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11. Ground Conditions and Hydrogeology

11.1 Introduction

11.1.1 This chapter of the Environmental Statement (ES) addresses the potential effects of the construction, operation (including maintenance) and decommissioning of the proposed gas fired generating station on the site of the West Burton Power Station (the Proposed Development) on geology, geo-environmental ground conditions and groundwater. The assessment considers:

- the present-day and future baseline geological and hydrogeological conditions during construction and at opening;
- the likely nature and existing sources of contamination which may be present at the Site;
- the effects of construction and operation of the Proposed Development on geology, geo-environmental ground conditions and groundwater; and
- the potential effects of the eventual decommissioning of the Proposed Development.

11.1.2 The assessment of cumulative geological and hydrogeological effects associated with the Proposed Development and other committed developments in the vicinity are described in **Chapter 16:** Cumulative and Combined Effects.

11.1.3 This chapter is supported by **Appendix 11A:** Phase 1 Geo-environmental Site Assessment and **Appendix 11B**: West Burton C Ground Investigation Environmental Support and Sampling (ES Volume II). It should be noted that given the considerable overlap between disciplines, some of the potential impacts and effects relating to the hydrogeology are also addressed within **Chapter 12:** Flood Risk, Hydrology and Water Resources of this ES.

11.2 Legislation, Planning Policy and Guidance

11.2.1 Redevelopment of brownfield land which forms part of the Site must take into account the regulatory context of the work, provide information that is appropriate for development, and be in accordance with UK good practice. An environmental assessment of the condition of the Site must not only consider the potential receptors of human health and controlled waters, but also include a review of the relevant legislation and planning policy that applies to the Site and its immediate environs.

Legislative Background

Water Framework Directive (WFD)

11.2.2 The European Union (EU) Water Framework Directive (WFD) (2000/60/EC) (Ref 11-1) is one of the key European Directives setting the context for the hydrogeological assessment included within this chapter. The purpose of the

WFD is to establish a framework for the protection and improvement of groundwater, and inland surface waters (rivers and lakes), transitional waters (estuaries) and coastal waters. The assessment on surface waters is described in **Chapter 12:** Flood Risk, Hydrology and Water Resources.

11.2.3 The WFD requires the UK to classify the current condition of key waterbodies (giving a '*status*' or '*potential*') and to set objectives to either maintain the condition, or improve it where a waterbody is failing minimum targets. Any activities or developments that could cause deterioration within a nearby waterbody, or prevent the future ability of a waterbody to reach its target status, must be mitigated, so as to reduce the potential for harm and allow the aims of the WFD to be realised.

Industrial Emissions Directive (IED)

11.2.4 The Industrial Emissions Directive (IED) (2010/75/EU) (Ref 11-2) was adopted on November 24 2010, and came into force in January 2011. The IED regulates certain industrial processes including generating stations of the capacity of the Proposed Development and has resulted in revisions to the existing Environmental Permitting Regulations (EPR) including the requirement to establish a baseline ground conditions report for all regulated sites storing and handling hazardous materials as required in Article 22 of the IED. This process is outlined in the European Commission Guidance concerning baseline reports under Article 22(2) of Directive 2010/75/EU on industrial emissions (2014/C136/03) (Ref 11-3).

11.2.5 This guidance presented a seven-stage approach to generating a 'baseline report' which presents the condition of the land under the site for '*relevant hazardous substances*' present at the Site. Following completion of a desktop assessment, collation of a targeted set of baseline site condition data may be needed to meet this requirement, including collection of samples of soil and groundwater and their analysis.

11.2.6 Article 16 of the IED requires monitoring of groundwater and soil condition to be carried out every 5 and 10 years respectively, with the scale and scope of this monitoring determined based on the findings of the baseline report.

Groundwater Daughter Directive (GDD)

11.2.7 The Groundwater Daughter Directive (GDD) (2006/118/EC) (Ref 11-4) was adopted in November 2006, and sets out the approach to protect groundwater against pollution and deterioration in response to Article 17 of the WFD. The transposition of the GDD into law in England and Wales was achieved through the Groundwater Regulations (2009) (Ref 11-5) but is now implemented in England and Wales though the Environmental Permitting (England and Wales) Regulations (2016) (Ref 11-6) and two Directions to the Environment Agency from the Secretary of State and National Assembly for Wales. The first Direction sets out the principles for classifying groundwater and surface water bodies and the

second Direction sets out water quality standards and groundwater threshold values.

7th Environment Action Programme (EAP)

11.2.8 The 7th EAP (Decision No. 1386/2013/EU) (Ref 11-7) entered into force in January 2014, and is guided by the following long-term vision:

"In 2050, we live well, within the planet's ecological limits. Our prosperity and healthy environment stem from an innovative, circular economy where nothing is wasted and where natural resources are managed sustainably, and biodiversity is protected, valued and restored in ways that enhance our society's resilience. Our low-carbon growth has long been decoupled from resource use, setting the pace for a safe and sustainable global society." (Annex, Paragraph 1)

11.2.9 The 7th EAP is based around three priority areas requiring more action, including:

- protect nature and strengthen ecological resilience;
- boost resource-efficient, low-carbon growth; and
- reduce threats to human health and wellbeing linked to pollution, chemical substances, and the impacts of climate change.

11.2.10 In relation to geology, hydrogeology and ground conditions, the first priority area identifies further action on soil protection and sustainable use of land, while the third area covers challenges to human health including air and water pollution and toxic chemicals.

National Legislation

11.2.11 There are three key statutes dealing with the risks posed to human health and the environment associated with historic land contamination, namely:

- Part IIA of the Environmental Protection Act, 1990 (the 'Contaminated Land' regime) (Ref 11-8);
- the Water Resources Act 1991 (Amendment) (England and Wales) Regulations 2009 (Ref 11-9); and
- the Town and Country Planning Act 1990 (Ref 11-10).

11.2.12 In the UK, Part IIA of the Environmental Protection Act, as introduced by Section 57 of the Environment Act 1995 (Ref 11-11), makes provision for identifying '*contaminated land*', the circumstances in which remediation is required and who is responsible for that remediation. Under Part IIA, '*contaminated land*' in respect of which remediation may be required is:

"Any land which appears to the local authority in whose area it is situated to be in such a condition, by reason of substance in, on or under the land, that -

significant harm is being caused or there is a significant possibility of such harm being caused; or

pollution of controlled waters is being or is likely to be caused."

11.2.13 Under the Water Resources Act, '*controlled waters*' are defined as including both surface waters and groundwater. Once a site is classified as '*contaminated land*' then remediation is required to render significant pollutant linkages (i.e. the source-pathway-receptor relationships that are associated with significant harm and/or pollution of controlled waters) insignificant, subject to a test of reasonableness.

11.2.14 A number of specific regulations have been enacted to implement the statutory European and national legislation into UK law. These regulations include:

- the Anti-Pollution Works Regulations 1999 (Ref 11-5);
- the Control of Pollution (Oil Storage) (England) Regulations 2001 (Ref 11-12);
- the Environmental Damage Regulations 2015 (Ref 11-13); and
- the Environmental Permitting (England and Wales) Regulations (Ref 11-6), which control discharge of water to surface water and groundwater.

Planning Policy Context

National Planning Policy

11.2.15 The Overarching National Policy Statement (NPS) for Energy (EN-1) Section 4.10 (Pollution control and other environmental regulatory regimes) (Ref 11-14) details issues relating to discharges or emissions from a proposed project, which may affect air quality, land quality and the marine environment may be subject to separate regulation under the pollution control framework or other consenting and licensing regimes. Before consenting any potentially polluting developments, the following are required:

"The relevant pollution control authority is satisfied that potential releases can be adequately regulated under the pollution control framework"; and

"The effects of existing sources of pollution in and around the site are not such that the cumulative effects of pollution when the proposed development is added would make that development unacceptable, particularly in relation to statutory environmental quality limits" (Paragraph 4.10.7)

11.2.16 Section 5.3 of EN-1 (Biodiversity and geological conservation) states:

"*Where the development is subject to EIA the applicant should ensure that the ES clearly sets out any effects on internationally, nationally and locally designated sites of ecological or geological conservation importance, on protected species and on habitats and other species identified as being of principal importance for the conservation of biodiversity."* (Paragraph 5.3.3)

11.2.17 Section 5.10 of EN-1 (Land use including open space, green infrastructure & Green Belt) states:

"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." (Paragraph 5.10.8)

11.2.18 Section 5.15 of EN-1 (Water Quality and resources) states:

"Where the project is likely to have effects on the water environment, the applicant should undertake an assessment of the existing status of, and impacts of the proposed project on, water quality, water resources and physical characteristics of the water environment as part of the ES or equivalent. The ES should in particular describe:

- *The existing quality of waters affected by the proposed project and the impacts of the proposed project on water quality, noting any relevant existing discharges, proposed new discharges and proposed changes to discharges;*
- *Existing water resources affected by the proposed project and the impacts of the proposed project on water resources, noting any relevant existing abstraction rates, proposed new abstraction rates and proposed changes to abstraction rates (including any impact on or use of mains supplies and reference to Catchment Abstraction Management Strategies);*
- *Existing physical characteristics of the water environment (including quantity and dynamics of flow) affected by the proposed project and any impact of physical modifications to these characteristics; and*
- *Any impacts of the proposed project on water bodies or protected areas under the Water Framework Directive and source protection zones (SPZs) around potable groundwater abstractions."* (paragraph 5.15.3)

11.2.19 NPS EN-2 (Ref 11-15) on Fossil Fuel Electricity Generating Infrastructure (EN-2) states that where a project is likely to have '*effects on water quality or resources, the applicant for development consent should undertake an assessment which should particularly demonstrate that appropriate measures will be put in place to avoid or minimise adverse impacts of abstraction and discharge of cooling water. The applicant for development consent should demonstrate measures to minimise adverse impacts on water quality and resources'.* (paragraph 2.10.2)

11.2.20 The revised National Planning Policy Framework (NPPF) (Ref 11-16) was published in February 2019, replacing earlier versions published in July 2018 and March 2012. The NPPF ensures that land contamination issues must be considered at the planning stage of development and that land must be 'suitable for use', stating in paragraph 178 that planning policies and decisions should ensure that:

"A site is suitable for its proposed use taking account of ground conditions and any risks arising from land instability and contamination. 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);

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; and

Adequate site investigation information, prepared by a competent person, is available to inform these assessments."

11.2.21 Further to this, paragraph 179 places the responsibility for ensuring that no harm from developments arises on land affected by land contamination:

"Where a site is affected by contamination or land stability issues, responsibility for securing a safe development rests with the developer and/or landowner."

11.2.22 **Table 11-1** provides a summary of relevant NPS advice regarding ground conditions and hydrogeology and presents details where matters are assessed within this chapter.

Table 11-1: Summary of relevant NPS advice regarding ground conditions and hydrogeology

Summary of NPS	Consideration within the Chapter
NPS EN-1	
Paragraph 4.10.7 states: "*The relevant pollution control authority is satisfied that potential releases can be adequately regulated under the pollution control framework; and* *The effects of existing sources of pollution in and around the site are not such that the cumulative effects of pollution when the proposed development is added would make that development unacceptable, particularly in relation to statutory environmental quality limits."*	**Table 11-2** and **Table 11-14** **Chapter 16:** Cumulative and Combined Effects
Paragraph 5.3.3 states: "*Where the development is subject to EIA the applicant should ensure that the ES clearly sets out any effects on internationally and locally designated sites of ecological and geological conservation importance, on protected species and on habitats and other species identified as being of principal importance for the conservation of biodiversity."*	**Section 11.6** and **Chapter 9:** Ecology
Paragraph 5.10.8 states: "*Applicants should also identify any effects and seek to*	**Section 11.4** and **Section 11.5.**

Summary of NPS	Consideration within the Chapter
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."	Framework Construction Environmental Management Plan (CEMP) **(Application Document Ref. 7.3)**
Paragraph 5.15.3 states: *"Where the project is likely to have effects on the water environment, the applicant should undertake an assessment of the existing status of, and impacts of the proposed project on, water quality, water resources and physical characteristics of the water environment as part of the ES or equivalent. The ES should in particular describe:* *The existing quality of waters affected by the proposed project and the impacts of the proposed project on water quality, noting any relevant existing discharges, proposed new discharges and proposed changes to discharges;* *Existing water resources affected by the proposed project and the impacts of the proposed project on water resources, noting any relevant existing abstraction rates, proposed new abstraction rates and proposed changes to abstraction rates (including any impact on or use of mains supplies and reference to Catchment Abstraction Management Strategies);* *Existing physical characteristics of the water environment (including quantity and dynamics of flow) affected by the proposed project and any impact of physical modifications to these characteristics; and* *Any impacts of the proposed project on water bodies or protected areas under the Water Framework Directive and source protection zones (SPZs) around potable groundwater abstractions."*	**Section 11.4** and **Section 11.6** **Chapter 12:** Flood Risk, Hydrology and Water Resources
NPS EN-2	
Paragraph 2.10.2 states, where a project is likely to have '*effects on water quality or resources, the applicant for development consent should undertake an assessment which should particularly demonstrate that appropriate measures will be put in place to avoid or minimise adverse impacts of abstraction and discharge of cooling water. The applicant for development consent should demonstrate measures to minimise adverse impacts on water quality and resources'.*	As noted in **Chapter 4**: The Proposed Development, the Applicant holds an Abstraction Licence for abstracting water from the River Trent for use in West Burton A (WBA)

Summary of NPS	Consideration within the Chapter
	Power Station and West Burton B (WBB) Power Station; the licenced capacity is sufficient to provide for the minor water volume requirements of the Proposed Development which will be drawn from the WBB Power Station water treatment facility and delivered either by pipeline or by road tanker. Impacts on water quality and resources are not envisaged due to there being negligible cooling water requirements; only a small amount of water is used in a closed loop cooling system.

Local Development Plan Policy

11.2.23 The Bassetlaw District Core Strategy and Development Management Policies Development Plan Document (Ref 11-17), adopted in December 2011 states:

"The District supports a range of locally designated sites that reflect its variety of rich habitat and geology. Even so, Nottinghamshire as a whole performs very poorly in terms of the amount of its land covered by statutory biological or geological designations and Bassetlaw has considerable opportunity to contribute to the improvement of this figure."

11.2.24 The Core DPD Strategic Objective SO8 concerns protection of "*Bassetlaw's natural environment by maintaining, conserving and enhancing its characteristic landscapes, biodiversity, habitats and species and seeking quantitative and qualitative growth in the green infrastructure network across and beyond the District*" (paragraph 3.3).

11.2.25 A Sustainability Assessment of the Publication Core Strategy and Development Management Policies (Ref 11-18) was published in November 2010, which included the following sustainability objective; *"to protect and manage prudently the natural resources of the district including water, air quality, soils and minerals"*.

11.2.26 BDC is currently in the early stages of preparing a new Local Plan for the District and began consulting on a Draft Bassetlaw Local Plan (Ref 11-19) in January 2019. It states:

*"Bassetlaw has a rich natural environment that reflects the distinctive character of the varied landscapes and underlying geology across the district."(*paragraph 15.1)

11.2.27 Strategic Objective 5 in the Draft Local Plan (Conserve the District's distinctive historic built and natural environments) states:

"The variety of distinctive historic and natural environments throughout Bassetlaw will be conserved and, where possible, enhanced for the enjoyment of future generations of residents and visitors alike. This will include making the most efficient use of land wherever appropriate."(Strategic Objective 5)

11.2.28 None of the policies adopted in the Sturton Ward Neighbourhood Plan (Ref 11-20) are relevant with respect to ground conditions and hydrogeology.

Other Guidance

11.2.29 The Building Act 1984 (Ref 11-21) is supported by the Building Regulations 2000 (Ref 11-22), which contains detailed information regarding the preparation of a site for redevelopment and resistance to contaminants.

11.2.30 The Environment Agency provides general guidance on the management of land contamination in document 'GPLC1 - Guiding Principles for Land Contamination' (Ref 11-23). The Environment Agency also acts as a statutory consultee for developments requiring an EIA. The Environment Agency's primary concern in the management of land contamination through the planning regime is in respect of the protection of the water environment.

11.2.31 Model Procedures for the Management of Contaminated Land, Contaminated Land Report 11 (referred to in this ES as 'CLR11') (Ref 11-24) outlines the approach for the evaluation of contamination in line with UK Government legislation, Environment Agency and National House-Building Council (NHBC) requirements. The procedures recommend the application of a risk-based approach with the first tier assessment being a Phase 1 Desk Top Report to identify previous and current site uses, geological setting and historical contamination records. The approach to further investigation is then based on the risk established by virtue of the Phase 1 Report. If a site has no historical or current evidence of contaminative uses, the scope of further investigation can be less than sites with a long standing history of potentially contaminative uses.

11.3 Assessment Methodology and Significance Criteria

Consultation

11.3.1 The consultation undertaken with statutory consultees to inform this chapter, including a summary of comments raised *via* the formal Scoping Opinion (**Appendix 1B** (ES Volume II)) and in response to the formal Stage 1 consultation is summarised in **Table 11-2**.

Table 11-2: Consultation summary table

Consultee or organisation approached	Date and nature of consultation	Summary of Response	How comments have been addressed in this chapter
Environment Agency	June 2017 (Scoping Opinion)	The Environment Agency are satisfied with the proposed assessment of risk to contaminated waters from land contamination as presented in chapters 5.7.5 to 5.7.9 in the Scoping Report.	Comment only – no response needed.
Marine Management Organisation	June 2017 (Scoping Opinion)	The MMO has noted that the proposed development site is indicated to lie within the footprint of the Environment Agency recorded historic landfill. If the release of contaminated sediments into the River Trent is a possibility, MMO would expect to see this fully addressed within the Environmental Statement, with mitigation measures proposed where necessary.	The potential for contamination of the River Trent and a summary of the impact avoidance and mitigation measures proposed is included within **Section 11.5** and **Section 11.7** of this chapter and in **Appendix 11A:** Phase 1 Geo-environmental Site Assessment (ES Volume II).
National Grid	June 2017 (Scoping	Drilling or excavation works should not be undertaken if they	Appropriate standoff distances will be adopted in

Consultee or organisation approached	Date and nature of consultation	Summary of Response	How comments have been addressed in this chapter
	Opinion)	have the potential to disturb/adversely affect the foundations or 'pillars of support' of any existing tower. These foundations always extend beyond the base area of the existing tower. Foundation drawings can be obtained by contacting national grid.	any ground investigation works, having regard to the extent of the foundations and method for drilling which would be prescribed by an appointed contractor.
Environment Agency	October 2017 (formal consultation response to Preliminary Environmental Information (PEI) Report)	The Environment Agency welcome the proposals for an intrusive site investigation, the production of a CEMP, and a piling risk assessment.	A preliminary intrusive investigation including soil and groundwater sampling was completed in 2017/2018 – results are presented in **Appendix 11B** (ES Volume II). Findings of this investigation are also reflected in this chapter. A Framework CEMP is provided as **Application Document Ref. 7.3.** As described in **Chapter 4:** The Proposed Development (**Section 4.5.10**) if piling is required, this will be subject to a piling and

Consultee or organisation approached	Date and nature of consultation	Summary of Response	How comments have been addressed in this chapter
			penetrative foundation design method statement, informed by a risk assessment, which will be submitted to and, after consultation with the Environment Agency, approved by BDC. This approach would be secured through a Requirement of the draft DCO (**Application Document Ref. 2.1**). All piling and penetrative foundation works would require to be carried out in accordance with the approved method statement to prevent contamination of the underlying soils and groundwater.
		The Environment Agency welcome the approach to site investigation and mitigation proposed by AECOM and advise that a thorough assessment is made of the risks posed by the site to controlled waters. It is suggested that to achieve this, groundwater level	The preliminary intrusive ground investigation (presented in **Appendix 11B** (ES Volume II)) includes soil and groundwater analysis; the results of which have been used in an initial risk assessment for the Environmental

Consultee or organisation approached	Date and nature of consultation	Summary of Response	How comments have been addressed in this chapter
		monitoring and groundwater and soil sampling should be included in the intrusive investigation, and a detailed site conceptual model should be developed.	Permit application. The findings of the investigation have been used to update the conceptual site model (CSM) which informs the assessment within this chapter.
Bassetlaw District Council Environment Agency Lincolnshire County Council Nottinghamshire County Council West Lindsey District Council	March/April 2019	Provision of copies of final draft chapter and offer of pre-application meeting to each consultee to: • discuss final proposals and assessments; • obtain feedback prior to submission of Application; and • agree an approach to drafting of Statements of Common Ground (SoCG) prior to submission of the Application. Further details on consultation undertaken can be found in the Consultation Report (**Application Document Ref. 7.1**).	

Summary of Key Changes to Chapter 11 since Publication of the Preliminary Environmental Information (PEI) Report

11.3.2 The PEI Report was published for statutory consultation in September 2017, allowing consultees the opportunity to provide informed comment on the Proposed Development, the assessment process and preliminary findings through a consultation process prior to the finalisation of this ES.

11.3.3 The key changes since the PEI Report was published are summarised in **Table 11-3** below.

Table 11-3: Summary of key changes to Chapter 11 since publication of the PEI Report

Summary of change since PEI Report	Reason for change	Summary of change to chapter text in the ES
The northern and southern outfall options to the River Trent that were previously under consideration and presented in the PEI Report have been removed from the Proposed Development. Instead, a connection to the existing drainage system will be used (via either a northern or southern drainage connection corridor or by connecting into the existing WBB Power Station site drainage system), resulting in no construction works being required within the River Trent.	Updated design information	The sensitivity of the River Trent has been downgraded from medium-high to medium, given that the proposed northern and southern drainage connection corridors do not extend to the banks of the River Trent and drainage will be discharged to the River Trent via the connection tie-in to the existing WBA Power Station purge line and existing discharge point.
Design and implementation of environmental sampling as part of the intrusive ground investigation.	Addition of initial findings of the ground investigation and refinement of the existing CSM to incorporate the latest information.	**Sections 11.3.28** and **Appendix 11B** (ES Volume II) present the scope of the initial ground investigation completed. Findings are summarised in **Sections 11.4.20 - 11.4.23**
Construction phase assessment year updated for road traffic related emissions.	To reflect updated indicative construction programme.	No changes required.

Methodology for Assessing Baseline Conditions

11.3.4 Baseline information has been obtained in order to assess the likelihood of contamination and its potential nature and extent. Baseline conditions have been

identified from documentary research of the site history, geology, hydrogeology and hydrology, and review of a commercially available regulatory database. The assessment has involved a review of the Groundsure Reports for the Proposed Development (presented within **Appendix 11A**: Phase 1 Geo-environmental Site Assessment (ES Volume II)), as well as publically available BGS mapping (Ref 11-25) and the Environment Agency website (Ref 11-26). This information, together with a site walkover, has then been used to formulate a CSM to allow an assessment of potential environmental risks. The above information has been synthesised, in order to characterise the baseline conditions of the Site.

11.3.5 The intrusive ground investigation completed in December 2017/January 2018 has provided further baseline information to assist in defining baseline soil and groundwater conditions through:

- inspection of soils for visual and olfactory evidence of contamination, including conducting headspace analysis of Volatile Organic Compounds (VOC) in soil samples using a Photo Ionisation Detector (PID);
- collection of samples of made ground, pulverised fuel ash (PFA) and natural soils for chemical laboratory analysis;
- identification of potential presence and depth of groundwater and observation of installation of gas and groundwater monitoring positions;
- development of installed monitoring wells, to ensure groundwater ingress during sampling works is representative of the surrounding formation;
- monitoring of gas and groundwater; and
- collection of ground and surface water samples for chemical laboratory analysis.

11.3.6 Potential receptors have been identified and their relative sensitivity evaluated as described within **Table 11-4**.

11.3.7 The criteria used to determine the sensitivity of receptors and the magnitude of impacts has been developed by technical specialists and has been applied before to similar land development proposals. Where appropriate, for the purpose of this assessment, risk likelihood has been interpreted as being equal to the impact rating (e.g. low likelihood/low impact).

Sensitivity/Importance of Receptors

11.3.8 Using information gathered during the desk-based study, the presence and relative sensitivity of receptors at risk from potential land contamination and risks to geological/geomorphologic features have been evaluated by consideration of the following factors:0

- surrounding land uses, based on mapping, site visits and consideration of the occupants of adjacent sites;

- proposed end-use, based on the nature of the Proposed Development;
- type of construction operations that would be necessary as part of the Proposed Development;
- surrounding sites of nature conservation importance;
- underlying groundwater;
- surrounding sites and/or areas of geological/geomorphologic importance; and
- geology and hydrogeology of the Proposed Development and its surrounding area.

11.3.9 The sensitivity of receptors or geological features that could be affected by the Proposed Development is described qualitatively in **Table 11-4**.

Table 11-4: Descriptive scale for sensitivity of receptors

Qualitative description	Receptor sensitivity		
	Low	Medium	High
End users (operational workers/visitors)	'Hard' end use (e.g. industrial, car parking)	Landscaping or open space	Residential, allotments and play areas
Surrounding land uses	Industrial area	Open space or commercial area	Residential area
Construction workers	Minimal disturbance of ground	Limited earthworks	Extensive earthworks and demolition of buildings
Ecological sites	No sites of significant ecological value close by	Locally designated ecological sites	Nationally or internationally designated ecological sites, including Sites of Special Scientific Interest (SSSIs), Local and National Nature Reserves, Special Protection Areas.
Built environment	Not applicable	Buildings, including services and foundations	Nationally or internationally designated sites of historic value or other sensitivity

Qualitative description	Receptor sensitivity		
	Low	Medium	High
Geology/geomorphology	Areas of superficial geology or geomorphologic features with no special significance	Other areas of potential mineral resources Exposed geological features of local importance or educational value	Nationally or internationally designated geological sites Local Geological Sites SSSIs Mineral reserve allocated on Local Minerals Plan
Groundwater	Non aquifer Low quality resource No abstractions within 1km	Secondary Aquifer Abstraction point within 1km SPZ within 1km of the Site	Principal Aquifer High quality resource Abstraction point within 250m SPZ on-site

11.3.10 The Site was then considered in detail with respect to the proposed construction, operational and decommissioning periods, and any ground contamination or soil quality related impacts considered likely to result are described herein and, where possible, quantified.

Prediction of Potential Impacts

11.3.11 The potential impacts (or risks) associated with land contamination have generally been assessed by means of a hazard-pathway-receptor model (the pollutant linkage), where the following definitions apply:

- hazard: source of contamination;
- receptor: the entity that is vulnerable to harm from the hazard; and
- pathway: the means by which the hazard can come into contact with the receptor.

11.3.12 This assessment considers the impacts of existing contaminants in the ground beneath the Site, as well as those arising from WBA and WBB Power Stations and the potential for the Proposed Development to impact on land quality and receptors on and adjacent to the Site. The assessment also considers the potential for the Proposed Development to impact upon any geological/geomorphologic features.

Contamination Sources (Hazards)

11.3.13 Land contamination sources can be described qualitatively according to the categories shown in **Table 11-5**. This is a qualitative judgement, developed in line with an accepted methodology for Phase 1 desk studies and Part IIA contamination studies (Ref 11-8).

Table 11-5: Descriptive scale for different sources of land contamination

Qualitative description of source (hazard)	Previous land use
Low	Greenfield site, or previous or on-going activities with low potential to cause contamination (e.g. residential, retail or offices), or site investigation data indicating no significant contamination.
Medium	Previous or on-going activities with some potential to cause moderate contamination (e.g. railways, collieries, scrap yards), or site investigation data indicating limited contamination.
High	Previous or on-going activity on or near to site with high potential to cause land contamination (e.g. gasworks, chemical works, landfills), or site investigation data including widespread or severe contamination.

11.3.14 If a hazard has been identified and potentially sensitive receptors are present, then the potential impacts associated with the Proposed Development can be predicted by considering the pathways by which the hazard may affect the receptors.

11.3.15 The most likely potential impacts that may occur in relation to the Proposed Development for different categories of receptor are illustrated on **Table 11-6**.

Table 11-6: Summary of the most likely sources of potential land contamination impacts that may affect sensitive receptors

End users (operational workers/ residents/visitors)	Surrounding land uses (including off-site residential areas)	Construction workers	Sensitive water resources	Ecological sites	Built environment
Direct or indirect ingestion of contaminated soil (operation)	Inhalation or deposition of wind-borne dust (construction)	Direct or indirect ingestion of contaminated soil (construction)	Existing and/or new pollutant pathways (construction and/or operation)	Phytotoxic impacts on plants (operation)	Chemical attack of buried concrete structures (operation)
Concentration of flammable or asphyxiating in-ground gases in enclosed spaces (operation)	Migration of contamination in sub-surface strata (including gases) (construction and/or operation)	Concentration of flammable or asphyxiating gases in confined spaces (construction)	Generation of liquid and/or mobile contaminants (operation)	Toxic impacts on fauna (operation and/or construction)	Concentration of flammable/explosive gases in confined spaces (operation)
Inhalation of harmful in-ground vapours/dusts indoors and outdoors (operation)	N/A	Inhalation of asbestos during building demolition (construction)	N/A	Indirect impacts via contamination of water resources (operation and/or construction)	Permeation of water supply pipelines (operation)

11.3.16 The potential impacts are assessed based on the existing land use at the Site and predicted construction, operation and decommissioning of the Proposed Development.

11.3.17 The magnitude of a potential impact is described, wherever possible, by using the terms defined in **Table 11-7**.

Table 11-7: Descriptive scale for the impacts of land contamination

Magnitude of impact	Examples of typical impacts
High	Loss of exposed designated geological feature. Very high risk of exposure of a sensitive receptor to potentially harmful levels of contamination via a confirmed pathway.
Medium	Quarrying of rock for imported fill, or substantial changes due to cuttings. Proven source – pathway – receptor pollutant linkage identified with elevated level of contamination recorded/or potential to be present.
Low	Superficial disturbance to geology; changes in geomorphology. Identified source – pathway – receptor pollutant linkage identified but contamination likely to be low risk.
Very low	Changes to made ground deposits. No source – pathway – receptor pollutant linkage identified.

Significance of Effects

11.3.18 For each of the potential impacts identified, an assessment has been made of the likely significance of effects.

11.3.19 Where geological receptors are present, then their importance (sensitivity) has been determined (see **Table 11-4**) and the potential magnitude of impacts of the Proposed Development qualitatively predicted (see **Table 11-7**).

11.3.20 Effects are classified based on the identified sensitivity/importance of the receptor and the predicted magnitude of the impact, using the standard assessment matrix set out in **Table 11-8**, in conjunction with professional judgement of site-specific factors that may be of relevance.

Table 11-8: Matrix to determine the significance of an effect (prior to mitigation)

Magnitude of impact	Sensitivity/importance of receptor			
	High	Medium	Low	Very Low
High	Major	Major	Moderate	Minor
Medium	Major	Moderate	Minor	Negligible
Low	Moderate	Minor	Negligible	Negligible
Very low	Minor	Negligible	Negligible	Negligible

11.3.21 This chapter considers that major or moderate effects are significant, in accordance with standard EIA practice.

11.3.22 If potentially significant effects are identified, measures are proposed to mitigate the risks from the hazards. However, industry best practices would be applied, whether there is the potential for significant effects, or not. The assessment is undertaken on the assumption that best practice would be implemented during construction, operation and decommissioning. The generic categories of mitigation are outlined in **Table 11-9**.

Table 11-9: Generic categories of mitigation

Category of mitigation	Description of mitigation measures
Remedial works	Remedial work may be required to allow the development to proceed. The scope and nature of any remedial work is likely to be highly dependent on the results of investigations and subsequent risk assessments.
Design changes	Significant effects can be reduced by changes in design (e.g. protective measures to prevent build-up of flammable gases), or modification of layouts to ensure that sensitive end uses are sited away from likely areas of contamination. Relocation of built features away from geologically important features. Consideration of the construction method proposed for underground structures to minimise potential impacts on groundwater.
Protective measures during construction	Many of the potentially significant effects on the construction workforce can be mitigated by the use of appropriate protective equipment, such as gloves and respiratory protection, and effective dust suppression techniques.

Category of mitigation	Description of mitigation measures
Environmental management	Environmental management may be required to prevent construction work and future operations from giving rise to land contamination.

Extent of Study Area

11.3.23 The Site encompasses the land required for the construction, operation and decommissioning of the Proposed Development (refer to **Chapter 3:** Description of the Site).

11.3.24 Multiple components together make up the Proposed Development, within different areas of the Site illustrated in **Figure 3.3** (ES Volume III). The components of Proposed Development assessed are set out in **Chapter 4**: The Proposed Development (paragraph 4.2.1 – 4.2.5). These include:

- Proposed Power Plant Site and ancillary/auxiliary buildings, equipment and structures;
- construction laydown area;
- surface water drainage system with a connection via either a northern or southern drainage connection corridor to the WBA Power Station drainage system, or a connection into the existing West Burton Power Station site drainage system to the south of the Proposed Power Plant Site. The latter option may include the installation of an additional oil water separator to the south-east corner of the WBB Power Station site. This drainage route also connects into the WBA Power Station purge line;
- rail offloading laydown area;
- gas receiving area;
- electricity connection routes (to tie-in to existing 400kV switchyard to the south-west of the Site); and
- landscaping and biodiversity management and enhancement area.

11.3.25 The study area comprises the Site and up to a 2km zone of influence, according to the Groundsure Reports for the Proposed Development commissioned from Groundsure Limited presented in **Appendix 11A:** Phase 1 Environmental Site Assessment (ES Volume II). Limits of the study radius with respect to individual datasets are described in the *Overview of Findings* section of the Groundsure Geo Insight and Enviro Insight reports and include the following;

- historical industrial sites (500m);
- environmental permits, incidents and registers (500m);
- landfill and other waste sites (1500m);

- current land use (500m);
- hydrogeology and hydrology (2000m);
- designated environmentally sensitive sites (2000m);
- ground workings (1000m);
- mining, extraction and natural cavities (1000m);
- borehole records (250m);
- estimated soil background chemistry (250m); and
- railways and tunnels (500m).

Information Sources

Desk Study

11.3.26 A Phase 1 Geo-Environmental Site Assessment (**Appendix 11A** (ES Volume II)) was conducted to determine the baseline ground conditions and potentially contaminative land uses. As part of this assessment, a review of available previous ground investigation reports, where these were considered relevant to the Proposed Development, was undertaken.

11.3.27 The Groundsure Reports (**Appendix 11A:** Phase 1 Environmental Site Assessment, Annex B (ES Volume II) summarise environmental information available in the public domain from a variety of sources. Information is included on authorisations, permits, discharge consents, water abstractions, groundwater, surface water, ecological sensitivities, licensed waste management and disposal facilities, consented trade effluent discharges, records of unlicensed landfills in the search area, trade directory entries of potentially contaminating activities, Control of Major Accident Hazards (COMAH) registered sites, radon risk, coal (and other) mining and natural subsidence risk, and sensitive land uses (nature reserves, protected areas, sensitive habitats). An updated Groundsure Report has been obtained (February 2019) to inform the assessment presented. It is noted however, that the databases referenced by Groundsure are continually updated and consequently recent developments/registrations in the Site area may have occurred since the Groundsure Report was produced.

Initial Intrusive Site Investigation

11.3.28 An initial Phase 2 intrusive investigation was conducted by the Applicant between 4 and 22 December 2017. The investigation comprised excavation of 13 hand dug and machine dug trial pits, advancement of 20 windowless and rotary boreholes, installation of gas and groundwater monitoring wells and collection of soil, gas, groundwater and surface water samples. Soil, groundwater and surface water samples obtained were submitted for analysis of a range of potential contaminants including heavy metals, sulphates, cyanides, nitrates, petroleum hydrocarbons, PAH and asbestos. **Appendix 11B** (ES Volume II) presents the findings of the

investigation. A factual report for the site investigation will be used by the Applicant to inform the Environmental Permit application for the Proposed Development.

Rochdale Envelope

11.3.29 As set out in **Chapter 4**: The Proposed Development, there are areas for which there is currently variability in the design that could affect the assessment. The Rochdale Envelope defined for building sizes and limits of deviation for building locations do not affect this assessment and is therefore not considered further.

11.4 Baseline Conditions

Existing Baseline

11.4.1 This section describes the Site at present and the sensitivity of the receiving environment to change.

Designated Sites

11.4.2 The Site is located within a Nitrate Vulnerable Zone.

11.4.3 A SSSI is recorded at Lea Marsh, approximately 1km north-east of the Site.

11.4.4 No other environmentally sensitive sites (including Special Protection Areas, Special Areas of Conservation, Ramsar sites, or National and Local Nature Reserves) have been identified within 2km of the Site.

Existing and Previous Land Uses

11.4.5 **Table 11-10** details the history of the Site within the context of the wider West Burton Power Station site, based on available OS historical mapping (**Appendix 11A:** Phase 1 Geo-Environmental Site Assessment (ES Volume II)).

Table 11-10: Review of historical maps relating to the Proposed Development Site

Date	On-Site Land Use	Off-Site Land Use
1885-1886	• agricultural land (fields); • two former river channel features (oxbow lakes, approx. 50-80m channel width) are denoted. One passes through the north of the Site beneath the centre of the Proposed Development and the proposed northern drainage connection corridor.	• Agricultural land (fields), field drains and minor watercourses.

Date	On-Site Land Use	Off-Site Land Use
	The second passes beneath the eastern extent of the proposed southern drainage connection corridor; • building of unknown purpose and a small watercourse are shown to pass through the Site and the proposed southern drainage connection corridor; • the River Trent follows its present course, adjoining the Site to the east.	
1899-1900	• Building of unknown use marked as 'Cheese House'.	• Pumping House shown 150m to the north-west of Site boundary.
1904	• No significant change.	• No significant change.
1916 - 1921	• Two footpaths cross the north of the Site.	• No significant change.
1947-1948	• No significant change.	• No significant change.
1951	• Pumping House no longer inferred.	• No significant change.
1969-1974	• Rail infrastructure is present in the north-west of the Site, adjacent to the coal stockyard of WBA Power Station site. Site drainage is denoted around the stockyard; • field drains shown across the Site; • pumping Station shown in the proposed southern drainage connection corridor; • inferred landfill in the north of the Site, assumed to be a PFA lagoon.	• WBA Power Station and supporting infrastructure shown immediately west and south-west of the Site; • area approximately 150m to the north-west of the Site inferred as 'Emergency dust disposal area' (assumed to be purposed for PFA disposal); • Wheatley Beck and the Catchwater Drain are named on mapping; • sewage works shown immediately north-east of the Site; and

Date	On-Site Land Use	Off-Site Land Use
		• ground workings shown immediately north-west of the Site.
1977-1980	• The former river channels are no longer denoted.	• Surface water ponds shown immediately east of the Site, between the northern and southern drainage connection corridors; • former site of medieval village and church shown 100m south of the Site; and • 'Emergency dust disposal area' still inferred north-east of the Site.
1989-1994	• No significant change.	• No significant change.
2002	• Works compound shown in the north of the Site; • track shown through the south of the Site.	• No significant change.
2010	• North of the Site inferred as 'Emergency Dust Disposal Area'.	• Expansion of WBA Power Station supporting operations west of the Site (possible flue-gas desulphurisation plant); and • excavations of unknown purpose north-east of the Site are shown to be flooded.
2014	• Construction of WBB Power Station. Supporting infrastructure is shown to extend around the Site and along the proposed northern drainage connection corridor.	• No significant change.

11.4.6 The West Burton Power Station site is located immediately north of the remains of the medieval village of West Burton. Prior to its development as a power station in the late 1950s and early 1960s, the West Burton Power Station site was primarily agricultural land. Electricity generation at coal fired WBA Power Station, to the

west of the Site, commenced in 1966 and was officially opened on 25 April 1969. Continued operation of the WBA Power Station facility has produced large volumes of PFA, which has been moved to disposal sites throughout the north-east of the West Burton Power Station site or transported off-site. During the 1970s, PFA produced from the WBA Power Station was disposed of at the Proposed Power Plant Site.

11.4.7 Deemed planning permission was granted for a combined cycle gas turbine (CCGT) generating station (WBB Power Station) in October 2007, under the provisions of Section 36 of the Electricity Act 1989. Construction of WBB Power Station commenced on 2 September 2008, immediately to the east of WBA Power Station. During the construction of the WBB Power Station facility, a large portion of the Proposed Power Plant Site was resurfaced and purposed as a construction laydown area. Electricity generation from WBB Power Station began in 2013.

11.4.8 Planning permission was granted to the Applicant for use of ash processing plant equipment (up to 175,000 tonnes per annum) (NCC Application Number: F/3581) in 2017. The development commenced on 14 July 2017 in accordance with a notification that was sent to NCC.

11.4.9 Planning permission for a 49MW battery storage facility within WBB Power Station was granted to the Applicant by BDC in September 2016. The development became operational in 2018 and includes 20 lithium battery storage units, with ancillary voltage conversion and underground cabling. Each battery unit is contained within a steel shell, and placed on a concrete slab.

11.4.10 In the unlikely event of any releases or spills from the batteries, these are unlikely to impact the Proposed Development, due to the location of the battery project within the WBB Power Station site. Shallow groundwater beneath the footprint of the Battery Storage Facility is anticipated to flow to the east and towards the fishing ponds and River Trent.

Surrounding Area

11.4.11 The surrounding land use has been predominantly agricultural prior to 1969, after which WBA Power Station was constructed, which signalled a shift towards a mixed industrial/agricultural land use.

11.4.12 There are numerous surface water features present adjacent to the West Burton Power Station site, including ponds and drainage water channels.

11.4.13 The West Burton Power Station site is located on the western bank of the River Trent, with both WBA Power Station and WBB Power Station using river water for cooling, via an abstraction point, with water returned to river via an outfall into the River Trent.

11.4.14 Based on this risk outline, there is the potential for contamination to present a high-medium hazard to environmental receptors.

Superficial Geology

11.4.15 A review of the Groundsure Reports (Annex B of **Appendix 11A:** Phase 1 Geo-environmental Site Assessment (ES Volume II)), BGS 1:50,000 solid and drift geology sheet 101 for East Retford, existing site investigation records and publically available BGS borehole records has been conducted to identify the likely geological sequence at the Site.

11.4.16 From a review of BGS information and the geology sections of the Groundsure Reports, the following superficial deposits have been identified as potentially being present beneath the Site:

- Made Ground (associated with PFA deposition);
- alluvium; and
- glacial till.

11.4.17 The relative extent of the uppermost superficial deposits in relation to the Site is discussed in more detail below.

Superficial Geology – the Site

11.4.18 Based on a review of the BGS sheets and Groundsure Report, superficial deposits are shown to underlie the full extent of the Site, consisting of: alluvium – comprised of clay, silt, sand and gravel.

11.4.19 Thick deposits of made ground are also present within the Site; due to the former land use as a PFA disposal site associated with WBA Power Station.

11.4.20 The initial ground investigation (December 2017) encountered made ground containing PFA to approximate depths of between 10.3m bgl (below ground level) to 13.5m bgl. The PFA was typically described as “dark grey silty clay” which was typically loose and friable in the shallower deposits but became wetter with depth. Within the PFA, occasional bands of cemented well rounded gravel, comprising pebbles were identified.

11.4.21 Underlying superficial deposits encountered included red-brown silty clay and grey clay with organic matter. These deposits ranged between 0.25m to 2.0m thick.

Bedrock Geology – the Site

11.4.22 The geological map and Groundsure Report indicate that the Site is underlain by Mercia Mudstone. The following boreholes located within the Site encountered Mercia Mudstone:

- SK88NW42, located within the WBB Power Station site, encountered mudstones and siltstones of the Mercia Mudstone group at 4.11m bgl and terminated at 17.34m bgl; and

- SK88NW41, located within the footprint of the Proposed Development encountered very stiff to hard weathered 'Keuper Marl' (Mercia Mudstone Group) at 5.03m bgl and terminated at 12.34m bgl.

11.4.23 Weathered Mercia Mudstone was encountered during the December 2017 intrusive site investigation at depths between 11.3 to 14.4m bgl.

Coal Mining

11.4.24 The Groundsure Report (within Annex B of **Appendix 11A**: Phase 1 Geo-environmental Site Assessment (ES Volume II)) and the online Coal Authority mapping tools do not show the Site to be within an identified coal mining reporting area. The Groundsure Report revealed no recorded instances of coal mining, mineral extraction, clay extraction or natural cavities beneath the Site. The sensitivity of the geology is low/moderate, based on the absence of coal mining activity beneath the Site.

Hydrogeology

11.4.25 The Environment Agency aquifer classifications for the identified superficial deposits and bedrock underlying the Site are summarised in **Table 11-11**.

Table 11-11: Summary of Environment Agency aquifer classifications

Formation	Environment Agency aquifer classification	Aquifer definition
Superficial deposits		
Alluvium (clay, silt, sand and gravel)	Secondary A Aquifer	Defined by the Environment Agency as *'permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers. These are generally aquifers formerly classified as minor aquifers'.*
Glacial Till (clay)	Secondary A (Undifferentiated) Aquifer	Defined by the Environment Agency as '*an aquifer where it has not been possible to attribute either category A or B to a rock type. In most cases, this means that the layer in question has previously been designated as both minor and non-aquifer in different locations due to the variable characteristics of the rock type*'.

Formation	Environment Agency aquifer classification	Aquifer definition
Bedrock		
Mercia Mudstone Group	Secondary B	Defined by the Environment Agency as '*predominantly lower permeability layers which may store and yield limited amounts of groundwater due to localised features such as fissures, thin permeable horizons and weathering. These are generally the water-bearing parts of the former non-aquifers'.*

11.4.26 Soils at the Site are classified as being of a high leaching potential, meaning that they readily transmit liquid discharges and pollutants, with the exception of soils in an area to the north of the Proposed Power Plant Site and those derived from glacial till in the south-east, which are not classified.

11.4.27 The Site is not located within a groundwater SPZ, according to the Environment Agency.

11.4.28 The Groundsure Report (**Appendix 11A:** Phase I Geo-Environmental Site Assessment, Annex B (ES Volume II)) revealed a single groundwater abstraction license 2km north-east of the Site. Records show the license is for an active Anglian Water potable water supply borehole.

11.4.29 Based on the presence of Secondary A Aquifers in superficial drift deposits and proximity to the River Trent, risk to groundwater is classified as high.

Radon

11.4.30 The Groundsure Report (within Annex B of **Appendix 11A:** Phase 1 Geo-environmental Site Assessment (ES Volume II)) indicates that the Site is not located in a Radon Affected Area, because less than 1% of properties are above the Action Level and no radon protective measures are necessary in construction of new properties or extensions.

Summary of Ground Conditions – the Site

11.4.31 Previous investigations into the ground conditions beneath the Site (see **Appendix 11A:** Phase I Geo-environmental Site Assessment (ES Volume II)) and the results of the December 2017 initial site investigation for the Proposed Development identified that made ground, including PFA, extends to depths between 8–12.5m bgl, which is consistent with the Site being previously used for PFA disposal. The termination depth of the PFA identified in six boreholes in the footprint of the

Proposed Power Plant Site, and underlain by Mercia Mudstone, is as shown in **Table 11-12**.

Table 11-12: Generalised ground conditions beneath the Proposed Development Site

Site Area	Geological unit	Approximate Level at top of stratigraphic sequence (m bgl)	Approximate Strata Thickness (m) encountered	Summary Description
Beneath the Proposed Power Plant Site	Made ground (PFA)	0.2 – 1.8	10.0m (average)	Silts with sand and some gravel
	Superficial deposits (alluvium)	8.0 – 13.2	1.15 – 4.9	Natural clays and silts
	Mercia Mudstone Group	11.0 – 15.2	Not proven	Very weathered to weathered mudstone (marl)
Wider Site outside of the Proposed Power Plant Site	Made ground (PFA)	0 – 1.7	0.6 – 4.6	Silts with sand and some gravel
	Superficial deposits (alluvium)	0 – 6.3	0.5 – 5.6	Natural clays and silts
	River Terrace Deposits	9.7 – 10.0	2.1 – 3.2	Sands and gravels
	Mercia Mudstone Group	8.5 – 12.9	Not proven	Extremely weathered to weathered mudstone (clay/marl)

Groundwater Levels

11.4.32 Groundwater monitoring data taken from the Annual Groundwater Monitoring Report produced by the Applicant in 2017 (Ref 11-27) indicates that groundwater levels vary from 12m AOD to a more typical 2–7m AOD across the majority of the West Burton Power Station site. Most of the Site lies at an elevation of between 10-14m AOD, and is therefore approximately 4–8m above typical groundwater levels.

11.4.33 During the December 2017 site investigation, water strikes were identified during drilling at depths of 1–4m AOD, typically associated with the base of the PFA and

top of the superficial deposits. Subsequent monitoring of standing water levels in the installed wells ranged from 3.3-5.8m AOD indicating sub-artesian conditions. It should be noted that groundwater levels are based on a single monitoring event, and additional monitoring is needed to assess any potential seasonal changes reflecting decreased rainfall and increased evapo-transpiration rates.

Potential Pollutant Linkages

11.4.34 In order for an area of potential contamination within the confines of the Site to pose a significant level of risk to or as a result of the Proposed Development or the wider environment, a potential source and sensitive target or receptor has to be identified, together with a plausible and effective pathway by which the receptor may be exposed to any given hazard.

11.4.35 Based upon the available information, potential sources of contamination within the Site include:

- contamination associated with the historical disposal of PFA (which may include other waste materials);
- permitted activities relating to the West Burton Power Station site's existing operational power stations, including storage and handling of fuels and oils etc.;
- contamination resulting from the Site's previous use as a construction laydown area, during the construction of the WBB Power Station;
- railway sidings adjacent to the coal stockyard;
- the Site's surface water and process water effluent systems, including oily water drainage system, drains, sumps and gullies; and
- historical agricultural land use (e.g. use of pesticides, heavy equipment).

11.4.36 Based upon the available information, potential sources of contamination outside the Site (typically within 500m, unless otherwise specified) include:

- contamination associated with the historical deposition of PFA;
- permitted activities relating to the existing operations associated with WBA and WBB Power Station, including contaminants associated with the main power plant from the boiler house, turbine house, switchyard etc.;
- the nearby wastewater treatment works;
- the West Burton Power Station site's effluent systems, including oily water drainage system, drains, sumps and gullies; and
- the coal stockyard and associated activities (including the railway line serving WBA Power Station).

Potential Contaminants of Concern

11.4.37 Potential compounds of concern associated with the identified potential sources of contamination (based upon desk study evidence) were used in order to schedule soil, groundwater and surface water samples collected during the initial ground investigation (December 2017). The results of the soil and water sampling conducted during the site investigation were screened against Generic Assessment Criteria (GAC). These represent a level of minimal risk, below which it can be presumed that there is no risk to the receptor in question. Where GAC have been exceeded, it does not automatically mean that a risk to the relevant receptor exists but further interpretation of the results may be required. In some cases, the GAC used may also be an environmental standard.

11.4.38 Contaminants of concern analysed included (but were not limited to):

- heavy metals;
- asbestos;
- inorganic ions, including alkalinity and sulphate;
- VOC including benzene, toluene, ethylbenzene and xylene (BTEX);
- semi-volatile organic compounds (SVOCs) including polycyclic aromatic hydrocarbons (PAHs);
- total petroleum hydrocarbons (TPH); and
- ground gases (carbon dioxide, methane, hydrogen sulphide etc.).

11.4.39 The results of the soil and groundwater analysis completed (see **Appendix 11B** (ES Volume II)) have indicated that levels of contamination detected at the Site do not currently present a risk to human health and controlled waters at the Site. The Mercia Mudstone bedrock contains naturally occurring measurable concentrations of a range of metals and sulphates, which can also be expected to occur in surface waters where fed by groundwater.

Potential Receptors

11.4.40 Based upon the available information, the following are considered to be potential receptors:

- human health:
- employees on neighbouring sites (WBA and WBB Power Stations);
- future construction (and on eventual decommissioning, demolition workers).
- controlled waters:
- perched water within made ground and PFA deposits;
- shallow groundwater within the superficial deposits (Secondary A Aquifer);

- deeper groundwater within the bedrock (Secondary B Aquifer);
- surface water (including the Catchwater drain, Wheatley Beck, fishing ponds to the east of the Site and the River Trent) assumed to be in hydraulic continuity with the shallow groundwater and receiving surface waters, via site drainage system;
- infrastructure:
- below-ground structures (e.g. concrete foundations, plastic water pipes);
- confined spaces within buildings (e.g. basements, store cupboards, service ducts); and
- ecology including flora and fauna in woodlands and fishing ponds surrounding the Site.

Potential Pathways

11.4.41 Based upon the available information, the following are considered potential pathways:

- human health:
  - *dermal contact with substances in shallow soil and/or shallow groundwater;*
  - *inhalation of substances in dust;*
  - *inhalation of substances from the partitioning of vapours from soil;*
  - *inhalation of ground gas; and*
  - *accidental ingestion of soil/dust and/or shallow groundwater during potential groundworks.*
- controlled waters:
  - *vertical migration through vegetated areas into areas of permeable made ground/shallow soil;*
  - *lateral and vertical migration within the made ground and superficial deposits (e.g. leaching from PFA in the unsaturated zone into shallow groundwater);*
  - *preferential lateral and vertical migration along former river channels, and former field drains (including granular backfilling materials);*
  - *lateral and vertical migration within shallow groundwater in the made ground/superficial deposits, including to deeper groundwater;*
  - *lateral and vertical migration through the on-site drainage system into surface waters e.g. River Trent;*
  - *lateral and vertical migration within deeper groundwater in the bedrock; and*

- *lateral migration within groundwater to surface water courses including the fishing ponds and River Trent.*

- infrastructure:
  - *direct contact of substances within shallow groundwater with off-site concrete foundations, plastic water pipes etc.; and*
  - *migration of ground gases and accumulation in confined spaces (e.g. basements, service ducts).*
- ecology:
  - *plant uptake and subsequent ingestion by fauna.*

11.4.42 Environmental receptors identified for the current operation of WBA and WBB Power Stations (i.e. baseline conditions) are summarised in **Table 11-13**.

Table 11-13: Summary of baseline receptors and sensitivity

Receptor	Sensitivity	Assumptions
On-site workers	Low	Assumes correct use of suitable personal protective equipment (PPE) and compliance with site operating procedures.
Construction/excavation workers	Medium	Assumes correct use of suitable PPE, compliance with procedures minimising exposure.
Off-site residents	Low	Initial high sensitivity reduced to low based on distance from site to neighbouring residents and assuming site operations are conducted according to agreed protocols, guidance and legislation, and no spillages or releases occur.
Groundwater (Secondary A and B aquifer deposits) and surface water	Medium/High	May be reduced to medium assuming normal site operations, no spills or releases and correct operation of site drainage.
On-site and off-site flora and fauna	Medium	Assuming normal site operations with no spills or releases and adherence to site guidance and protocols during operations.
On-site infrastructure	Low	Assuming appropriate mitigation measures are in place during excavation.

Future Baseline

11.4.43 In the event that the Proposed Development does not proceed, no significant changes to the existing baseline assumed for the Proposed Development are anticipated.

11.5 Development Design and Impact Avoidance

11.5.1 The following impact avoidance measures would either be incorporated into the design or are standard demolition/construction and operational practices. These measures have therefore been taken into account during the impact assessment in **Section 11.6**. Any need for additional mitigation measures are described, where necessary, in **Section 11.7**.

Construction

11.5.2 The appointed contractor(s) would (in due course) be required to produce a Construction Environmental Management Plan (CEMP) that would provide details of proposed environmental control measures, including measures related to the protection of land quality. The CEMP would include the impact avoidance measures as outlined in this section. A Framework CEMP has been prepared to accompany the Application (**Application Document Ref. No. 7.3**); the CEMP prepared by the contractor will be in accordance with the principles set out in the Framework CEMP, and is proposed to be secured by a Requirement of the draft DCO (**Application Document Ref. 2.1**).

11.5.3 During construction of the Proposed Development, the contractor(s) would be required to minimise adverse land contamination effects on sensitive receptors by implementing good operational practices (e.g. employing suitable surface water drainage control).

11.5.4 Construction workers would be protected from contact with hazardous materials by adopting appropriate health and safety measures including an assessment of appropriate measures under the Control of Substances Hazardous to Health (COSHH) Regulations 2002 (Ref 11-28). Such measures would include suitable PPE, welfare facilities and the implementation of dust control where considered necessary.

11.5.5 With regards to earthworks, the contractor(s) would ensure that all material is suitable for its proposed use and would not result in an increase in contamination-related risks on identified receptors including any landscaped areas and underlying groundwater. The CEMP would include measures to ensure that all materials are suitable for the proposed end use. This may include a Materials Management Plan as an appendix, to deal with any removal of materials off-site, although substantial quantities of waste disposal from Site are not envisaged.

11.5.6 The final levels of the Proposed Development platform may require reprofiling or removal of some of the existing PFA deposits present on the Site. However, the

amount of PFA being excavated based on the current design is likely to be extremely small, and where possible will be re-used on-site, with very little envisaged requiring off-site disposal.

11.5.7 The main potential source of oils and fuels on-site is from plant and machinery. Example pollution control measures to avoid or reduce impacts relating to land contamination would include:

- containment measures would be implemented, including drip trays, bunding or double-skinned tanks of fuels and oils; all chemicals would be stored in accordance with their COSHH) guidelines, whilst spill kits would be provided in areas of fuel/oil storage;
- an Emergency Spillage Plan would be produced, which site staff would have read and understood;
- the mixing and handling of materials would be undertaken in designated areas and away from surface water drains; and
- plant and machinery would be kept away from surface water bodies wherever possible and would have drip trays installed beneath oil tanks/engines/gearboxes and hydraulics, which would be checked and emptied regularly. Refuelling and delivery areas would be located away from surface water drains.

11.5.8 Given the historical land use within the West Burton Power Station site, there is a potential for contamination to be encountered locally within excavations. The contractor(s) would be required to implement pollution control measures to deal with any land contamination encountered during the construction works. These measures would include, as a minimum, the following:

- all workers would be required to wear PPE as applicable;
- should any potentially contaminated ground, including isolated 'hotspots' of contamination and/or potential deposits of asbestos containing materials (ACM), be encountered during construction, the contractor(s) would be required to investigate the area and then assess whether there is a need for containment or disposal of the material. The contractor(s) would also be required to assess whether any additional health and safety measures are required. Any such investigations would be required to be undertaken in consultation with the Environment Agency and other appropriate consultees, prior to commencement of the development. To further minimise the risks of contaminants being transferred and contaminating other soils or water, construction workers would be briefed as to the possibility of the presence of such materials;
- in the event that contamination is identified during construction works, appropriate remediation measures would be taken to protect construction workers, future site users, water resources, structures and services;

- the contractor(s) would be required to place arisings and temporary stockpiles away from watercourses and drainage systems, whilst surface water would be directed away from stockpiles to prevent erosion;
- the risk to surface water and groundwater from run-off from any contaminated stockpiles during construction works would be further reduced by implementing suitable measures to minimise rainwater infiltration and/or capture runoff and leachates, through use of bunding and/or temporary drainage systems. These mitigation measures would be designed in line with current good practice, follow appropriate guidelines and all relevant licences including discharge consents;
- any waters removed from excavations by dewatering would be discharged appropriately, subject to the relevant licences being obtained; and
- the contractor(s) would implement, as required, a dust suppression/management system in order to control the potential risk from airborne contamination migrating off-site to adjacent sites, specifically the adjacent agricultural land, surrounding villages and the River Trent.

11.5.9 Foundations and services would be designed and constructed to prevent the creation of pathways for the migration of contaminants and be constructed of materials that are suitable for the ground conditions and designed use, for example water supply pipes would be designed in accordance with current good practice and applicable guidance to ensure pipes are protected from potential impacts associated with any contamination.

11.5.10 Piling design and construction works would be completed following preparation of a piling risk assessment, completed in accordance with the Environment Agency's '*Piling and Penetrative Ground Improvement Methods on Land Affected by Contamination: Guidance on Pollution Prevention*' (Ref 11-29). A piling and penetrative foundation design method statement would be submitted to, and after consultation with the Environment Agency, approval sought from BDC prior to relevant works commencing, secured by a Requirement of the draft DCO (**Application Document Ref. 2.1**).

11.5.11 A site-specific (Phase 2) intrusive ground investigation has been undertaken to provide an initial assessment of ground conditions beneath the Proposed Development. Initial findings of the investigation are summarised in **Section 11.4** above. Following completion of the site-specific (Phase 2) intrusive ground investigation and presentation of results within this chapter and **Appendix 11B:** West Burton C Ground Investigation Environmental Support and Sampling Report (ES Volume II), the need for any investigation or mitigation measures in addition to the impact avoidance measures in **Section 11.5** will be developed and after consultation with the Environment Agency, agreed with BDC, prior to commencement of the Proposed Development, as required, secured by a Requirement of the draft DCO (**Application Document Ref. 2.1**).

Operation

11.5.12 Liquid fuel storage areas, including the above ground emergency diesel generator and storage tank provided for emergency back-up and possibly black-start purposes and the transformer building areas, would be appropriately bunded to ensure that, in the event of any spillage, the materials are safely contained. The following measures are included in the Outline Drainage Strategy presented as **Application Document Ref. 7.8** and would be considered in the detailed design of the Proposed Development:

- an oily water drainage system will be necessary to serve the gas turbines, fuel delivery area and transformer compound to prevent oil contamination from reaching the surface water drainage system;
- any leakages of lube oil from the turbines to drain will either be captured in a local 'blind' bund (i.e. unconnected to site drainage network) for periodic removal off-site or integrated into the station full retention oily water separator which may be connected to the site drainage system;
- the containment of the road tanker fuel delivery area (**Figure 4.1a** and **Figure 4.1b** (ES Volume III)) would be sized as a minimum to capture spillages. Major spillages will be managed either by an appropriately sized oily water separator at the delivery point, or integrating the delivery point drains in to the site oily water management system, this would have the capacity to contain the discharge from a single failed cell of a road tanker (up to 7,600L maximum);
- any transformers that are oil-cooled will require connection to the oily water system;
- diesel tanks will be appropriately bunded (e.g. containerised emergency diesel generator with double skin leak protection);
- rainwater collected within bunds shall be removed using recognised control procedures that prevent rainwater containing any oils entering the drainage system; and
- periodic maintenance, including de-silting and emptying of collected oil, will be undertaken in order to maintain the intended function of the oily water drainage system.

11.5.13 With the above measures in place and with good housekeeping and management practices adopted and adhered to through compliance with the Environmental Permit, significant impacts to soil and groundwater can be avoided.

Decommissioning

11.5.14 The Proposed Development would be subject to decommissioning under the conditions of the Environmental Permit, including conditions relating to chemical/polluting material handling, storage and use and emergency procedures in line with Best Available Techniques (BAT). A detailed Decommissioning Environmental Management Plan (DEMP) would be prepared to identify required

measures to prevent pollution during this phase of the Proposed Development, based on the detailed decommissioning plan.

11.5.15 The impact avoidance measures for decommissioning would be similar to those identified above for the construction phase. As above, measures would be in place to prevent pollution in accordance with the Environmental Permit.

11.6 Likely Impacts and Effects

Construction

11.6.1 Based on current understanding of potential contaminants which may be present in the ground underlying the Site, potential impacts during the construction phase have been identified. These will be re-confirmed following completion of the initial risk assessment and detailed CSM, through the Environmental Permit Site Condition Report. Potential impacts that may be identified as construction works progress are listed below:

- the discovery of soils exhibiting visual and olfactory evidence of contamination during groundworks and the potential disturbance of residual soil contamination through earthworks and construction activities;
- the discovery of impacted groundwater/surface water recovered during dewatering which may not be suitable for discharge (including via the existing West Burton Power Station outfall) without treatment;
- foundation methods and construction activities that may open and/or modify potential pollutant linkages, including the disturbance of sediments from existing drainage channels and the fishing ponds;
- re-profiling of the Site including the possible introduction of new fill materials and the removal of unsuitable or excessive materials;
- runoff from contaminated material exposed and/or stockpiled during Site construction works;
- contamination arising from spillages associated with vehicles and construction materials;
- airborne contamination arising from potentially contaminated dust;
- removal of any waste materials and/or contaminated soil; and
- introduction of contaminated materials during infilling activities.

Operation

11.6.2 Potential impacts during the operational phase are anticipated to include the following:

- leaks, spills and contamination from storage of chemicals, fuels and wastes on-site affecting site users and groundwater; and

- presence of gases, vapours and groundwater in the ground affecting site users and buildings.

Decommissioning

11.6.3 Potential impacts during the decommissioning phase are anticipated to include the following:

- generation of wastes during decommissioning of existing chemical tanks, pipework, and associated infrastructure;
- generation of crushed concrete and other demolition materials;
- the discovery of soils exhibiting visual and olfactory evidence of contamination during demolition and the potential disturbance of residual soil contamination through demolition activities such as the removal of site drainage;
- demolition activities that may open and/or modify potential pollutant linkages, including the disturbance of sediments;
- re-profiling of the Site including the removal of unsuitable materials;
- runoff from contaminated material exposed and/or stockpiled during site demolition works;
- contamination arising from spillages associated with vehicles and demolition materials;
- airborne contamination arising from potentially contaminated dust;
- removal of any waste materials and/or contaminated soil; and
- introduction of contaminated materials during infilling activities.

Summary of Effects

11.6.4 Assuming the implementation of the impact avoidance measures and best practice guidance defined within **Section 11.5**, there is a low likelihood of the identified sensitive receptors being impacted upon by the Proposed Development throughout the construction, operation and decommissioning periods, as described in **Table 11-14**.

Table 11-14: Summary of impacts and likely effects

Description of impact	Mitigating factors	Sensitivity of resource/ receptor	Magnitude of impact	Classification of effect
Construction				
Impact to construction workers from	PPE requirements and engineering controls to be	Medium	Low	Minor adverse (not significant)

Description of impact	Mitigating factors	Sensitivity of resource/ receptor	Magnitude of impact	Classification of effect
contaminated soils, sediments and groundwater/ surface water encountered during construction.	determined following groundwater monitoring as part of the future site investigation. Depth to groundwater to be considered as part of the Environmental Permit Application.			
Impact to groundwater from runoff and/or leachates from stockpiled materials during construction.	Thickness of made ground/PFA anticipated to be high. Mitigation measures to be adopted including collection of runoff and/or covering of stockpiles.	Medium	Low	Minor adverse (not significant)
Impact to groundwater through creation of new or exacerbation of existing pathways during construction.	Potential for residual sources of contamination likely to be moderate. Additional mitigation (e.g. piling risk assessment, proposed to be secured through a Requirement of the draft DCO (**Application Document Ref. 2.1**) would further reduce hazard.	Medium	Low	Minor adverse (not significant)
Impacts to flora, fauna and agricultural land from contaminated soils	Contaminated soils anticipated to be restricted to the Proposed Power Plant Site, away from agricultural	Medium	Low	Minor adverse (not significant)

Description of impact	Mitigating factors	Sensitivity of resource/ receptor	Magnitude of impact	Classification of effect
encountered during construction.	land.			
Impact to workers, off-site residents and land from potentially contaminated dusts generated during construction.	Adoption of suitable mitigation measures to minimise dust generation (e.g. damping down of materials).	Medium	Low	Minor adverse (not significant)
Risks to underlying groundwater potential contamination in imported fill placed at the Site.	Imported fill to be suitable for use, and subject to testing and visual inspection prior to acceptance at the Site.	Medium	Low	Minor adverse (not significant)
Operation				
Impact to groundwater from spills, leachates and runoff during site operation.	All fuel and chemical storage areas to be bunded. Design of surface water drainage to include oil-water separator and sediment traps.	Medium	Low	Minor adverse (not significant)
Impacts to buildings and site workers from gases, vapours and groundwater during operation.	Risks to be minimised through completion of site investigation, gas and groundwater monitoring, assessment of gas characteristic situation and identification of design measures	Low	Low	Negligible adverse (not significant)

Description of impact	Mitigating factors	Sensitivity of resource/ receptor	Magnitude of impact	Classification of effect
	and engineering controls to minimise risks. Proposed gas monitoring rounds during different climatic conditions.			

11.7 Mitigation and Enhancement Measures

11.7.1 As no significant effects have been identified, no additional mitigation measures are required in order to further reduce the potential impacts and effects from the ground conditions on the Proposed Development. Notwithstanding, Requirements of the draft DCO (**Application Document Ref. 2.1**) outline measures to be taken to address any contamination of land, including groundwater on the Site including dealing with unexpected contamination.

11.8 Limitations or Difficulties

Assumptions

11.8.1 The identification of possible future receptors is based on the Proposed Development indicative concept design and details on the components of the development and likely construction methods outlined in **Chapter 4**: The Proposed Development. Detailed method statements and/or work plans for the construction activities at the Site have not yet been prepared as a contractor has not yet been appointed. However, it is considered reasonable to assume that proposed construction activities would follow industry best practice and relevant guidance and comply with current applicable legislation, and that standard construction techniques would be used.

Limitations

11.8.2 Due to the lack of existing information regarding ground conditions within the Proposed Power Plant Site, and in particular relating to the nature and extent of the PFA deposits which may be present, an intrusive ground investigation was conducted in December 2017, a factual report was produced at the end of January 2018 and an interpretative report produced in March 2018 (**Appendix 11B:** West Burton C – Ground Investigation Environmental Support and Sampling Report in ES Volume II). The ground investigation was designed to obtain additional information on ground conditions beneath the Site, both from the perspective of engineering design and assessing environmental risks. While adequate for the purposes of an initial assessment, it should be noted that there may be ground

conditions or contamination present in areas of the Site which are not identified in the ground investigation and which cannot be considered in this assessment.

11.8.3 The findings of the site investigation have been used to inform the ground conditions assessment included in the ES.

11.9 Summary of Likely Significant Residual Effects

11.9.1 Assuming that the design and impact avoidance measures detailed in **Section 11.5** would be employed, the effects related to potential geological, hydrogeological and contamination related impacts associated with the Proposed Development during the construction, operation and decommissioning periods are likely to be negligible or minor adverse (not significant).

11.10 References

Ref 11-1 European Commission (2000) *Water Framework Directive* (2000/60/EC).

Ref 11-2 European Parliament and Council of the European Union (2010) *Directive 2010/75/EU on industrial emissions (integrated pollution and control.*

Ref 11-3 European Commission (2014) *European Commission Guidance concerning baseline reports under Article 22(2) of Directive 2010/75/EU on industrial emissions.*

Ref 11-4 European Parliament and Council of the European Union (2006) *Directive 2006/118/EC on the protection of groundwater against pollution and deterioration (Daughter to 2000/60/EC).*

Ref 11-5 Her Majesty's Stationary Office (1999) *Water Resources, England and Wales The Anti-Pollution Works Regulations 1999.*

Ref 11-6 Her Majesty's Stationary Office (2010) *Environmental Protection, England and Wales The Environmental Permitting (England and Wales) Regulations 2010*.

Ref 11-7 European Parliament and Council of the European Union (2013) *Decision 1386/2013/EU on a General Union Environment Action Programme to 2020 'Living well, within the limits of our planet'*.

Ref 11-8 Her Majesty's Stationary Office (1990) *The Environmental Protection Act 1990.*

Ref 11-9 Her Majesty's Stationary Office (2009) *The Water Resources Act 1991 (Amendment) (England and Wales) Regulations 2009.*

Ref 11-10 Her Majesty's Stationary Office (1990) *The Town and Country Planning Act 1990.*

Ref 11-11 Her Majesty's Stationary Office (1995) *The Environment Act 1995.*

Ref 11-12 Her Majesty's Stationary Office (2001) *The Control of Pollution (Oil Storage) (England) Regulations 2001.*

Ref 11-13 Her Majesty's Stationary Office (2015) *The Environmental Damage (Prevention and Remediation) (England) Regulations 2015.*

Ref 11-14 Department of Energy and Climate Change (2011) Overarching National Policy Statement for Energy (EN-1).

Ref 11-15 Department of Energy and Climate Change (2011) National Policy Statement for Fossil Fuel Electricity Generating Infrastructure (EN-2).

Ref 11-16 Ministry of Housing, Communities and Local Government (2019) *The National Planning Policy Framework* (NPPF).

Ref 11-17 Bassetlaw District Council (2011), Bassetlaw District Core Strategy & *Development Policies DPD.*

Ref 11-18 Bassetlaw District Council (2010) *A Sustainability Assessment of the Publication Core Strategy and Development Management Policies.*

Ref 11-19 Bassetlaw District Council (2019), *Bassetlaw Draft Local Plan.*

Ref 11-20 Sturton Ward Planning Group (2015) *The Sturton Ward Neighbourhood Plan 2015-2030.*

Ref 11-21 Her Majesty's Stationary Office (1984) *The Building Act 1984.*

Ref 11-22 Her Majesty's Stationary Office (2000) *The Building Regulations 2000.*

Ref 11-23 Environment Agency (2010) *GPLC1 - Guiding Principles for Land Contamination.*

Ref 11-24 Department of the Environment, Food and Rural Affairs (2004) *Model Procedures for the Management of Contaminated Land, Contaminated Land Report 11.*

Ref 11-25 British Geological Survey (2019) (http://www.bgs.ac.uk/) accessed 17/01/19.

Ref 11-26 Environment Agency (2019) (https://www.gov.uk/government/organisations/environment-agency) accessed 17/01/19.

Ref 11-27 EDF, 2017, *Annual Groundwater Monitoring Report.*

Ref 11-28 HMSO (2002) Control of Substances Hazardous to Health (COSHH) Regulations, 2002.

Ref 11-29 Environment Agency, 2001, *Piling and Penetrative Ground Improvement Methods on Land Affected by Contamination: Guidance on Pollution Prevention*.