85 to 1.7 m of medium sand, all resting on diamicton. The base of the diamicton was not reached. The boreholes were not reduced to a datum so only thicknesses are available.

11.6.10 A ground investigation was undertaken at the Biomass UK No. 3 Ltd site in 2012, which is located to the east of the Application Site (Lincolnshire County Council, 2011). The borehole and trial pit locations carried out as part of this investigation are shown on **Figure 11.6**. At each of the borehole locations, the underlying natural strata was represented by a sequence of Tidal Flat or Alluvial deposits (clay, silt and sand) underlain by Glacial Till. The Glacial Till comprised firm to stiff, greenish brown, mottled lightly grey, silty, slightly sandy clay containing chalk and flint. This rested on a band of wet medium dense greenish brown and yellowish silty sand with coarse gravels. The band was underlain by boulder clay. Occasionally, lenses of sand were encountered or hard stony layers (**Table 11.13**).

**Table 11.13 Borehole Records from Previous Stages of Investigation**

| Borehole/Trial Pit | Depth (m) | Description |
|---|---|---|
| BH1 | 0 – 0.50 | Topsoil / MADE GROUND |
| BH1 | 0.50 – 5.70 | Tidal Flat deposits / Alluvium |
| BH1 | 5.70 - | Glacial Till / Boulder Clay |
| | | |
| BH2 | 0 – 0.50 | Topsoil |
| BH2 | 0.50 – 5.90 | Tidal Flat deposits / Alluvium |
| BH2 | 5.90 - | Glacial Till / Boulder Clay |
| | | |
| BH3 | 0 – 0.30 | Topsoil |
| BH3 | 0.30 – 6.20 | Tidal Flat deposits / Alluvium |
| BH3 | 6.20 - | Glacial Till / Boulder Clay |

| Borehole/Trial Pit | Depth (m) | Description |
|---|---|---|
| | | |
| BH4 | 0 – 0.30 | Topsoil |
| BH4 | 0.30 – 7.9 | Tidal Flat deposits / Alluvium |
| BH4 | 7.90 | Glacial Till / Boulder Clay |
| BH5 | 0 – 0.50 | Topsoil |
| BH5 | 0.50 – 5.90 | Tidal Flat deposits / Alluvium |
| BH5 | 5.90 - | Glacial Till / Boulder Clay |
| BH6 | 0 – 0.50 | Topsoil |
| BH6 | 0.50 – 13.45 | Tidal Flat deposits / Alluvium |

## Hydrogeology

11.6.11 The Environment Agency classified the Tidal Flat Deposits and Ancholme Clay Formation that underlies the Application Site as unproductive strata. Unproductive strata are defined as rock layers or drift deposits with low permeability that have negligible significance for water supply or river base flow.

11.6.12 The Environment Agency groundwater vulnerability maps indicate that site is located within an area of low groundwater vulnerability. This indicates that surface soils may provide some protection to groundwater from pollution and the area likely to be characterised by low leaching soils.

11.6.13 BGS flood risk information shows that the site is not located within an area with the potential for groundwater flooding, as shown in **Figure 11.7.**

11.6.14 Perched groundwater was encountered at the Biomass UK No. 3 Ltd site within the alluvial deposits at approximately 3.5 m bgl (Lincs Laboratory, 2011). The location of these boreholes in relation to the Facility is shown in **Figure 11.6.**

11.6.15 The Facility is not located within any groundwater source protection zones (SPZ) and no SPZs occur within 1 km of the Application Site.

11.6.16 Records held by the Environment Agency and Boston Borough Council indicate

that there are no groundwater abstractions (of any volume) present below the Application Site or located with 1 km.

**Hydrology**

11.6.17 The hydrology associated with the Facility is outlined in detail within **Chapter 13 Surface Water, Flood Risk and Drainage Strategy.** The eastern extent of the Facility directly adjoins the Haven, which is tidal. The Haven flows past Facility and drains into The Wash, approximately 7 km downstream. The downstream reaches of the river, where it meets the sea, include a wide range of intertidal features including intertidal mudflats, saltmarshes and sand and shingle banks and beaches.

11.6.18 In addition to being adjacent to The Haven, there is an extensive network of drainage systems within the vicinity of the Application Site (Black Sluice IDB, 2017; Environment Agency, 2016; Groundsure, 2014). There are watercourses located within the Application Site.

11.6.19 Data from the Environment Agency's Catchment Data Explorer (2016) indicate that water quality in the surface drainage network is below the required standards. Surface waters are affected by pressures from sewage discharges, agricultural and rural land management and industrial discharges. These pressures combine to give rise to alterations in chemical composition and high temperatures. Water quality is sufficiently poor to adversely impact upon fish populations. WFD requirements are detailed in **Appendix 13.1** of **Chapter 13 Surface Water, Flood Risk and Drainage Strategy**.

**Land Quality**

11.6.20 The Application Site is located directly adjacent to one authorised landfill and two historic landfill operations. Additionally, the newly developed Biomass UK No. 3 Ltd facility and Boston's household waste recycling centre are located adjacent to the Application Site. The existing flood defences along the river or infilled historical channels have the potential to contain fill material of unknown composition.

11.6.21 The preliminary CSM for the Application Site was developed for the Preliminary Risk Assessment (PRA). The findings of the PRA indicated that the following potential contaminants of concern were associated with the historical land uses associated with the Application Site and its surrounding environs (1 km from the Facility):

- Metals and metal compounds;
- Petroleum hydrocarbons;

- Polycyclic aromatic hydrocarbons (PAHs);
- Volatile and semi-volatile organic compounds (VOCs / SVOCs);
- Phenols;
- Polychlorinated biphenyls (PCBs);
- Pulverised fuel ash (PFA);
- Inorganic contaminants (e.g. ammonia, arsenic, cyanides, sulphides, phosphates); and
- Asbestos.

11.6.22 Specifically, the potential onsite sources were identified as stockpiles of sand, gravel and waste materials associated with development adjacent to the site, and unknown fill material associated with onsite flood defences and embankments.

**Soil and Agricultural Land Quality**

11.6.23 The Soilscapes map indicates that the soils within the Study Area are generally classified as loamy and clayey soils, associated with coastal flat deposition and an area with naturally high groundwater. The soil parent material group is medium to heavy and heaviest soils as shown in **Figure 11.2.**

11.6.24 Agricultural land in England and Wales is classified according to the quality and versatility of the soil in a nationally recognised grading system (the Agricultural Land Classifications (ALCs)). The grading system was produced by the former Ministry of Agriculture, Fisheries and Food (MAFF, now Defra). Grade 1 represents best quality agricultural land, through to Grade 5 which represents agricultural land of the poorest quality. The ALC system classifies land into five grades, with Grade 3 subdivided into subgrades 3a and 3b. BMV agricultural land is defined as Grades 1, 2 and 3a.

11.6.25 The classification of soils within the Application Site is ALC Grade 1 (Excellent) (ALC, 2011), and are described as loamy and clayey soils, developed from coastal flat deposits in an area with naturally high groundwater. According to the Soilscapes map, the soils are of moderate natural fertility (National Soil Resources Institute, 2017).

11.6.26 No detailed assessment of the Application Site's ALC classification was carried out; however, a detailed assessment of the adjacent land, carried out in 1991 (Natural England, 2016), showed that the ALC of soils encountered was lower than ALC Grade 1 for the majority of the area surveyed.

11.6.27 The provisional and strategic ALC mapping indicate that there is potential for BMV land present. However, it is the detailed-ALC field survey data which is used to support developments. Detailed site-specific data carried out according to the Agricultural Land Classification of England and Wales: revised guidelines and criteria for grading the quality of agricultural land (MAFF, 1988) and provides a most robust assessment of the likely anticipated conditions of agricultural soils.

11.6.28 The provisional ALC mapping (1:250,000 scale ALC mapping) indicates the Application Site as being predominantly Grade 1 Agricultural Land, as shown in **Figure 11.3. Figure 11.3** also identifies where detailed post 1988 mapping has been undertaken, in relation to the Application Site. This figure lists ALC classification of soils of the Application Site according to the classified as soils as Grade 1, 2 or 3a.

**Human Health**

11.6.29 The baseline human health receptors likely to interact with the Facility, which are located within the Study Area for the construction stage of the Facility, are construction workers and the general public. The general public is considered to be represented by commercial workers from adjacent industrial units, people visiting the household waste recycling centre, and local residents located within the Study Area.

11.6.30 For the operational stage of the Facility, maintenance workers were considered under the same parameters as construction workers, and additional human health receptors were considered in line with the proposed operational requirements and staffing. Further details on human health receptors are outlined within **Chapter 22 Health Impact Assessment**. All human health receptors were considered to be of high sensitivity for the purpose of this assessment.

## 11.7 Potential Impacts

11.7.1 A summary of the identified potential impacts on sensitive receptors from the interaction of the Facility with contaminated land, land use and hydrogeology can be divided into impacts associated with the following aspects:

- Impacts associated with the terrestrial elements of the Facility, including associated infrastructure; and
- Impacts associated with the proposed wharf.

11.7.2 The main Facility is envisioned to have a 23.4 ha (234,050 $m^2$) footprint and will require construction of 15 – 20 m foundation piles across strata and associated earthworks required for the plant across the Facility.

11.7.3 The wharf construction is envisaged to comprise a suspended deck of piles on a sloping revetment. This would have a likely landside footprint of 400 m by 20 m and require approximately 300 piles. The depth of piles required would likely be across multiple strata below the site and into depth of 15 - 20 m bgl, to within the (firm to stiff) solid geology below the Application Site.

11.7.4 The elements of construction most likely to be associated with impacts contaminated land, land use and hydrogeology are:

- General earthworks;
- Footprint of the Facility;
- Footprint of temporary works;
- Pilling across strata; and
- Removal or disturbance of embankments.

## Embedded Mitigation

11.7.5 As part of the project design, several embedded mitigation measures have been proposed to reduce potential impacts on sensitive receptors for contaminated land, land use and hydrogeology. The embedded mitigation for the project has been set out in accordance with current industry best practice and associated guidance and are outlined in detail within **Table 11.14.**

11.7.6 The assessment of impacts associated with contaminated land, land use and hydrogeology was developed assuming the adherence and adoption of the outlined embedded mitigation measures.

**Table 11.14 Embedded Mitigation Measures**

| Parameter | Mitigation Embedded into the Project Design |
|---|---|
| **Construction** | |
| Code of Construction Practice (CoCP) | Environmental best practice would include both the now-revoked Environment Agency best practice guidelines (e.g. Pollution Prevention Guidance (PPG) PPG1, PPG5, PPG6, PPG22) and current best practice guidelines. The methods adopted will also follow the he Environment Agency's approach to groundwater protection (Environment Agency, 2018). |
| Construction Design Management Regulations (CDM-2015) | All works/operations to be carried out by appropriately trained personnel.<br>Appropriate personal protective equipment (PPE) and working practices to be adopted by construction workers, including subcontractors, and health and safety measures would be implemented to mitigate any short term risk during construction.<br>Development of CDM site specific risk assessment. |

| Parameter | Mitigation Embedded into the Project Design |
|---|---|
| Construction Environmental Management Plan (CEMP) | Adherence to a Construction and Environmental Management Plan (CEMP) and an Incident/Emergency Response Plan which will be drafted in advance of any construction works. The CEMP will provide a protocol under which the environmental risk mitigation and other specific remedial measures will be defined and executed. |
| Environment agency groundwater protection pollution prevention guidance and hydrogeological risk assessment | The Environment Agency's approach to groundwater protection (Environment Agency, 2018) and current best practice guidance's for the groundwater protection pollution prevention guidance will be considered.<br>A hydrogeological risk assessment will be produced pre-construction to ensure protection of ground and surface waters where construction activity including piling and is in hydraulic continuity with sensitive receptors. This will include method statements and detailed hydrogeological risk assessment of the effects of pilling activities. |
| General environmental best practice | Store oils and fuel within designated areas above ground in impervious storage bunds with a minimum of 110% capacity to contain any leaks or spillages;<br>Carry out regular inspection of oil and fuel storage areas;<br>Restrict refuelling activities to designated areas were impermeable surfaces and drip trays are utilised;<br>Have spill kit available for use on site always;<br>All staff to have site inductions where appropriate use of chemical and fuels on site are discussed;<br>A pollution prevention plan and incident response plan will be incorporated into the CEMP. This is to be agreed with the Environment Agency and follow industry best practice;<br>Storage of hazardous materials will be done with due care and if adequate store locations cannot be identified within the site compound, these materials will be stored off-site in a secure location; and<br>A protocol for dealing with potentially contaminated materials will be utilised during the construction works. |
| CL:AIRE The Definition of Waste: Development Industry Code of Practice | Construction activities within the Application Site will involve the excavation of soils and is likely to involve the movement of soil around the site for stockpiling, potential re-use or removal for recovery or disposal off-site. These activities could result in the relocation and disturbance of potentially contaminated soils. The potential for cross contamination as a result of soil movements would be mitigated following the principles of the CL:AIRE Code of Practice incorporating the development of a Materials Management Plan. Excavated soils would be chemically tested and screened against regulatory-approved assessment criteria to demonstrate the soils are suitable for use prior to re-placement on-site. |
| Asbestos Management Plan | Risks to construction workers can generally be managed through construction best practice, however it may be necessary to adopt additional measures when working in the areas potentially impacted |

| Parameter | Mitigation Embedded into the Project Design |
|---|---|
| | by asbestos. Subject to further ground investigation and assessment, an asbestos management strategy would be developed in liaison with an appropriately qualified and experienced asbestos contractor to ensure the risks associated with asbestos are appropriately mitigated. Mitigation measures may require the works to be undertaken by specialist operatives, the provision of decontamination units, atomisers to prevent dust generation and monitoring during the works. The strategy would be agreed with the relevant regulators prior to commencing works on the Application Site. |
| Soil quality and management | Soils handling, storage and reinstatement would be carried out by a competent contractor under Defra (2009) Construction Code of Practice for the Sustainable Use of Soils on Construction Sites;<br>Topsoil stripping will be carried out within all construction areas and will be stored adjacent to where it is extracted, where practical;<br>Textural classification of soils will be undertaken in accordance with BS3882 and grading in accordance with BS1377;<br>Excavated subsoil will be stored separately from the topsoil, with sufficient separation to ensure segregation;<br>Soils will be handled according to their characteristics;<br>Where necessary, tree roots would be removed by screening;<br>For most after-uses, subsoils may be treated as a single resource for stockpiling;<br>During wet periods, mechanised soil handling would be limited in areas where soils are highly vulnerable to compaction;<br>Movements of heavy plant and vehicles would be restricted to specific routes and trafficking of construction vehicles in areas of the site which are not subject to construction phase earthworks would be avoided;<br>The excavation footprint would be minimised where possible; and<br>In circumstances where construction has resulted in soil compaction, further remediation may be provided, through an agreed remediation strategy. |
| **Operation** | |
| | Operation of the Facility would be covered by environmental permit requirements and adherence to health and safety legislation. |
| **Decommissioning** | |
| | The same best practice methods and guidance documents would be adhered to as described for the construction stages of the project. |

## Worst Case

11.7.7 The Worst-Case Scenario (WCS) developed for interaction with contaminated land, land use and hydrogeology is outlined in **Table 11.15** below. Only those design parameters with the potential to influence the level of impact to relevant

receptors were identified. Therefore, if the design parameter is not described below in **Table 11.15**, it was not considered to have a material bearing on the outcome of this assessment.

11.7.8 Preparation of the site will require general earthworks which could lead to topsoil loss, soil compaction, soil erosion and runoff. The likely associated impacts are considered to be localised and short term in duration. There is the potential for the disturbance and remobilisation of existing contaminant sources to occur.

**Table 11.15 Worst-Case Scenario Conditions Considered for this Chapter**

| Impact | Parameter |
|---|---|
| **Construction / Decommissioning** | |
| Impacts to Human Health<br><br>Impacts to Groundwater<br><br>Impacts to Surface Water Quality<br><br>Impacts to Soils and Agricultural Land (including Best Most Versatile agricultural soils) | Potential on-site sources of soil and groundwater contamination from storage of construction wastes and material used to construct embankments. This could represent an unacceptable risk to construction/ maintenance workers. The potential pathways would be through dermal contact, ingestion or inhalation through any contaminated soil present.<br><br>A further potential impact to construction workers is the risk that runoff from exposed made ground or spoil heaps during construction could transport contaminated sediments or dissolved contaminants to surface waters via the on-site or highway drainage system, resulting in potentially unacceptable risks to controlled waters (The Haven).<br><br>Migration of potential contaminants into groundwater beneath the site could affect construction and maintenance workers, as well as adjacent sites.<br><br>There will be a permanent loss of agricultural land during both the construction and operational phase.<br><br>There is a risk of potential migration of off-site groundwater contamination onto the Application Site, which could be a risk if volatile contaminants are able to migrate and accumulate in confined spaces. However, site users are unlikely to come into contact with contaminated groundwater.<br><br>Landfill gas generated during decomposition of waste deposits have the potential to migrate via permeable deposits onto the Application Site and accumulate in confined space and may represent a risk to human health. |
| **Operation** | |
| Impacts to Human Health<br><br>Impacts to Groundwater<br><br>Impacts to Surface Water | Potential on-site sources of soil and groundwater contamination could provide an unacceptable risk to future users of the site in landscaped areas, or due to migration of volatile contaminants (if present) into buildings. |

| Impact | Parameter |
|---|---|
| Quality | There is a risk of potential migration of off-site groundwater contamination onto the Application Site, which could be a risk if volatile contaminants are able to migrate and accumulate in confined spaces. However, site users are unlikely to come into contact with contaminated surface/ groundwater.<br><br>Landfill gas generated during decomposition of waste deposits have the potential to migrate via permeable deposits onto the Application Site and accumulate in confined space and may represent a risk to human health. |
| **Decommissioning** | |
| The worst case scenario impacts for the decommissioning of the Facility and associated infrastructure align with the impact considerations for the construction stage of the Facility. | |

## Potential Impacts during Construction

Impact 1 – Impact to Human Health, Including Construction Workers and General Public During Any Excavations and Construction Related Activities

11.7.9 The impacts to human health from the construction stages of the Facility were considered in the context of existing identified contaminated sources and how the Facility is likely to interact with these, based on significant pollution linkages.

11.7.10 A PRA was undertaken for the Facility as part of the scoping stage (**Appendix 11.1**). The Application Site is not anticipated to contain significant sources of contamination. However, several localised sources of contamination were identified.

11.7.11 Storage of construction wastes, and material used to construct embankments may give rise to soil and groundwater contamination, which could represent a risk to construction workers. The potential pathways would be through dermal contact, ingestion or inhalation through any contaminated soil or groundwaters present. The potential contamination of most concern, as identified in the PRA, is a potential for asbestos risks, in particular unknown fill materials used for the construction of embankments on the Application Site, which will in part be removed. However, given the embankments have been in place for many years the extent of PCOC being incorporated into them is likely to be minimal. Further assessment of the risk to human health from these sources should be carried out post-consent, as part of the geotechnical investigations prior to the development of the wharf. Further Phase 2 investigation works will inform the necessary requirements for PPE used to inform this assessment.

11.7.12 In the event of exposing soils and stockpiling construction waste (including excavated materials), dust could be generated during dry and windy conditions.

Under these conditions, construction workers and the general public, such as users of neighbouring sites and surrounding residents, could temporarily be exposed to contamination via the inhalation of potentially contaminated dust. However, the volume of stockpiled materials on site is anticipated to be low.

11.7.13 Additionally, the risk associated with soil contamination sources to human health could be altered by a change in the migration pathways by construction activities. A specific risk of concern is ground gases and vapour risks due to the location of two historic landfills and a total of nine waste management facility licences within 1 km of the Facility. Historic landfills were identified 343 m and 852 m east and south-east of the boundary of the site respectively. Both sites were authorised to receive Category A inert waste and as such are anticipated to be a low gas generation source. Active waste management licences within 250 m of the site boundary were also identified, with sites within 100 m carrying out vehicle depollution and receiving household, commercial and industrial wastes, and a household waste transfer facility, anticipated to be low sources of ground gas and groundwater contamination. However, adjacent to the Application Site boundary, active landfilling and incineration of non-hazardous wastes occurs. The ground gas risk for the Facility is unknown and no ground gas information is available. Consideration of the potential risk from ground gas, including the potential risk of ground gas accumulation in confined spaces could represent a risk to human health through asphyxiation and explosion. In addition to the risk posed from existing sources of contamination, there are potential risks from the accidental spillages, leakages and inadvertent release of contamination during construction activity. Further Phase 2 investigation works will inform the necessary requirements for mitigation used to inform this assessment.

11.7.14 Construction workers were considered the most sensitive receptor, due to their longer and more direct exposure routes, resulting from the activities they would be engaged in, in comparison to the general public. Potential impacts to construction workers can, however, be managed directly via appropriate controls and construction management practices. Embedded mitigation, as described in **Table 11.14**, will control the majority of impacts associated with ground contamination.

11.7.15 The impacts were predicted to be of local spatial extent (localised to the work areas), of short-term duration, of intermittent occurrence and high reversibility (occurring only during the works). Exposure to contamination will vary depending on the exposure scenario, e.g. duration of exposure and proximity to contamination. Embedded mitigation will control most impacts associated with ground contamination. Where significant risks have been identified, (such as

ground gases and vapours) further assessment and remediation will be undertaken prior to development. The magnitude of effect was therefore assessed as **low** for construction workers and **low** for the public.

11.7.16 The sensitivity of human health is considered to be **high**.

11.7.17 Given the magnitude of the impact and sensitivity of the receptors, impacts were therefore predicted to be of **moderate adverse** significance for construction workers and general public prior to mitigation.

Impact 2 – Impact on Groundwater Quality from Construction-Related Activities

11.7.18 The Application Site is underlain by superficial deposits and bedrock geology that is classified as unproductive strata. No groundwater abstractions were identified as supported by or associated with the groundwater environment present beneath the Application Site.

11.7.19 Construction activities will likely involve the direct disturbance of superficial deposits and soils during construction. Piled foundations will also be utilised for the proposed wharf and site plant.

11.7.20 Removal of superficial deposits could alter the surface hydrology, disrupt infiltration rates and alter surface runoff interactions with the subsurface. This could alter pathways and allow the mobilisation of sources of contamination within superficial deposits and allow the migration of contaminants into strata containing the underlying superficial aquifer. Piling could also result in the creation of preferential pathways. The magnitude of the impacts on groundwater were therefore considered to be **moderate**.

11.7.21 The superficial and bedrock deposits below the site are classified as unproductive strata. There are no licenced or private water groundwater abstraction or groundwater source protection zones within 1 km of the Application site. The sensitivity of the aquifer alone would be considered low. However, given the proximity (adjacent) and anticipated groundwater flow being towards The Haven which supports a local nature reserve (Havenside), the sensitivity of the receptor was therefore considered to be **medium.**

11.7.22 Taking into account the proposed embedded mitigation (**Table 11.14**) and with agreement on appropriate groundwater protection measures for the Facility the magnitude of effect would be considered **low.** Given the sensitivity of the receptor is **medium** the anticipated impact of the Facility is considered to be of **minor adverse** significance.

Impact 3 – Impact on Groundwater Quantity from Construction Related Activities

11.7.23 Construction activities will involve the direct disturbance of superficial deposits and soils during construction. The specific impact of concern is the requirement for dewatering and alteration in the groundwater flow from the Application Site. This may occur as a result of direct dewatering or surcharging requirements for the Facility or as the indirect alteration of the site's groundwater flow dynamic by the creation of preferential pathways or creation of below ground structures. The site is underlain by superficial deposits and bedrock geology that is classified as unproductive strata. No groundwater abstractions were identified as supported by or associated with the groundwater environment present beneath the Application Site.

11.7.24 Dewatering and surcharging requirements for the construction of the Facility have not been defined at this stage. However, dewatering and / or surcharging could be required for the installation of foundations and piling for the proposed wharf and the gasification Facility and associated infrastructure. Dewatering or surcharging would impact the quantity of groundwater flow from within the site to the surrounding environs.

11.7.25 Removal of superficial deposits could alter the surface hydrology, disrupt infiltration rates and alter surface runoff interactions with the subsurface. This could alter pathways and quantity of groundwater flow within superficial deposits. However, given the anticipated ground conditions, with superficial deposits and bedrock geology consisting of low permeability strata, the geology is unlikely to hold significant flows.

11.7.26 The magnitude of the impacts on groundwater quantity are considered to be long to medium term, with localised effects on water quality or availability. Therefore, the magnitude of effects is considered to be **moderate**. Considering the embedded mitigation (**Table 11.14**) and requirement for a hydrogeological risk assessment the magnitude would be reduced to **low.**

11.7.27 The superficial and bedrock deposits below the site are classified as unproductive strata. There are no licenced or private water groundwater abstraction or groundwater source protection zones within 1 km of the Application site. The sensitivity of the aquifer alone would be considered low. However, given the proximity (adjacent) and anticipated groundwater flow being towards The Haven which supports a Local Nature Reserve (Havenside), the sensitivity of the receptor was therefore considered to be **medium**.

11.7.28 The sensitivity of receptors is considered to be **medium** and the magnitude of

effect taking into account embedded mitigation is **low** therefore, the anticipated significance of impact to groundwater quantity is considered to be of **moderate adverse** significance.

Impact 4 – Impact on Surface Water Quality from General Earthworks and Construction Related Activities

11.7.29 Construction activities will involve the direct disturbance of superficial deposits and soils during construction. This could alter the surface water regime during construction. In addition, where soils or superficial deposits excavated during the works are retained on site in bunds, run off could occur.

11.7.30 The potential impacts to surface water quality relate to:

- Run off from stockpiles of superficial deposits and soils;
- Accidental spillages or leakages;
- Mobilisation of existing contamination; and
- Alteration of the groundwater regime and mobilisation of groundwater contaminants and subsequent discharged to surface waters.

11.7.31 Surface water receptors are located adjacent to the Application Site with works taking place within the flood bank and mudflats adjacent to main channel of The Haven. Additional surface water receptors include three land drains located within and surrounding the Application Site. Surface waters including drains present on the Application Site are considered to be a **medium** sensitivity receptor, as The Haven supports the Local Nature Reserve site (Havenside) directly opposite the Facility.

11.7.32 Taking into account the nature of the anticipated construction (as outline above) and the embedded mitigation (**Table 11.14**) the effect to surface water quality is considered to be short-term. With a short-term impact on water quality and potential for short-term derogation, it is anticipated that the magnitude of construction impacts would be **low.**

11.7.33 It is anticipated that after adopting the outlined embedded mitigation measures, specifically the adherence to the environment agency pollution prevention guidance, the magnitude of effect will be **low** and therefore given the sensitivity of the receptor is **medium** the impact would be considered to be of **minor adverse** significance.

Impact 5 – Impacts to Soil Quality

11.7.34 The following activities proposed during the construction phase were identified as

having a detrimental impact on existing soil resources:

- Intrusive pre-construction technical surveys and investigations;
- Removal of vegetation;
- Topsoil stripping, earthworks and landscaping within the construction footprint;
- Construction and operation of temporary haul roads to minimise traffic on soils;

11.7.35 There is the potential for soils to be compacted and soil structure to deteriorate during the works. The result would be reduced biological activity, porosity and permeability and increased strength. It can also lead to reduced water infiltration capacity and increased risk of erosion (European Commission, 2008). The effect of all of these impacts is usually reduced fertility and crop yields, should the site be returned to agricultural use in the future.

11.7.36 The current known baseline for the site classifies the soils as heavy loamy soils. The sensitivity heavy loamy and clay soils, which are vulnerable to degradation is considered to be **high**.

11.7.37 The embedded mitigation outlined above will be incorporated into a Soil Management Plan (SMP) for the site. This would be completed pre-construction once an earthworks contractor has been appointed and detailed earthworks phasing information is available. The contractor would be required to comply with the SMP.

11.7.38 Following the incorporation of the mitigation measures outlined above in detail. The magnitude of effects are considered to be **negligible,** given the sensitivity of soil quality is **high**, the significance of impacts are considered to be of **minor adverse** significance.

<u>Impact 6 – Loss of Best Most Versatile (BMV) Agricultural Land</u>

11.7.39 The current known baseline classifies the soils present on the majority of the site as ALC Grade 1, therefore the sensitivity of this receptor is considered to be **high**. However, where detailed post-1988 surveys have taken place, within and adjacent to the Application Site, the ALC classification has been shown to be of a lower grade. For some areas of the Application Site detailed agricultural land classification surveys have been undertaken. During this survey, soils were classified as Grade 2 and Grade 3a (Natural England (2016)). This is considered BMV agricultural land. Detailed post 1988 surveying is more accurate than strategic agricultural mapping, therefore should further detailed soil classification

work be carried out, the classification of the site would likely be reduced given areas of the site no longer contain soil and current have the high grade classification. However, soils are still likely to be considered BMV agricultural soils.

11.7.40 The Facility will lead to a loss of agricultural land. The Application Site is currently not utilised for agricultural purposes and was allocated for industrial use in the Lincolnshire Minerals and Waste Local Plan (LCC, 2016). The magnitude of the impacts on agricultural land and loss of BMV for the size of the proposed Facility would be considered to be **high**, with the potential to effect regulatory compliance for the Application Site and a permeant loss of agricultural land across the Application Site. However, taking into consideration the allocation of the Facility within an adopted Local Plan (LCC, 2016). Meaning that regulatory assessment and approval for this loss of BMV and agricultural soils within the Application site has already be made. Additionally, it is anticipated that after adopting the outlined embedded mitigation measures and requirement for a soil survey and development of SMP pre-construction the magnitude impacts to agricultural soils and BMV from the Facility is considered to be **negligible.**

11.7.41 Given the magnitude of the impact is considered to be **negligible** and sensitivity of BMV and agricultural land at the Facility is **high**, the significance of the effect the potential impacts was therefore predicted to be of **minor adverse** significance for human health and groundwater. This is not considered to be “significant” in EIA terms.

### Potential Impacts during Operation

11.7.42 On completion of construction works, the majority of the Application Site will be hard standing. This significantly reduces the potential impacts from contaminated land to human health and controlled waters. However, during operational activities within any peripheral landscaped areas or disturbance of the ground, future pathways for contamination exposure could occur. Potential operational phase impacts may occur from ground gas and gas encountered from maintenance related activities.

11.7.43 The impacts during the operation of the Facility will be mitigated by the requirement to adhere to the Facility’s environmental permit, site operational procedures, working practices and appropriate PPE required under UK Health and Safety legislation.

11.7.44 No impacts to soils in terms of ALC or Soil Quality are anticipated to arise during the operational phase of the Facility, because all proposed operational activities

will occur on hard standing or dedicated roadways. With all agricultural soils removed from site during the construction phase. Impacts to soils during the operation phases have therefore not been considered further.

11.7.45 Impacts to surface waters from operational activities were considered in **Chapter 15 Marine Sediment and Water Quality** and the drainage requirements for the Facility were considered in **Chapter 13 Surface Water, Flood Risk and Drainage Strategy**.

Impact 1 - Impact to Human Health and Groundwaters During Operational and Maintenance Activities as a Result of Residual Contaminants

11.7.46 During the construction phases of the Facility, further investigation work is proposed and specific measures for dealing with identified and unidentified sources of contamination will have been established. Where appropriate and necessary, unacceptable pollutant linkages will be addressed. This will be completed considering a conceptual model with the operational stages of the Facility considered. Potential impacts could still occur where maintenance activities are required.

11.7.47 The sensitivity of human health receptors is considered to be **high.** Construction workers were considered to experience the greatest magnitude of effect due to longer and more direct exposure routes resulting from the activities they would be engaged in, in comparison to the general public. Potential impacts to construction workers can, however, be managed via appropriate controls and construction management practices. Embedded mitigation, as described in **Table 11.14**, will control most impacts associated with ground contamination.

11.7.48 The sensitivity of controlled waters is considered to be **medium**, for the reasons previously outlined.

11.7.49 The magnitude of effect from exposure to contamination will vary depending on the exposure scenario e.g. duration of exposure and proximity to contamination. Best practice will control most impacts associated with ground contamination and operational risks from gasses. Considering the embedded mitigation (**Table 11.14**) the magnitude of effects was considered to be **negligible** for construction workers and the general public.

11.7.50 Given the magnitude of the impact is considered to be **negligible** and the sensitivity of the receptor is considered **high**, the predicted impact is considered to be of **minor adverse** significance. This is not considered to be significant in EIA terms.

Impact 2 - Impact to Human Health and Groundwater during Operation as a Result of New Sources of Contamination being Introduced

11.7.51 The Facility will operation under an environmental permit, be operated by fully trained and staff, and in line with company standard operating procedures. Risk to human health and controlled waters could occur during the operation of the Facility from new sources of contamination could be introduced as a result of maintenance activities. Should any maintenance activities be undertaken during the operation of the Facility, the same risks to human health (including maintenance works and general public) and controlled waters are likely to occur. However, it is anticipated that same PPE requirements and embedded mitigation measures considered during the construction stage of the Facility will be utilised. Therefore, the magnitude of impacts is considered to be **negligible.**

11.7.52 Impacts to hydrogeology as a sensitive receptor are considered to be highly localised and restricted to the Application Site. Accidental spillages may occur, leading to the introduction of new sources of contamination during the operation of the Facility. These were considered in detail within **Chapter 13 Surface Water, Flood Risk and Drainage Strategy**.

11.7.53 With the incorporation of environmental permitting requirements, embedded mitigation impacts to human health and groundwaters from operational and maintenance actives are considered to be of **minor adverse** significance. This is not considered to be “significant” in EIA terms.

**Potential Impacts during Decommissioning**

11.7.54 The impacts during the decommissioning phase of the project are considered to be similar to the impacts considered during the construction phase, with the exception of the loss of agricultural land. It is not anticipated that the operation of the Facility would significantly change the baseline conditions at the site, and therefore the same control and management processes would be applicable to decommissioning as for construction.

11.7.55 The loss of agricultural land during the decommission phase of the Facility is not anticipated to have a similar impact during the decommissioning phase of the project. The site has been allocated for industrial use and as such is unlikely to be considered for agricultural use in the future. Therefore, no alteration to the status of agricultural soils are anticipated to occur during the decommissioning phase.

## 11.8 Cumulative Impacts

11.8.1 Cumulative impacts with the Boston Barrier project are outlined in **Table 11.16**.

11.8.2 Cumulative impacts associated with other local projects will be provided in the ES.

**Table 11.16 Potential Cumulative Impacts**

| Impact | Potential for cumulative impact | Data confidence | Rationale |
|---|---|---|---|
| Impact 1 – Impact on Human Health, Including Construction Workers and General Public During Any Excavations and Construction Related Activities | No | High | Construction activities will require environmental management controls (e.g. dust suppression) likely to limit the impacts with project boundaries. |
| Impact 2 – Impact on Groundwater Quality from construction related activities | No | High | Boston Barrier could interact with the Facility should construction activities overlap. However, the programme for construction of the Facility and the Boston Barrier are not anticipated to overlap. |
| Impact 3 – Impact on Groundwater Quantity from construction related activities | No | High | Boston Barrier could interact with the Facility should construction activities overlap. However, the programme for construction of the Facility and the Boston Barrier are not anticipated to overlap. |
| Impact 4 – Impact on Surface Water Quality from general earthworks and construction related activities | No | High | Boston Barrier could interact with the Facility should construction activities overlap. However, the programme for construction of the Facility and the Boston Barrier are not anticipated to overlap. |
| Impact 5 – Impacts on soil quality | No | High | Boston Barrier is located within an urban area, therefore no impacts to soil quality are likely to occur. Any impacts to soil quality are highly localised and are only considered within project boundaries. |
| Impact 6 – Loss of Best Most Versatile (BMV) agricultural Land | No | High | Boston Barrier is located within an urban area, therefore no impacts to soil quality are likely to |

| Impact | Potential for cumulative impact | Data confidence | Rationale |
|---|---|---|---|
| | | | occur. Any impacts to soil quality are highly localised and are only considered within project boundaries. |

## 11.9 Transboundary Impacts

11.9.1 There are no transboundary impacts regarding contaminated land, land use and hydrogeology because the Application Site is not sited in proximity to any international boundaries. Therefore, transboundary impacts were scoped out of this assessment and were not considered further.

## 11.10 Inter-Relationships with Other Topics

11.10.1 This chapter has inter-relationships with **Chapter 8 Cultural Heritage**, **Chapter 13 Surface water, Flood Risk and Drainage Strategy**, **Chapter 14 Air Quality**, **Chapter 15 Marine Water and Sediment Quality and Chapter 22 Health**, as detailed in **Table 11.17**.

**Table 11.17 Chapter Topic Inter-Relationships**

| Topic and description | Related Chapter | Where addressed in this Chapter |
|---|---|---|
| Impacts on water quality associated with surface water discharges | **Chapter 15 Marine Water and Sediment Quality** | **Section 11.7** |
| Cultural heritage: Impacts on peat deposits | **Chapter 8 Cultural Heritage** | **Sections 11.6 and 11.7** |
| Impacts to Human Health | **Chapter 22 Health** | **Section 11.7** |
| Waste | **Chapter 23 Waste** | Embedded mitigation |

## 11.11 Interactions

11.11.1 The impacts identified and assessed in this chapter have the potential to interact with each other, which could give rise to synergistic impacts because of that interaction. The worst-case impacts assessed within the chapter take these interactions into account and for the impact assessments are considered conservative and robust. For clarity, the areas of interaction between impacts are presented in **Table 11.18**, along with an indication as to whether the interaction may give rise to synergistic impacts.

**Table 11.18 Interaction Between Impacts**

| Potential interaction between impacts | | | | | | |
|---|---|---|---|---|---|---|
| **Construction** | | | | | | |
| | Impact 1 – Impact on Human Health, Including Construction Workers and General Public During Any Excavations and Construction Related Activities | Impact 2 – Impact on Groundwater Quality from construction related activities | Impact 3 – Impact on Groundwater Quantity from construction related activities | Impact 4 – Impact on Surface Water Quality from construction related activities | Impact 5 – Impacts on soil quality | Impact 6 – Loss of Best Most Versatile (BMV) Agricultural Land |
| Impact 1 – Impact on Human Health, Including Construction Workers and General Public During Any Excavations and Construction Related Activities | - | Yes | Yes | Yes | No | No |
| Impact 2 – Impact on Groundwater Quality from construction related activities | Yes | - | Yes | Yes | No | No |

| Potential interaction between impacts | | | | | | |
|---|---|---|---|---|---|---|
| **Construction** | | | | | | |
| | Impact 1 – Impact on Human Health, Including Construction Workers and General Public During Any Excavations and Construction Related Activities | Impact 2 – Impact on Groundwater Quality from construction related activities | Impact 3 – Impact on Groundwater Quantity from construction related activities | Impact 4 – Impact on Surface Water Quality from construction related activities | Impact 5 – Impacts on soil quality | Impact 6 – Loss of Best Most Versatile (BMV) Agricultural Land |
| Impact 3 – Impact on Groundwater Quantity from construction related activities | Yes | Yes | - | Yes | No | No |
| Impact 4 – Impact on Surface Water Quality from construction related activities | Yes | Yes | | - | No | No |
| Impact 5 – Impacts on soil quality | No | No | No | No | - | Yes |
| Impact 6 – Loss of Best Most Versatile (BMV) Agricultural Land | No | No | No | No | Yes | - |

| Potential interaction between impacts | | | | | | |
|---|---|---|---|---|---|---|
| **Construction** | | | | | | |
| | Impact 1 – Impact on Human Health, Including Construction Workers and General Public During Any Excavations and Construction Related Activities | Impact 2 – Impact on Groundwater Quality from construction related activities | Impact 3 – Impact on Groundwater Quantity from construction related activities | Impact 4 – Impact on Surface Water Quality from construction related activities | Impact 5 – Impacts on soil quality | Impact 6 – Loss of Best Most Versatile (BMV) Agricultural Land |
| **Decommissioning** | | | | | | |
| It is anticipated that the decommissioning impacts will be similar in nature to those of construction. | | | | | | |

## 11.12 Summary

11.12.1 A summary of the impacts relating to contaminated land, land use and hydrogeology are detailed in **Table 11.19** below.

**Table 11.19 Impact Summary**

| Potential Impact | Receptor | Value/ Sensitivity | Magnitude | Significance | Mitigation | Residual Impact |
|---|---|---|---|---|---|---|
| **Construction** | | | | | | |
| Impact 1 – Impact on Human Health, Including Construction Workers and General Public During Any Excavations and Construction Related Activities | Human Health | High | Low | Minor | Further investigation to assess ground gas risk and embedded mitigation | **Minor Adverse** |
| Impact 2 – Impact on Groundwater Quality from construction related activities | Groundwaters | Medium | Negligible | Minor | Embedded mitigation | **Minor Adverse** |
| Impact 3 – Impact on Groundwater Quantity from construction related activities | Groundwaters | Medium | Negligible | Minor | Embedded mitigation | **Minor Adverse** |
| Impact 4 – Impact on Surface Water Quality from general earthworks and construction related activities | Surface waters | Medium | Negligible | Minor | Embedded mitigation | **Minor Adverse** |
| Impact 5 – Impact on soil quality | Soils quality | High | Moderate | Moderate | Embedded mitigation | **Minor Adverse** |
| Impact 6 – Loss of Best Most Versatile (BMV) agricultural land | Land Use | High | Negligible | Minor | Embedded mitigation | **Minor Adverse** |
| **Operation** | | | | | | |
| Impact 1 - Impact on Human Health and Controlled waters Including Workers and Public During Operation as a result of residual contaminants present within the | Human Health Groundwater | High | Negligible | Minor | Embedded mitigation | **Minor Adverse** |

| Potential Impact | Receptor | Value/ Sensitivity | Magnitude | Significance | Mitigation | Residual Impact |
|---|---|---|---|---|---|---|
| ground | Surface waters | | | | | |
| Impact 2 - Impact on human health and controlled waters during Operation from as a result of new sources of contamination being introduced | Human Health<br>Groundwater<br>Surface waters | High | Negligible | Minor | Embedded mitigation | **Minor Adverse** |

## 11.13 References

British Geological Survey. (2019) Onshore GeoIndex, [Online], Available: http://mapapps2.bgs.ac.uk/geoindex/home.html [January 2019].

British Geological Survey. (1995). Boston. England and Wales Sheet 128. Solid and Drift Geology. 1:50 000 Provisional Series (Keyworth, Nottingham: British Geological Survey).

British Standard Institute (BS) 10175: 2011 + A2 2017 – Investigation of Potentially Contaminated Sites – Code of Practice

British Standard Institute (BS) 5930: 2015 – Code of practice for ground investigations

Department for Environment, Food and Rural Affairs (2009) Code of practice for the sustainable use of soils on construction sites PB13298 Defra Soils Policy Team London

Environment Agency (2018) The Environment Agency's approach to groundwater protection Available: https://www.gov.uk/government/publications/groundwater-protection-position-statements [July 2018]

Environment Agency (2017) Groundwater Protection: Principles and Practice, Environmental Agency Bristol. https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/598799/LIT_7660.pdf

Environment Agency (2010) Managing Invasive Non-native Plants – Managing invasive non-native plants in or near fresh water. Bristol, United Kingdom.

Lincs Laboratory. (2011). Ground Investigation Report for Boston Waste Transfer Station, Slippery Gowt Lane, Riverside Industrial Estate, Lincolnshire. December 2011.

Lincolnshire County Council (2016) Lincolnshire Minerals and Waste Local Plan – Core Strategy and Development Management Policies

Ministry of Agriculture, Fisheries and Food (1988) Agricultural Land Classification of England and Wales - Revised guidelines and criteria for grading the quality of agricultural land

Mott MacDonald. (2015). Boston Barrier Ground Investigation Report. Report to the Environment Agency, February 2015.

Natural England (2016) Agricultural Land Classification detailed Post 1988 ALC survey, Boston, Slippery Gowt Lane (ALCC02991) Available: http://publications.naturalengland.org.uk/publication/4509216597868544 [November 2018]

Natural England (2018) Guide to assessing development proposals on agricultural land [online] Available: https://www.gov.uk/government/publications/agricultural-land-assess-proposals-for-development/guide-to-assessing-development-proposals-on-agricultural-land [December 2018]

T.L.P. Ground Investigations. (2012). Ground Investigation Report. Proposed Power Generation Plant, Land off Nursery Road, Boston, Lincolnshire. November 2012.

South East Lincolnshire Joint Strategic Planning Committee. (2019). South East Lincolnshire Local Plan 2011-2036 Publication Version, March 2019.

WYG (White Young Green) Environment. (2015). Boston Barrier Phase 3 Final Factual Ground Investigation Report.