FENWICK SOLAR FARM

Fenwick Solar Farm

EN010152

Environmental Statement

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Executive Summary

A Stage 1, Tier 1 Preliminary Risk Assessment (PRA) (as defined by the Government guidance titled ‘Land Contamination Risk Management’) of the Grid Connection Corridor of Fenwick Solar Farm has been undertaken by AECOM Limited to support the Development Consent Order Application.

The Grid Connection Corridor comprises the installation of the 400 kilovolt (kV) and associated cables (the Grid Connection Cables) would be installed between the On-Site Substation within the Solar PV Site to the Existing National Grid Thorpe Marsh Substation.

The purpose of this PRA is to determine whether potentially contaminative land uses have taken place within, or in close proximity to the Grid Connection Corridor which could have led to the contamination of underlying soils and/or groundwater.

The Grid Connection Corridor consists of fields mainly under arable production, interspersed with individual trees and hedgerows. Carcroft Junction to Stainforth Junction railway line crosses the southern part of the Grid Connection Corridor, north of Ash Road. The Grid Connection Corridor is mainly surrounded by agricultural fields and wooded areas, with some agricultural buildings and dwellings located adjacent the Grid Connection Corridor. The Grid Connection Corridor lies within the Bramwith Drain from Source to River Don water body; within the Don from Mill Dyke to River Ouse water body, and within the Ea Beck from the Skell to River Don water body.

The anticipated geology includes quaternary deposits over sedimentary bedrock of sandstone formations. The northern part of the Grid Connection Corridor is directly underlain by Unproductive Strata associated with a glaciolacustrine formation, and the southern part of the Grid Connection Corridor is directly underlain by a Secondary A aquifer associated with alluvial deposits. The solid geology of the Sherwood Sandstone Group, which extends at depth beneath the quaternary deposits, is classified as a Principal Aquifer.

Based on a review of historical maps, most of the Grid Connection Corridor was undeveloped land/agricultural fields since the earliest available historical maps (late 1800s). The former Thorpe Marsh Power Station was located across the southern part of the Grid Connection Corridor between 1960s and early 2000s. Former railways (Gowdall and Braithwell railway line) have also been identified cross the southern part of the Grid Connection Corridor, between 1930s and 1960s. Potential contaminative sources identified locally within the Grid Connection Corridor may be associated with former small ponds/pits which may have been filled with a variety of (potentially unlicensed) waste materials.

The potential geo-environmental risks identified have been assessed by the PRA as being very low to low, considering the proposed use of the area as a Grid Connection Corridor. It is assumed that site investigation information may be required along the cable run to inform soil disposal and the health and safety of construction workers, and limited investigation is therefore likely to be required in the areas of potential contamination to confirm the results of this PRA.

The information collected as part of this PRA suggests that there are no significant constraints with regards to contamination of soil and groundwater that would limit the development of the Grid Connection Corridor.

The regional unexploded bomb (UXB) mapping published by Zetica shows that the Grid Connection Corridor lies within a zone that experiences a low risk of UXB.

The Grid Connection Corridor is located within a Coal Mining Reporting Area. It is recommended that a coal mining report from the Coal Authority is commissioned. However, there are no Development High Risk Areas within the Grid Connection Corridor noted on the Coal Authority's Interactive Map Viewer.

1. Introduction

1.1 Terms of Appointment

1.1.1 On the instruction of Fenwick Solar Project Limited (hereafter referred to as 'the Applicant'), AECOM Limited (AECOM) has undertaken a Stage 1, Tier 1 Preliminary Risk Assessment (PRA) (as defined by Government guidance titled 'Land Contamination Risk Management' (Ref. 1)) of the Grid Connection Corridor of Fenwick Solar Farm.

1.1.2 The Grid Connection Corridor comprises the installation of the 400 kilovolt (kV) and associated cables (the Grid Connection Cables) that would be installed between the On-Site Substation within the Solar PV Site to the Existing National Grid Thorpe Marsh Substation.

1.1.3 Together with the Solar PV Site, the Grid Connection Corridor would allow for the generation, storage, and export of more than 50 megawatts (MW) electrical generation capacity. Due to this proposed generating capacity, it is classified as a Nationally Significant Infrastructure Project (NSIP) and will therefore require consent via a Development Consent Order (DCO) under the Planning Act 2008 (Ref. 2) for its construction, operation and maintenance, and decommissioning.

1.1.4 **ES Volume II Figure 1-2: Site Boundary Plan [EN010152/APP/6.2]** shows the maximum area of land potentially required for the construction, operation and maintenance, and decommissioning. The Grid Connection Corridor boundary represents the current maximum extent of land being considered and may be further refined.

1.1.5 Further details regarding the Grid Connection Corridor are presented in **ES Volume I Chapter 2: The Scheme [EN010152/APP/6.1]**.

1.1.6 The Solar PV Site has been assessed separately in **ES Volume III Appendix 14-3: Phase 1 Preliminary Risk Assessment – Solar PV Site [EN010152/APP/6.3]**.

1.2 Report Objectives

1.2.1 The primary objective of this PRA is to determine whether potentially contaminative land uses which could have led to the contamination of underlying soils and/or groundwater have taken place within, or in close proximity to, the Grid Connection Corridor. This PRA aims to identify and evaluate potential land quality risks and development constraints associated with the Grid Connection Corridor and to construct an initial conceptual site model (CSM) that can be used to inform future decision making and the design of future ground investigation, if needed.

1.2.2 This PRA is prepared to support a DCO Application under the requirements of the Planning Act 2008 (as amended) (Ref. 2), the National Planning Policy Framework 2023 (Ref. 3) and considers the potential implications of Part 2A of the Environmental Protection Act 1990 (Ref. 4) and the associated Contaminated Land (England) Regulations 2006 (as amended) (Ref. 5). Relevant legislation, policy and guidance is noted in **ES Volume III**

Appendix 14-1: Legislation, Policy and Guidance (Other Environmental Topics) [EN010152/APP/6.3].

1.2.3 The planning policies from relevant National Policy Statements (NPS) that have been considered in this assessment include:

a. Overarching NPS for Energy (NPS EN-1) (November 2023) (Ref. 6), with particular reference to sections 5.3 Biodiversity and Geological Conservation and 5.15 Water Quality and Resources;

b. NPS for Renewable Energy Infrastructure (EN-3) (November 2023) (Ref. 7), with particular reference to the recommendation to utilise suitable previously developed land, brownfield land, contaminated land and industrial land, where possible, as a suitable site location; and

c. NPS for Electricity Networks Infrastructure (NPS EN-5) (November 2023) (Ref. 8), with particular reference to impact of electricity networks on soils and geological conservation.

1.2.4 This PRA has been prepared in general accordance with the technical guidance and procedures described in the UK Government guidance (applicable to England, Northern Ireland and Wales) 'Land Contamination Risk Management' 2023 (Ref. 1); British Standard (BS) 5930:2015+A1:2020 Code of Practice for Ground Investigations (Ref. 9) and BS 10175:2011+A2:2017 Investigation of Potentially Contaminated Sites – Code of Practice (Ref. 10) to:

a. Describe the geology, hydrogeology and shallow mining potential across the Grid Connection Corridor;

b. Describe the environmental setting/sensitivity and current/historical land use of the Grid Connection Corridor and surrounding area;

c. Describe the findings of a site reconnaissance visit;

d. Provide an initial CSM for the prevailing ground conditions; and

e. Using the source-pathway-receptor model, present a qualitative PRA of potential land contamination risks to human health (chronic), environmental, and controlled water receptors from contamination sources on, or in the vicinity of, the Grid Connection Corridor.

1.3 Sources of Information

1.3.1 This PRA has been prepared using a combination of published records (e.g. British Geological Survey (BGS), Environment Agency and Department for Environment, Food and Rural Affairs (Defra)). These include statutory records and historical mapping supplied within a Groundsure Report (Ref. 11), published geological and hydrogeological mapping, historical borehole records and observations made during a site reconnaissance visit completed on the 12 January 2024. The site reconnaissance included a visual inspection (non-intrusive survey) of the Grid Connection Corridor to identify the range of activities undertaken on the Grid Connection Corridor and obvious potential sources of ground contamination present at the time of the visit.

1.3.2 The City of Doncaster Council website (Ref. 12) has been reviewed for any ‘contaminated land’ register entries as defined under the Environmental Protection Act 1990, Part 2A (Ref. 4), within the Grid Connection Corridor and surrounding areas.

1.3.3 An Unexploded Bomb (UXB) Risk Map from Zetica (Ref. 13) has been obtained and included as Annex C.

1.3.4 Specific information sources are referenced throughout the document and a bibliography is included in Section 13 of this Appendix.

2. Site Setting

2.1 Location

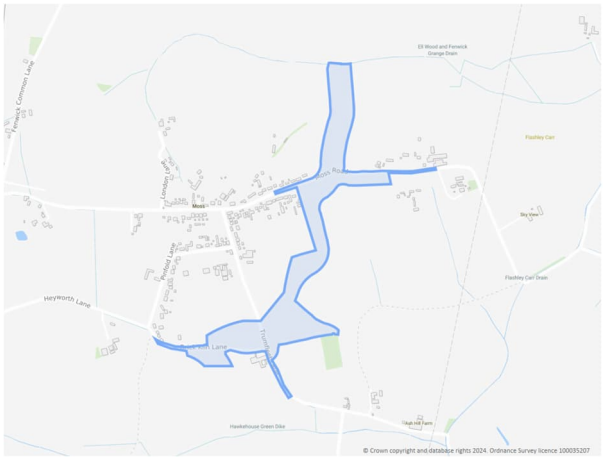
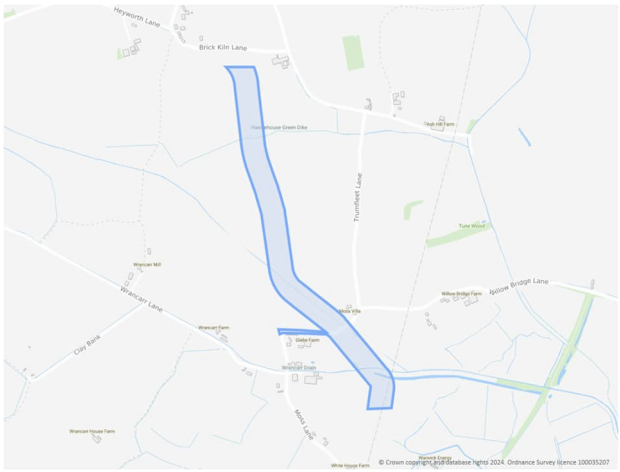
2.1.1 The Grid Connection Corridor is located within the administrative area of the City of Doncaster Council, approximately 6 km north of Doncaster. The Grid Connection Corridor extends from National Grid Reference (NGR) SE 602149 to NGR SE 601087 with an area of approximately 115 ha.

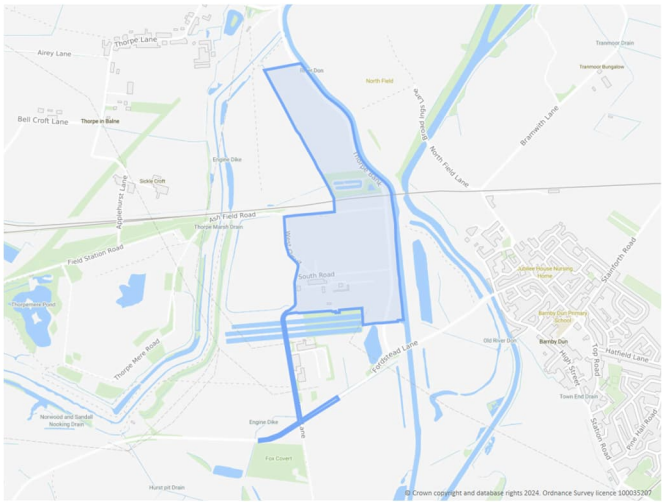
2.2 Description and Setting

2.2.1 The Grid Connection Corridor is shown in **ES Volume II Figure 1-2: Site Boundary Plan [EN010152/APP/6.2]**.

2.2.2 To facilitate the assessment, the Grid Connection Corridor has been divided into sections (A to D) (refer to the Groundsure Report (Ref. 11) with extracts in Table 2-1).

Table 2-1: Sections of the Grid Connection Corridor

Section	Description	Map (Ref. 11)
Section A	From Ell Wood and Fenwick Grange Drain to Trumfleet Lane and Brick Kiln Lane (refer to the Groundsure Report GSIP-2024-14447-16721_A).	
Section B	From Brick Kiln Lane to Wrancarr Drain (refer to the Groundsure Report GSIP-2024-14447-16721_B).	

Section	Description	Map (Ref. 11)
Section C	From south of Wrancarr Drain to Thorpe Bank (refer to the Groundsure Report GSIP-2024-14447-16721_C).	
Section D	From Thorpe Bank to Fordstead Lane (refer to the Groundsure Report GSIP-2024-14447-16721_D).	

2.2.3 Section A mainly comprises agricultural fields under arable production, individual trees and hedgerows. Where there are hedgerows, these generally form the boundaries of fields as they adjoin roads. Moss Road, Trumfleet Lane and Brick Kiln Lane are included within the Site Boundary of the Grid Connection Corridor.

2.2.4 Section B similarly comprises agricultural fields under arable production, individual trees and hedgerows, but transects the following features (from north to south): the Hawkehouse Green Dike, Dick Mill, Trumfleet Lane and Wrancarr Drain.

2.2.5 Section C mainly comprises agricultural fields and includes Marsh Road and Thorpe Bank, which runs on-site along the eastern boundary of the Grid Connection Corridor. Two electricity pylons are located within this section. Livestock were observed in a few areas of Section C during the site reconnaissance.

2.2.6 Section D includes agricultural fields and areas of woodland in its northern extent and areas associated with a former Thorpe Marsh Power Station in its southern extent. A railway line (Carcroft Junction to Stainforth Junction railway line) transects the central section of Section D. The Existing National Grid Thorpe Marsh Substation occupies the southern part of Section D.

2.2.7 The topography of the Grid Connection Corridor is relatively flat, with existing ground levels under 10 m Above Ordnance Datum (AOD) according to online Ordnance Survey (OS) mapping (Ref. 14).

2.2.8 Relevant features immediately surrounding the Grid Connection Corridor are summarised in Table 2-2, sourced from Google Earth (Ref. 15) and the Groundsure Report (Ref. 11).

Table 2-2: Features Surrounding the Grid Connection Corridor

Section	Feature Surrounding the Grid Connection Corridor
Section A	**North** – Agricultural land. **East** – Agricultural land. A few farms are located adjacent east of the Grid Connection Corridor in Moss Lane. **South** – Agricultural land. Farms are located adjacent south of the Grid Connection Corridor in Brick Kiln Lane. **West** – Agricultural land and the village of Moss. Residential properties and a transport, storage and delivery site (Brason Transport Ltd) are located on Moss Road, adjacent the Grid Connection Corridor in the village of Moss. Residential properties are also located adjacent the Grid Connection Corridor in Brick Kiln Lane.
Section B	**West** – Agricultural fields. A farm (Glebe Farm) is located adjacent west of the Grid Connection Corridor in Trumfleet Lane. **East** – Agricultural fields. Residential properties (Moss Villa) are located adjacent east of the Grid Connection Corridor in Trumfleet Lane.
Section C	**West** – Agricultural fields and areas of woodland. Ponds are indicated approximately 100 m west of the Grid Connection Corridor, north and south of Thorpe Lane. A farm (White House Farm) is located approximately 50 m west of the Grid Connection Corridor on Marsh Road. **East** – Agricultural fields. The Trumfleet Power Station, including a series of back up diesel generators and electrical transformers is located approximately 50 m east of the Grid Connection Corridor, south of Engine Dike. The River Don adjoins the Grid Connection Corridor, east of Marsh Road and east of Thorpe Bank. Wilsick House Farm and a pond are located adjacent the Grid Connection Corridor.
Section D	**West** – Agricultural fields adjoin the northern part of Section D to the west. Lands associated with the former Thorpe Marsh Power Station extend off-site to the west. **East** – River Don adjoins the eastern boundary of Section D; and River Dun Navigation is approximately 50 m east of Section D. The village of Barnby Dun is located approximately 450 m east of the Grid Connection Corridor at its nearest point.

Section	Feature Surrounding the Grid Connection Corridor
	South – the Existing National Grid Thorpe Marsh Substation is adjacent south of the Grid Connection Corridor, to the east of Marsh Lane.

3. Geological and Environmental Setting

3.1 Introduction

3.1.1 The environmental setting including the topography, geology, hydrogeology, and hydrology are the key factors that influence the way in which contaminants in the soil or groundwater can be transported on or off the Grid Connection Corridor, and also the way in which contamination can affect applicable receptors including controlled waters and users of the Grid Connection Corridor and surrounding areas.

3.1.2 The environmental setting of the Grid Connection Corridor has been assessed by making reference to the information sources detailed in Section 1.3.

3.2 Geology and Soils

Published Geology and Exploratory Hole Records

3.2.1 AECOM has reviewed publicly available information. The published 1:50,000 scale geological map of the area produced by the BGS (Ref. 16) and the BGS Geoindex Onshore online geological mapping (Ref. 17) indicates that the Grid Connection Corridor is underlain by the geological succession summarised in Table 3-1.

3.2.2 Five bedrock faults are indicated across the Grid Connection Corridor, including one fault to the south of the village of Moss; one fault to the north of Wrancarr Lane; one fault adjacent north of Moss Road; and two faults northeast of Thorpe in Balne.

3.2.3 The BGS maintains an archive of historical exploratory hole records. AECOM has searched the database and those which are considered to provide useful information on the ground profile at the Grid Connection Corridor have been considered as part of the Preliminary Ground Model in Section 7. Copies of these exploratory hole records are included as Annex B. The locations of the boreholes are included in the Groundsure Report (Ref. 11).

Table 3-1: Geology Encountered Across the Grid Connection Corridor

Age	Group or Parent	Geological Stratum	Description	Anticipated Thickness (m) (approximate)	Location
Superficial deposits					
Quaternary Age	Fluvial Deposits	Alluvium	Clay, silt, sand and gravel	Variable.	Across the southern extent of the Grid Connection Corridor (Section C and D), from south of Moss Lane.
Triassic Age	North Pennine Glaciogenic Subgroup	Hemingbrough Glaciolacustrine Formation	Silty clay	Variable, maximum 30 m.	Across the northern part of the Grid Connection Corridor (Section A and B). Potentially present also across the southern part (Section C and D) of the Grid Connection Corridor, beneath the Alluvium. Approximately 50 m east of Section D.
Triassic Age	Yorkshire Catchments Subgroup	Breighton Sand Formation	Sand	Average 1 to 2 m; but can exceed 6 m in some areas.	Scattered areas within 250 m of the Grid Connection Corridor, 20 m south of Moss Road (off-site, south of Section A).

Age	Group or Parent	Geological Stratum	Description	Anticipated Thickness (m) (approximate)	Location
Bedrock					
Induan Age — Anisian Age	New Red Sandstone Supergroup	Sherwood Sandstone Group	Sandstone	Variable, approximately 100 m (refer to BGS borehole SE61SW4).	Across the northern part of the Grid Connection Corridor (Section A and B).
Olenekian Age	New Red Sandstone Supergroup	Chester Formation of the Sherwood Sandstone Group	Sandstone, pebbly (gravelly)	Variable, approximately 45 m (refer to BGS borehole SE61SW4).	Across the southern part of the Grid Connection Corridor (Section C and D).

Soils and Chemistry

3.2.4 Natural England (Ref. 18) reports the Agricultural Land Classification (ALC) for the Grid Connection Corridor to be mainly Grade 4 (poor) with some areas of Grade 3 (good to moderate). However, Natural England maps represent a generalised pattern of land classification grades and are not sufficiently accurate for use in the assessment of individual fields. The maps do not show the subdivisions of Grade 3 which are normally mapped by a more detailed survey. Information obtained from Soilscape (Ref. 19) describes the soils within the Grid Connection Corridor as (Soilscape 18) *"slowly permeable seasonally wet slightly acid but base-rich loamy and clayey soils".*

3.2.5 The Groundsure Report (Ref. 11) provides indicative information on regional concentrations of five potentially harmful elements (PHEs) including arsenic, cadmium, chromium, nickel and lead in soil. Elevated concentrations of these PHEs can exist because of natural geological conditions or possible anthropogenic contamination. The values are estimated primarily from rural topsoil data collected at a sample density of approximately one per 2 km^2 (presented in Table 3-2).

Table 3-2: Estimated Soil Chemistry

Potentially Harmful Element	Estimated Geometric Mean Concentration (mg/kg)
Arsenic	(Section A) 15
	(Section B) 15
	(Section C) 15
	(Section D) 15
Cadmium	(Section A) 1.8
	(Section B) 1.8
	(Section C) 1.8
	(Section D) 1.8
Chromium	(Section A) 60 – 90
	(Section B) 60 – 90
	(Section C) 60 – 90 to 90 – 120
	(Section D) 90 – 120
Lead	(Section A) 100
	(Section B) 100 to 100-200
	(Section C) 100 to 100 – 200
	(Section D) 100 to 100 – 200
Bio-accessible lead	(Section A) 60
	(Section B) 60 to 60 – 120
	(Section C) 60 to 60 – 120

	(Section D) 60 to 60 – 120
Nickel	(Section A) 15 – 30
	(Section B) 15 – 30
	(Section C) 15 –30 to 30 – 45
	(Section D) 30 – 45

3.3 Ground Stability Records

3.3.1 Table 3-3 shows the variable risk of ground stability hazards across the Grid Connection Corridor, taken from the Groundsure Report (Ref. 11). All hazard ratings apply to 50 m radius surrounding the Site Boundary of the Grid Connection Corridor.

Table 3-3: Ground Stability Records

Hazard Type	Hazard Potential
Collapsible Hazard	(Section A) Very low
	(Section B) Negligible to very low
	(Section C) Negligible to very low
	(Section D) Negligible to very low
Compressible Hazard	(Sections A and D) Negligible to moderate (Sections B and C) Moderate
Ground Dissolution Hazard	(Sections A, B, C and D) Negligible
Landslide Hazard	(Section A) Very low
	(Section B) Very low
	(Section C) Very low
	(Section D) Very low to low
Running Sand Hazard	(Sections A, B and C) Negligible to low
	(Section D) Very low to low
Shrinking or Swelling Clay Hazard	(Section A) Negligible to low
	(Sections B and C) Very low to low
	(Section D) Negligible to very low

Mining and Mineral Extraction

Aggregate/Mineral Quarrying, Mining, Mineral Sites and Plants Extracting Liquid or Gas

3.3.2 Table 3-4 presents the available information on mining, quarrying operations and plants extracting liquid or gas (Ref. 11), past or present that are known to have taken place within the Grid Connection Corridor and within 250 m of the Grid Connection Corridor.

Table 3-4: Quarrying and Wellsite, or Other Surface Plant, Extracting Liquid or Gas (<250 m of the Grid Connection Corridor)

Distance and Direction	Name	Commodity/Status
On-site, along the western boundary of Section C, south of Highfield Lane.	Pit (Pit Bridge)	NA
On-site, central extent of Section D, on Thorpe Bank	Thorpe Marsh Power Station (BritPit)	Oil/Ceased
40 m west of Section C, south of Highfield Lane	Unspecified ground workings	NA
50 m east of the Section C, south of Engine Dike. (at the location of the Trumfleet Power Station)	Trumfleet Gasfield (BritPit)	Natural gas/Active

Coal Mining

3.3.3 The Coal Authority's Interactive Map Viewer (Ref. 20) and the Groundsure Report (Ref. 11) indicates that the Grid Connection Corridor is within the Nottingham Coal Mining Reporting Area. This is an area which could be affected by past, current or future coal mining. There are no Development High Risk Areas (DHRA) as defined by the Coal Authority within the Grid Connection Corridor (Ref. 20).

3.4 Radon

3.4.1 The UK Health Security Agency (UKHSA) and BGS interactive map for radon (Ref. 21) indicates that the Grid Connection Corridor is within a low probability radon area (less than 1% of homes are estimated to be above the Action Level). No radon protective measures are necessary in the construction of new dwellings or extensions.

3.5 Hydrogeology

Aquifer Classification

3.5.1 The Environment Agency's Groundwater Protection Policy adopts aquifer designations that are consistent with the Water Framework Directive. Definitions of the various aquifer types can be found on the Environment Agency section of the gov.uk website (Ref. 22). According to this system, the superficial deposits underlying the Grid Connection Corridor are classified as Unproductive Strata (Hemingbrough Glaciolacustrine Formation) and Secondary A Aquifers (Breighton Sand Formation and Alluvium). The bedrock geology of the Sherwood Sandstone Group is classified as a Principal Aquifer.

Groundwater Vulnerability

3.5.2 The Environment Agency's Simplified Groundwater Vulnerability Map in Magic (Ref. 23) shows that the Grid Connection Corridor is located in an area where the groundwater vulnerability to pollution is generally low. The groundwater vulnerability is medium and medium-high across the areas where the Breighton Sand Formation and alluvial deposits are mapped.

3.5.3 All associated terminology/definitions can be found on the Environment Agency section of the gov.uk website (Ref. 22).

Source Protection Zones and Drinking Water Safeguarding Zones for Groundwater

3.5.4 In terms of identifying the risk of contamination from potentially polluting activities in a given area to groundwater sources (wells, boreholes and springs) used for supplying public drinking water, the Environment Agency identifies Source Protection Zones (SPZ). These show the extent of a groundwater source catchment and are divided into three zones, which can be found on the Environment Agency section of the gov.uk website (Ref. 22).

3.5.5 The southern part of the Grid Connection Corridor, south of Thorpe in Balne (southern edge of Section C and the entire Section D), lies within a Zone III (Total Catchment) SPZ (Ref. 23).

3.5.6 None of the Grid Connection Corridor lies within a Drinking Water Safeguard Zone for surface water or groundwater (Ref. 23).

Licensed Groundwater Abstractions

3.5.7 The Groundsure Report (Ref. 11) indicates that a historical groundwater abstraction, used for general farming and domestic purposes, was located at Thorpe in Balne, approximately 330 m west of Section C. The licence was expired in March 2017. No further licensed groundwater abstractions have been identified within 1 km of the Grid Connection Corridor.

Risk of Flooding from Groundwater

3.5.8 The Groundsure Report (Ref. 11) indicates that there is generally a moderate to high risk for groundwater flooding to occur within the Grid Connection Corridor. The areas with the highest risk are those surrounding Hawkehouse

Green Dike (Section B) and most of the southern part of the Grid Connection Corridor (Sections C and D).

Surface Water Courses and Drainage

3.5.9 The Grid Connection Corridor is located within the Don Lower Catchment (Ref. 24). The Grid Connection Corridor mostly lies within the Bramwith Drain from Source to River Don water body (Water Body ID GB104027063290) (Section B and C). The northern and southeastern parts (Section A and D) of the Grid Connection Corridor lie within the Don from Mill Dyke to River Ouse water body (Water Body ID GB104027064243). The southwestern part (Section D) of the Grid Connection Corridor lies within the Ea Beck from the Skell to River Don water body (Water Body ID GB104027057591). These waterbodies are classified as having the ecological status of moderate in 2022.

3.5.10 The main watercourse of the Bramwith Drain from Source to River Don water body is the Hawkehouse Green Dike, which crosses the Grid Connection Corridor to the south of Brick Kiln Lane. The main watercourse of the Don from Mill Dyke to River Ouse water body is the River Don, which borders the Section C and D of the Grid Connection Corridor to the east. The main watercourse of the Ea Beck from the Skell to River Don water body is the Thorpe Marsh Drain, which crosses Section D east of Thorpe in Balne.

3.5.11 A series of drains and dikes cross the Grid Connection Corridor, including Mill Dike (Section B), Wrancarr Drain (Section B), Hawkehouse Green Dike (Section B) Engine Dike (Sections C and D) and Wilsick House Drain (Section C).

Licensed Surface Water Abstractions

3.5.12 The Groundsure Report (Ref. 11) indicates that no licensed surface water abstraction entries have been identified within the Grid Connection Corridor. Two active surface water abstraction entries have been identified within 250 m of the Grid Connection Corridor, including an abstraction located approximately 75 m east of the Section C, for transfer between sources; and an abstraction located approximately 210 m east of Section C for spray irrigation. Both are abstracting from the River Don. There are further licensed surface abstractions between 250 m and 1 km of the Grid Connection Corridor, for spray irrigation.

Private Water Supplies

3.5.13 Following consultation with the Local Authority regarding records of private abstractions, there is one private abstraction within 1 km from the Grid Connection Corridor. This abstraction is located approximately 300 m west of Section C along Thorpe Lane, and it is for domestic use. This abstraction is indicated in **ES Volume II Figure 9-2: Groundwater Features and their Attributes [EN010152/APP/6.2]**.

Risk of Flooding from Surface Water

3.5.14 The indicative floodplain map (Ref. 25) for the area, published by the Environment Agency, shows that the risk of surface water flooding at the Grid

Connection Corridor is generally very low (annual chance of flooding of less than 0.1%) with areas medium (chance of flooding of less than 3.3%) and high risk (chance of flooding of greater than 3.3%) generally associated with watercourses.

River and coastal flooding – Flood Zones

3.5.15 The Grid Connection Corridor is located largely within Flood Zone 3 with smaller areas of Flood Zone 2 in Section B and D and Flood Zone 1 toward its northern extent (Section A) (Ref. 25). The Existing National Grid Thorpe Marsh Substation is located entirely within Flood Zone 2. However, the surrounding area is designated as a water storage area with flood defences present along adjacent watercourses. Flood Zones within and adjacent to the Grid Connection Corridor are illustrated in **ES Volume II Figure 9-4: Environment Agency Flood Map for Planning (Rivers and Seas) [EN010152/APP/6.2].**

4. Historical and Planned Development

4.1 Historical Ordnance Survey Mapping and Aerial Photographs

4.1.1 Historical OS maps of the Grid Connection Corridor and the wider environs were provided in the Groundsure Report (scales 1:2,500, 1:1,250 and 1:10,560) (Ref. 11, Annex A) and are reviewed in this section.

4.1.2 The historical OS maps obtained with the Groundsure Report (Ref. 11) date between mid-19th Century to present (2023). Table 4-1 provides a summary of the main features present on, and within, approximately 250 m radius of the Grid Connection Corridor. It should be noted that only indicative map scales are provided. Where dates are stated, these refer to the dates of maps on which the features are present, have changed use or are no longer annotated, and do not necessarily refer to the exact dates of existence of a particular feature. Development that may have occurred between map editions is recorded as occurring on the later published map, hence there are some limitations to the accuracy of the date of development unless supplementary evidence is available.

Table 4-1: Summary of Historical Mapping

Sections of the Grid Connection Corridor	Key Features On-Site	Key Features Off-Site
Section A	a. No features considered relevant to contaminated land.	a. No features considered relevant to contaminated land.
Section B	a. A small pond south of Hawkehouse Green Dike (Section B) is shown as infilled in the historical map dated 1959. b. A small pond south of Wrancarr Drain (Section B) is shown as infilled in the historical maps dated 2001	a. No features considered relevant to contaminated land.
Section C	a. A pit (Pit Bridge) is indicated on-site, beneath Marsh Road in the historical maps dated between 1854 and 2010. b. Railway lines (Gowdall and Braithwell railway line) cross Section C east of Thorpe in Balne, in the historical maps dated between 1930 and 1967.	a. A good station is indicated 20 m west of Section C, in Thorpe in Balne, in the historical maps dated between 1933 and 1951. Railway sidings associated with the good station are shown 90 m west of the Grid Connection Corridor in the historical maps dated between 1948 and 1933. b. Ground workings (Trumfleet Pit) are indicated 40 m west of the Section C, south of Highfield Lane, in the historical map dated 1893. c. An unspecified tank is indicated 220 m west of the Section C, south of Highfield Lane, in the historical maps dated between 1961 and 1984 (historical map GSIP-2024-14447-16720_LS_2-6 large scale). d. The Trumfleet Power Station is indicated approximately 50 m east of the Grid Connection Corridor in the historical map from 2001.

Sections of the Grid Connection Corridor	Key Features On-Site	Key Features Off-Site
Section D	a. A railway (the current Carcroft Junction to Stainforth Junction railway line) is indicated across Section D since 1850s. b. Thorpe Marsh Power Station is shown on-site in the historical map dated between 1960 and 2003. As part of this feature, settling ponds are shown across the southern part of the Section D. Some unspecified tanks bordered the northern extent of the power station. The power station is shown as demolished in the historical map dated 2010. c. Small ponds south of Marsh Drain (Section D) are shown as infilled in the historical map dated 1984.	a. Railway buildings are indicated 20 m west of the Section D in the historical maps dated between 1967 and 1992. b. Unspecified ground workings are indicated 40 m west of the Section D in the historical maps dated between 1967 and 1982. c. Railway buildings are indicated 120 m west of the Section D in the historical maps dated between 1933 and 1951. d. Cuttings are indicated 170 m west of the Section D in the historical map dated 1951. e. Cuttings are indicated 170 m east of the Section D in the historical maps dated between 1904 and 1907. f. An unspecified heap is indicated 230 m south of the Section D in the historical map dated 1951.

4.2 Local Planning Authority Records

City of Doncaster Council

4.2.1 A search of planning application records on, and within, 250 m of the Grid Connection Corridor has been undertaken using the search facility on the City of Doncaster Council website (Ref. 26). There have been several applications for erection of stables and agricultural storages since February 1947 (the earliest available records). Table 4-2 summarises the most relevant applications (where potential impact to the ground may have occurred) in the records dating back to 1947.

Table 4-2: Local Planning Authority Records

Decision Issued Date	Application Status	Location	Reference	Description
24 April 2019	Granted	Bethel House Moss Road, Moss, Doncaster DN6 0HN. On-site, northern extent (Section A).	18/00873/FUL	Construction of a manège, erection of stables, including use of land for the keeping of horses.
21 December 2023	Granted	Wilsic House Farm Marsh Road Thorpe In Balne Doncaster DN6 0DX. On-site, central extent (Section C).	23/02132/CPE	Certificate for existing lawful use for the construction of a detached barn/storage building for farm equipment.
13 January 2015	Decided	Thorpe Marsh Power Station Marsh Lane Barnby Dun Doncaster DN3 1ET. On-site, southern edge (Section D).	14/02534/WCCC	Construction of a gas-fired Combined Cycle Gas Turbine (CCGT) electricity generating station following demolition of former cooling towers (without

Decision Issued Date	Application Status	Location	Reference	Description
				compliance with condition 19 of planning application 10/00442/CON, granted on 04/04/11 substitution of plan showing traffic routes)
6 July 2023	Decided - Application Withdrawn	Thorpe Marsh Ash Fields Marsh Lane Barnby Dun Doncaster DN3 1ET. Off-site, adjacent west of the southern edge (Section D).	23/00022/FULM	Reclamation through recovery of Pulverised Fuel Ash to facilitate creation of Energy Hub incorporating Battery Energy Storage, Substation and associated Infrastructure, including construction of railhead.

4.3 Unexploded Ordnance Risk

Wartime Land-Use

4.3.1 Based on a review of historical maps (Ref. 11), the Grid Connection Corridor was open land during wartime Britain and was undeveloped, meaning it was possible for bomb strikes to go unobserved.

Post War Development

4.3.2 An analysis of the post war historical map (Ref. 11) does not show obvious, visible changes of the land uses on the Grid Connection Corridor which could indicate potential aerial bombing. However, due to its rural nature, the chances of Unexploded Ordnance (UXO) going unnoticed do exist. An online search has been undertaken for mentions of recent ordnance discovery reported at or around the Grid Connection Corridor. The search did not identify any reported records of ordnance in the Study Area.

Unexploded Bomb Mapping

4.3.3 The regional Unexploded Bomb (UXB) mapping published by Zetica (Ref. 13, Annex C) show that the Grid Connection Corridor lies within a zone that experiences a low risk of UXB. It is estimated that the bombing density of the area is 15 bombs or less within 1000 acres. The Zetica maps provide a high-level assessment of regional World War II bombing densities and do not assess the presence of other potential sources of UXO.

Table 4-3: Historical and Planned Development Key Findings

Historical and Planned Development Key Findings
The former Thorpe Marsh Power Station is shown across the southern extent (Section D) of the Grid Connection Corridor in the historical map dated between 1960 and 2003. The power station is no longer shown in the map dated 2010. The planning records indicate that the construction of a gas-fired CCGT electricity generating station following demolition of former cooling towers was decided in 2015. Carcroft Junction to Stainforth Junction railway line crosses the southern part (Section D) of the Grid Connection Corridor, north of Ash Road, since the earliest available historical maps (mid 1800s). Gowdall and Braithwell railway line crosses Section C east of Thorpe in Balne, in the historical maps dated between 1930 and 1967. The remaining Grid Connection Corridor has been undeveloped land/agricultural fields since the earliest available historical maps, with contamination sources limited to potential application of pesticides and fertilisers for agricultural purposes. Potential contaminative sources identified locally on-site may be associated with former small ponds or pits which may have been filled with a variety of (potentially unlicensed) waste materials. The land uses surrounding the Grid Connection Corridor (relevant to land contamination) include farmland, with farm buildings and yards where fuel and agricultural materials were/are stored, former good station and railway sidings (20 m west and 90 m west of the Section C, respectively); unspecified ground workings (40 m west of the Section C); an unspecified tank (220 m west of the Section C); railway buildings (20 m west and 120 m west of the Section D); unspecified ground workings (40 m west of the Section D); cuttings (170 m west of the Section D); and un unspecified heap (230 m south of the Section D).

5. Regulated Activities and Statutory Consultation

5.1 Introduction

5.1.1 The key relevant features that characterise the Grid Connection Corridor and surrounding area are summarised in this section, along with an indication of the risk to the land quality of the Grid Connection Corridor.

5.1.2 Information on groundwater and surface water abstractions is detailed in Paragraphs 3.5.7, 3.5.12 and 3.5.13 and is not repeated here.

5.1.3 Generally, any regulated activities within 250 m of the Grid Connection Corridor could, depending upon their nature, represent potential off-site sources of contamination. This section indicates the activities present within 250 m. The extent of this Study Area has been developed using professional judgement on the basis that contamination migration beyond this distance is likely to be minimal. This principle has been applied in assessing similar sites.

5.2 Regulated Processes

5.2.1 Table 5-1 summarises information on regulated processes contained in the Groundsure Report (Ref. 11). The Groundsure Report collates data from a variety of sources including the Environment Agency and the BGS.

5.2.2 There were no instances of the following data (within 250 m of the Grid Connection Corridor) identified within the information sources reviewed:

a. Sites determined as Contaminated Land;
b. Control of Major Accident Hazards (COMAH);
c. Regulated Explosive Sites;
d. Hazardous Substance storage/usage;
e. Licensed pollutant release (Part A (2)/B);
f. Radioactive Substance Authorisations;
g. Pollutant release to surface waters (Red List);
h. Pollutant release to public sewer;
i. List 1 Dangerous Substances;
j. List 2 Dangerous Substances;
k. Pollution inventory substances; and
l. Pollution inventory radioactive waste.

5.2.3 The City of Doncaster Council website (Ref. 12) indicates that there are currently (as of January 2024) no entries on their public register of ‘contaminated land’ within the Study Area) as defined under the Environmental Protection Act 1990, Part 2A (Ref. 4).

Table 5-1: Summary of Regulatory Information

Subject	Groundsure Report Section	Number Present		Details
		On site	0-250 m	
Agency and Hydrological				
Licenced Discharges to controlled water	Section A	NA	3	Three active discharge consents are listed off-site, 150 m west, 160 m east and 230 m west of the Grid Connection Corridor. They relate to sewage discharges of final treated effluent into drains.
	Section B	NA	1	One active discharge consent is listed off-site, 20 m west of the Grid Connection Corridor, at Glebe Farm. The consent relates to sewage discharges of final treated effluent into a tributary of the River Don.
	Section D	2	9	Two revoked discharge consents are listed on-site, and related to trade discharges into an unspecified receiving water and into the Engine Dyke. Nine revoked or surrendered discharge consents are listed adjacent the Grid Connection Corridor and related to sewage discharges of final treated effluent or trade discharges into the Engine Dike.
Pollution Incidents (Environment	Section A	NA	3	Three pollution incidents to controlled waters are listed off-site, approximately 60 m east

Subject	Groundsure Report Section	Number Present		Details
		On site	0-250 m	
Agency/Natural Resources Wales)				of the Grid Connection Corridor, north of Moss Road. The pollution incidents relate to asbestos and contaminated water and occurred in April 2003. The entries show minor impacts to land and water.
	Section B	NA	1	One pollution incident to controlled waters is listed off-site, approximately 180 m west of the Grid Connection Corridor. The pollution incident relates to general biodegradable materials and wastes and occurred in February 2003. The entry shows minor impacts to land and air.
	Section C	1	NA	One pollution incident is listed on-site and relates to discarded tyres and occurred in March 2003. The entry shows no impacts to land, air and water.
	Section D	2	2	Two pollution incidents are listed on-site, with one relevant to water or land impact. The incident relates to release of oils and fuel and occurred in September 2003. The entry shows minor impact to water. Two pollution incidents are listed off-site, 90 m east of Section D; and 140 m southeast of

Subject	Groundsure Report Section	Number Present		Details
		On site	0-250 m	
				Section D. The pollution incidents relate to discarded waste material occurred in March 2003; and to release of oils and fuels, occurred in August 2008. The entry shows minor impact to land and minor impact to water, respectively.
Current industrial land use				
Historical licenced industrial activities/integrated pollution control (IPC)	Section C	NA	4	One revoked and three superseded IPC are listed off-site, approximately 50 m east of the Grid Connection Corridor, in Marsh Road. The consents relate to gasification and associated processed, operated by Warwick Energy Exploration and Production Ltd.
	Section D	3	NA	One surrendered and two superseded IPC are listed on-site and relate to combustion processes, operated by Rwe Npower Plc at former Thorpe Marsh Power Station.
Licenced industrial activities (Part A(1))	Section D	11	NA	Several (effective) licenced industrial activities are listed on-site and relate to combustion processes, operated by the former Thorpe Marsh Power Station; and waste disposal at the Thorpe Marsh Oil Management Unit operated by

Subject	Groundsure Report Section	Number Present		Details
		On site	0-250 m	
				National Grid Electricity Transmission Plc.

5.3 Licensed Waste Management Facilities

5.3.1 An attempt has been made to identify landfilling operations, past and present, that have taken place in the vicinity (within 250 m) of the Grid Connection Corridor.

5.3.2 There are no active or recent landfill or historical landfill within 250 m of the Grid Connection Corridor. There are two recent landfills, approximately 320 m west and 390 m south of the southern extent (Section D) of the Grid Connection Corridor. The status of both is indicated as closed.

5.3.3 There is one historical waste site and one licenced waste site in the Section D of the Grid Connection Corridor, located at the former Thorpe Marsh Power Station. The historical waste site was a waste composting facility; and the licenced waste site included a factory curtilage. The status of the licenced waste site is indicated as ‘transferred’.

5.3.4 There are four waste exemption entries within the Grid Connection Corridor, in Section D, for use of waste in construction.

5.4 Current Industrial Land Use

5.4.1 There are no current industrial land use entries on-site, except for three electricity pylons across Section C and D; and tanks and travelling cranes in Section D.

5.4.2 There are a few current industrial land uses within 250 m of the Grid Connection Corridor and these are summarised Table 5-2. Any significant inactive listings thought not to be covered by the historical development review in Section 4 are also noted if present and/or identified. There were no instances of current or recent petrol stations and gas pipelines identified within the information sources reviewed. Electricity cables are indicated across Section D.

Table 5-2: Potentially Contaminative Industrial Land Use on and Within 250 m of the Grid Connection Corridor

Groundsure Report section	Location	Details
Section C	On-Site	a. Electricity pylons.
Section D	On-Site	a. Travelling cranes. b. Tanks. c. Electricity pylons.

Groundsure Report section	Location	Details
Section A	Off-Site	a. Transport, storage and delivery site/distribution and haulage (Brason Transport Ltd) – adjacent west. b. Water pumping station – approximately 130 m east. c. Electricity pylon – approximately 240 m east.
Section B	Off-Site	a. Electricity pylon – approximately 30 m east. b. Industrial products (fences, gates and railways) (Orchard Workshop) – approximately 50 m east.
Section C	Off-Site	a. Electricity pylons – approximately 90 m, 130 m and 135 m west. b. Farming (hoppers and silos) – approximately 180 m west.
Section D	Off-Site	a. Telecommunication Mast – approximately 30 m south. b. Waste Storage, processing and disposal outfall – approximately 10 m southeast. c. Electricity pylons – from 90 m south. d. Settling ponds – approximately 220 m west.

5.5 Environmental Designations

5.5.1 The Groundsure Report (Ref. 11) identifies sensitive land uses in the form of Sites of Special Scientific Interest (SSSI), Conserved wetland sites (Ramsar sites), Special Areas of Conservation, Special Protection Areas, National Nature Reserves, Local Nature Reserves, Designated Ancient Woodland, Biosphere Reserves, Forest Parks, Marine Conservation Zones, Green Belt, Possible Special Areas of Conservation, Potential Special Protection Areas, Nitrate Sensitive Areas, Nitrate Vulnerable Zones, SSSI Impact Risk Zones and SSSI Units.

5.5.2 The Grid Connection Corridor lies within Nitrate Vulnerable Zones (NVZ) and within SSSI Impact Risk Zones with several developments requiring consultation. The consultation required does not include solar farms or associated infrastructure.

5.5.3 According to the Doncaster Local Plan 2015-2035 (Adopted) Policies Map (Ref. 27) there are no Local Geological Sites on-site and within 250 m of the Grid Connection Corridor.

5.5.4 There are no other sensitive land uses within 250 m of the Grid Connection Corridor.

6. Site Reconnaissance

6.1.1 An inspection of the Grid Connection Corridor was completed by a suitably qualified and experienced AECOM Engineer on 11 January 2024. The aim of the visit was to identify the range of activities carried out on the Grid Connection Corridor and obvious potential sources of ground contamination.

6.1.2 A photographic record of the visit is included as Annex D. Maps showing the site walkover observations and photo locations are appended Figure 1 and Figure 2.

6.1.3 The Grid Connection Corridor consists of agricultural fields used for crops or grazing and some areas of dense vegetation. There are a number of access tracks/lanes that run through the Grid Connection Corridor connecting the fields. Several drains were observed on-site. Electrical pylons are located in a few locations at the Grid Connection Corridor and surrounding area. Due to its size, the site walkover took place at several locations spread evenly throughout the Grid Connection Corridor. Access to some parts of the Grid Connection Corridor was restricted due to hedgerows, foliage, and fencing. The most relevant observations are listed as follows:

a. Photos 25 and 26 (in Annex D) shows the Trumfleet Power Station, including a series of back up diesel generators and electrical transformers. This feature is located 50 m east of the Grid Connection Corridor, south of Engine Dike. Photo 27 (in Annex D) shows two diesel above ground storage tanks (AST) associated with this feature;

b. Photo 31 (in Annex D) shows areas where livestock were present to the north of Thorpe in Balne; and

c. Photo 39 and 39 (in Annex D) show the area of the former Thorpe Marsh Power Station, with the Existing National Grid Thorpe Marsh Substation in the background.

6.1.4 No evidence of contamination was observed during the site reconnaissance.

7. Preliminary Ground Model

7.1.1 Based on the review of published geological and hydrogeological information and a selection of historical borehole records, the ground conditions within the Grid Connection Corridor are considered to comprise the following sequence presented in Table 7-1.

Table 7-1: Preliminary Ground Model

Geology	Description	Thickness	Groundwater
Topsoil	Variable. Described as dark brown loam in BGS borehole SE51SE19 (located east of Trumfleet Lane, in Moss, in the Section A of the Grid Connection Corridor)	0.30 m in BGS borehole SE51SE19.	Not reported
Made Ground	Variable	Made Ground is indicated up to 1.5 m bgl in BGS borehole SE60NW178 (located in Thorpe Bank, in Section D)	Not reported
Superficial deposits (Alluvium, Hemingbrough Glaciolacustrine Formation and Breighton Sand Formation)	Clay with scattered bands of sand	Hemingbrough Glaciolacustrine Formation up to 30 m thick, Breighton Sand Formation up to 6 m thick. Drift deposits are indicated up to 8.2 m thick in BGS borehole SE60NW178 (located in Thorpe Bank, in Section D). Drift deposits are indicated up to 38 m bgl in BGS borehole SE51SE19 (Section A of the	Water level reported at 2 m bgl in BGS borehole SE60NW178. Rest water identified at 2.9 m bgl (BGS borehole SE60NW178).

Geology	Description	Thickness	Groundwater
		Grid Connection Corridor).	
Bedrock Geology of Sherwood Sandstone Group	Sandstone	Variable (over 110 m BGS borehole SE60NW178).	Not reported

8. Initial Conceptual Site Model

8.1 Introduction

8.1.1 This section is aimed at identifying possible risks, if any, arising from substances used or deposited on-site, or from other sources of land contamination. Both past and current potentially contaminative land uses have been considered. It is based on the Grid Connection Corridor, as identified in Section 1. The aim of the initial CSM is to inform future decision making and the design of any future ground investigation, if needed.

8.2 Preliminary Ground Gas Risk Assessment

8.2.1 The CL:AIRE Research Bulletin RB17 A Pragmatic Approach to Ground Gas Risk Assessment 2012 (Ref. 28), describes a method of estimating the potential gas risk of a site based on the site geology and historical use. Table 8-1 presents the considerations included in the RB17 methodology together with the likely status for the Grid Connection Corridor, based upon the data collected and reviewed in the above sections of this PRA.

Table 8-1: Consideration of Potential Ground Gas Risk

Considerations from RB17	Applicable information for the Grid Connection Corridor
If there is a credible source underlying or in the close vicinity of the site.	Thorpe Marsh Power Station was located in the southern section of the Grid Connection Corridor (Section D). Alluvium and localised infilling are considered a credible source. Infilling of former ponds/pits are limited and not present site-wide.
If the site been registered as a landfill (not including general Made Ground) or whether there are mine openings nearby.	An industrial waste site (factory curtilage) was located in the southern section of the Grid Connection Corridor (Section D). There are no mine openings nearby.
If the maximum Made Ground depth is greater than 5 m or there is an average depth greater than 3 m.	Significant thickness of Made Ground across the southern part of the at the Grid Connection Corridor (Section D) is a possibility, based on site development history.
If the Total Organic Carbon (TOC) in Made Ground exceeds 4% or 6% where the Made Ground is greater than 20 years old.	Unknown.
Whether radon protective measures are required.	None required.

Considerations from RB17	Applicable information for the Grid Connection Corridor
If an off-site source is present, is there a credible pathway to the development site based on the distance, the specific ground conditions and topography, or whether there are potential effects such as rising ground water which would have the potential to force large volumes of gas from the ground in a short period.	Credible pathway may be associated with alluvial deposits located off-site.

8.2.2 Based on this preliminary gas risk assessment, gas monitoring is likely to be a requirement for the Grid Connection Corridor. This is due to the presence of the former Thorpe Marsh Power Station, the presence of Alluvium and localised infilling of former ponds/pits. By virtue of the development comprising a grid connection corridor, the linkage associated with accumulation could be limited to any service buildings/enclosures.

8.3 Assessment Framework

8.3.1 The Grid Connection Corridor, in terms of potential land contamination, will be regulated by the City of Doncaster Council (Ref. 29), taking account of the NPPF (December 2023) (Ref. 3), with the Environment Agency, Natural England and Historic England acting as potential statutory consultees.

8.3.2 Environmental liabilities can arise through provisions contained within statutory legislation including Part 2A of the Environmental Protection Act 1990 (Ref. 4), the Environmental Damage (Prevention and Remediation) (England) Regulations 2015 (Ref. 30), the Water Resources Act 1991 (Ref. 31), the Environmental Permitting (England and Wales) Regulations 2016 and the Water Act 2003 (Ref. 32).

8.3.3 Current industry good practice recommends that the determination of health hazards due to land contamination is based on the principle of risk assessment, as outlined in the Statutory Guidance to Part 2A (2012) and LCRM (Ref. 1).

8.3.4 The ‘suitable for use’ approach is adopted for the assessment of land contamination where remedial measures are undertaken if unacceptable risks to human health or the environment are realised considering the use (or proposed use) of the land in question and the environmental setting. The proposed end-use for the Grid Connection Corridor is the installation of the 400 kV Grid Connection Cables between the On-Site Substation and the Existing National Grid Thorpe Marsh Substation. It is anticipated that temporary construction compounds (primarily for the storage of cable) for the Grid Connection Corridor would be positioned in the field immediately to the east of the junction between Trumfleet Lane and Brick Kiln Lane, and in the field northeast of Marsh Road adjacent to Engine Dike. The precise location and dimensions of these compounds is to be determined and, therefore, for the purpose of assessment a wider area in which it could be located has been considered where relevant. The indicative location of temporary

construction compounds is shown of **ES Volume II Figure 2-3: Indicative Site Layout Plan [EN010152/APP/6.2]**.

8.3.5 The risk assessment process for environmental contaminants is based on a source-pathway-receptor analysis. These terms can be defined as follows:

a. Source: hazardous substance that has the potential to cause adverse impacts.

b. Pathway: route whereby a hazardous substance may come into contact with the receptor: examples include ingestion of contaminated soil and leaching of contaminants from soil into watercourses; and

c. Receptor: target that may be affected by contamination: examples include human occupants/users of site, water resources (surface waters or groundwater), or structures.

8.3.6 For a risk to be present, there must be a relevant/viable contaminant linkage i.e. a mechanism whereby a source impacts on a sensitive receptor via a pathway.

8.3.7 The following sections detail the initial CSM which has been developed for the Grid Connection Corridor with a view to assessing the potential risks/liabilities and constraints associated with the Grid Connection Corridor in its current condition prior to any proposed development. Risks associated with the Scheme have also been assessed based on a future land use scenario as a Grid Connection Corridor, including potential sources of contamination, potential receptors and potential contaminant pathways identified during this desk-based assessment.

8.4 Sources of Potential Contamination

On Site – Grid Connection Corridor

8.4.1 The potential for contamination has been identified on the Grid Connection Corridor. The most significant source consists in the areas historically occupied by the Thorpe Marsh Power Station (Section D of the Grid Connection Corridor).

8.4.2 Sources of potential contaminations also include railway land, associated with the current Carcroft Junction to Stainforth Junction railway line (Section D of the Grid Connection Corridor) and former Gowdall and Braithwell railway line (Section C).

8.4.3 Potential sources of contamination (albeit limited) have been also identified locally within the Grid Connection Corridor and consist of historical small ponds/pits, which may have been filled with a variety of (potentially unlicensed) waste materials.

8.4.4 Potential contaminants associated with the above sources include metals, semi-metals, asbestos, organic and inorganic compounds. In addition, there is the potential for ground gases such as methane or carbon dioxide and leachate.

8.4.5 The Grid Connection Corridor is occupied by agricultural land comprising arable fields. It is considered that although chemicals such as pesticides, herbicides and insecticides may have been used on-site and in its proximity,

these chemicals typically have a low residency time in soils, and they degrade rapidly in compliance with the requirements for crops and grazing prior to products being used for human consumption. Therefore, agricultural uses are not considered a potential significant source of contamination.

8.4.6 One Pollution Incident to Controlled Waters of Category 3 – Minor Accident identified on the Section D of the Grid Connection Corridor occurred 20 years ago and is therefore not considered of concern.

Off Site – Grid Connection Corridor

8.4.7 The following potential sources of off-site contamination have been identified as requiring consideration for the Grid Connection Corridor:

a. Farm buildings and yards where fuel and agricultural materials were/are stored located adjacent to the Grid Connection Corridor at various locations.

b. former good station and railway sidings (20 m west and 90 m west of the Section C, respectively).

c. railway buildings (20 m west of the Section D).

d. a transport, storage and delivery site/distribution and haulage (Brason Transport Ltd) (adjacent north of Section A).

e. a current electrical substation adjacent south of the Grid Connection Corridor, east of Marsh Lane.

8.4.8 The unspecified ground workings (40 m west of the Section C and D) are small scale, hence not considered to be a pertinent off-site source. The unspecified tank (220 m west of Section D) would be also excluded from the assessment, due to the distance from the Grid Connection Corridor. The two recent landfills located 320 m west of 390 m south of the southern extent (Section D) of the Grid Connection Corridor would also not be included in the assessment, due to the distance and the location downgradient from the Grid Connection Corridor. Potential pathways from contaminant migration to the Grid Connection Corridor from these locations are also restricted by the low permeability Hemingbrough Glaciolacustrine Formation and Alluvium, which underlie most of the Grid Connection Corridor.

8.5 Summary of Potential Sources

8.5.1 Table 8-2 indicates the potential contaminants that may be associated with the current land use.

Table 8-2: Potential Sources of Contamination

Source Reference	Location	Potential Sources	Associated Contaminants of Potential Concern (CoPC)
S1	On Site	Former Thorpe Marsh Power Station	Metals, polyaromatic hydrocarbons (PAH), total petroleum hydrocarbon (TPH), Polychlorinated biphenyls (PCB), inorganic compounds (ammonium salts,

Source Reference	Location	Potential Sources	Associated Contaminants of Potential Concern (CoPC)
			boron, hydrazine, sulphide, sulphate, phosphate, chloride), asbestos. Ground gases (such as methane or carbon dioxide) and leachate.
S2	On Site	Current and former railway lines	Metals, TPH, PAH, semi-volatile organic compound (SVOCs), Volatile Organic Compound (VOCs), asbestos and asbestos containing materials (ACMs), sulphate. Glycols – associated with the potential use of antifreeze liquids on the rail tracks. Herbicides – typically associated with running lines. Creosote (includes phenolic compounds) – associated with running lines.
S3	On Site	Historical small ponds/pits, which may have been filled with a variety of (potentially unlicensed) waste materials.	Heavy metals and inorganics (including sulphate, nitrate, phosphate, ammoniacal nitrogen, acidic/alkaline pH), TPH, PAH, SVOCs, VOCs, asbestos and ACMs. Ground gases (such as methane or carbon dioxide) and leachate.
S4	Off Site.	Farm buildings and yards where fuel and agricultural materials were/are stored. Former goods station, railway buildings and railway sidings Current distribution	Heavy metals and inorganics (including sulphate, nitrate, phosphate, ammoniacal nitrogen, acidic/alkaline pH), PCB, TPH, PAH, SVOCs, VOCs, asbestos and ACMs. Ground gases (such as methane or carbon dioxide) and leachate.

Source Location Reference	Potential Sources	Associated Contaminants of Potential Concern (CoPC)
	and haulage. Current Trumfleet Power Station. Electrical substation.	

8.6 Potential Receptors

On-Site Receptors

8.6.1 The principal human receptors relevant to the Grid Connection Corridor are considered to be construction and maintenance workers. Exposure to other human receptors such as current and future site users is unlikely to be changed except during the cable run construction, and risks to such users are considered outside of the scope of this assessment.

8.6.2 The groundwater receptors include Secondary A Aquifers (Breighton Sand Formation and Alluvium), and a Principal Aquifer (Sherwood Sandstone Group).

8.6.3 Surface water receptors include the water courses associated with the Bramwith Drain from Source to River Don water body; Don from Mill Dyke to River Ouse water body; and Ea Beck from the Skell to River Don water body.

8.6.4 Property receptors include the proposed cables and associated infrastructures. Exposure to property receptors such as crops and livestock is unlikely to be changed except during the cable run construction, and risks to such receptors are considered outside of the scope of this assessment.

8.6.5 There are no sensitive ecological receptors associated with the Grid Connection Corridor.

Off-Site Receptors

8.6.6 The principal human receptors off-site are considered to be neighbours in residential/commercial properties adjacent to the Grid Connection Corridor and the general public in the areas adjacent the Grid Connection Corridor. Property receptors (off-site) include residential and commercial buildings.

Summary of Potential Receptors

8.6.7 Potential receptors associated with the Grid Connection Corridor are shown on Table 8-3.

Table 8-3: Potential Receptors

Receptor Reference	Receptor	Description
R1	Human Health: Acute[1]	Construction and maintenance workers
R2	Human Health[1]	Adjacent site users during earthworks: neighbours in residential/commercial properties adjacent to the Grid Connection Corridor and general public in the areas adjacent the Grid Connection Corridor.
R3	Water Environment: Aquifers	Secondary A Aquifers (Breighton Sand Formation and Alluvium). Principal Aquifer of the bedrock (Sherwood Sandstone Group).
R4	Water Environment: Surface waters	Water courses associated with the Bramwith Drain from Source to River Don water body; Don from Mill Dyke to River Ouse water body; and Ea Beck from the Skell to River Don water body.
R5	Buildings and Infrastructure.	Future proposed infrastructures (cables)
R6	Buildings and Infrastructure	Proposed structures

8.7 Potential Pathways

On-Site Pathways

8.7.1 The human health exposure pathways that are considered viable based on UK guidance (Environment Agency, Contaminated Land Exposure Model (CLEA UK)) (Ref. 33) are listed below:

a. Direct contact, dermal absorption or ingestion of soil;

b. Inhalation of soil particulates derived from soils; and

c. Migration of hazardous gases/vapours via permeable strata into confined spaces (asphyxiation/explosion).

8.7.2 The evaluation of exposure pathways for controlled waters receptors requires an understanding of geological and hydrogeological pathways beneath the Grid Connection Corridor. The controlled waters pathways considered viable with respect to the grid Connection Corridor are as follows:

a. Spillage/loss/run off from surface direct to receiving water;

[1] Refers to a considerable exposure to land contamination in a short period of time (for example during construction activities).

b. Leaching of chemicals and vertical migration via permeable unsaturated strata to groundwater; and

c. Lateral migration in groundwater and baseflow into surface waters.

8.7.3 The buildings and infrastructure pathways considered viable with respect to the Grid Connection Corridor are as follows:

a. Direct contact of the proposed cables with contaminated soils (i.e. hydrocarbons) and aggressive ground conditions (pH and sulphate); and

b. Migration of hazardous gases/vapours via permeable strata into enclosed spaces and service/utility trenches.

Summary of Potential Pathways

8.7.4 Potential pathways associated with the Grid Connection Corridor are shown in Table 8-4.

Table 8-4: Potential Pathways

Pathway Reference	Receptor	Description
P1	Human Health	Direct Pathway: direct contact, dermal absorption or ingestion of soil.
P2	Human Health	Indirect Pathway: inhalation of soil particulates or vapour derived from soils.
P3	Human Health	Indirect Pathway: migration of hazardous gases/vapours via permeable strata into confined spaces (asphyxiation/explosion)
P4	Water Environment: Groundwater	Indirect Pathway: leaching of chemicals and vertical migration via permeable unsaturated strata to groundwater.
P5	Water Environment: Groundwater	Direct Pathway: spillage/loss/run off from surface direct to receiving water
P6	Water Environment: Surface water/Groundwater	Indirect Pathway: lateral migration in groundwater and baseflow into surface waters
P7	Buildings and Infrastructure: proposed cables	Direct Pathway: direct contact of proposed cables with contaminated soils (i.e. hydrocarbons) and aggressive ground conditions (pH and sulphate).
P8	Buildings and Infrastructure: Structures	Direct Pathway: Migration of hazardous gases/vapours via permeable strata into enclosed spaces and service/utility trenches

9. Environmental Risk Assessment

9.1 Risk Assessment Principles

9.1.1 Current industry good practice recommends that the determination of hazards due to land contamination land is based on the principle of risk assessment, as outlined in the Environment Agency guidance LCRM (Ref. 1).

9.1.2 For a risk to be present, there must be a viable contaminant linkage (at the current site condition and/or during construction and/or when the Grid Connection Corridor is complete and operational) i.e. a mechanism whereby a source impacts on a sensitive receptor via a pathway.

9.1.3 Assessments of risks associated with each of these contaminant linkages are discussed in the following sections. The methodology adopted within this PRA does not intend to reflect the EIA Methodology, as described in Chapter 5: Methodology of the Scoping Report (**ES Volume III Appendix 1-1: EIA Scoping Report [EN010152/APP/6.3]**).

9.1.4 Using criteria based on those presented in Annex 4 of the Environment Agency/NHBC/CIEH R&D Publication 66, ‘Guidance for the Safe Development of Housing on Land Affected by Contamination’ (Ref. 34), the magnitude of the risk associated with potential contamination at the Grid Connection Corridor has been assessed. To do this an estimate is made of:

a. The magnitude of the potential consequence (i.e. severity); and

b. The magnitude of probability (i.e. likelihood).

9.1.5 The severity of the risk is classified according to the criteria in Table 9-1.

9.2 Risk Assessment Framework

Table 9-1: Description of Severity of Risk

Term	Description
Severe	a. Highly elevated concentrations likely to result in significant harm to human health. b. Catastrophic damage to crops, buildings or property (e.g. by explosion). c. Equivalent to Environment Agency Category 1 pollution incident including persistent and/or extensive effects of water quality. d. Major damage to aquatic or other ecosystems.
Medium	a. Elevated concentrations which could result in significant harm to human health. b. Significant damage to crops, buildings or property (e.g. damage to building rendering it unsafe). c. Equivalent to Environment Agency Category 2 pollution incident including significant effect on water quality. d. Significant damage to aquatic or other ecosystems.

Mild	a. Exposure to human health unlikely to lead to significant harm. b. Minor damage to crops, buildings or property (e.g. surface spalling to concrete). c. Equivalent to Environment Agency Category 3 pollution incident including minimal or short-lived effect on water quality. d. Minor or short-lived damage to aquatic or other ecosystems.
Minor	a. No measurable effect on humans. b. Repairable effects of damage to buildings, structures and services. c. Equivalent to insubstantial pollution Incident with no observed effect on water quality of ecosystems.

9.2.1 The probability of the risk occurring is classified according to the criteria in Table 9-2.

Table 9-2: Likelihood of Risk Occurrence

Likelihood	Explanation
High	Contaminant linkage may be present that appears very likely in the short-term and risk is almost certain to occur in the long term, or there is evidence of harm to the receptor.
Likely	Contaminant linkage may be present, and it is probable that the risk will occur over the long term.
Low	Contaminant linkage may be present and there is a possibility of the risk occurring, although there is no certainty that it will do so.
Unlikely	Contaminant linkage may be present but the circumstances under which harm would occur even in the long-term are improbable.

9.2.2 An overall evaluation of the level of risk is gained from a comparison of the severity and probability, as shown in Table 9-3.

Table 9-3: Risk Based on Comparison of Likelihood and Severity

		Severity			
		SEVERE	**MEDIUM**	**MILD**	**MINOR**
Likelihood	**HIGH**	Very High	High	Moderate	Low
	LIKELY	High	Moderate	Moderate/Low	Low
	LOW	Moderate	Moderate/Low	Low	Very Low
	UNLIKELY	Moderate/Low	Low	Very Low	Very Low

9.3 Preliminary Risk Assessment

9.3.1 A CSM illustrating plausible contaminant linkages has been formulated for the Grid Connection Corridor. The qualitative preliminary risk assessment of the possible linkages of the above sources (S1 to S4), transport pathways (P1 to P8) and receptors (R2 to R7) is provided in the Table 9-4.

9.3.2 The level of risk is determined based on the current condition of the Grid Connection Corridor (i.e. the effects of mitigation measures are not included).

9.3.3 The preliminary risk assessment undertaken within this section does not consider acute linkages for construction and maintenance workers (R1). It is anticipated that these acute linkages will be managed by appropriate health and safety measures. As construction workers are protected under existing health and safety legislation, any potential effects are considered to be temporary and will be avoided, prevented and reduced through the implementation of standard mitigation measures to be incorporated into a Construction Environmental Management Plan (CEMP). Work will be undertaken in accordance with relevant Construction (Design and Management) (CDM) Regulations 2015 (Ref. 35).

9.4 Discussion of Acute Risk to Future Construction Workers and Off-Site Receptors

9.4.1 The proposed works will be undertaken in compliance with Construction (Design and Management) (CDM) Regulations 2015 (Ref. 35).

9.4.2 Prior to work commencing, a health and safety risk assessment should be undertaken by the appointed principal contractor and developed in accordance with current health and safety regulations. This assessment should cover potential risks to construction staff, permanent site staff and the local population. Based on the findings of this risk assessment, appropriate mitigation measures should be implemented during the construction phase. These mitigation measures, defined by IEMA (Ref. 36), are considered to be standard measures that form part of the general environmental management of the Grid Connection Corridor, and will be integrated within the CEMP.

9.4.3 The greatest potential for generation of dust will be ground disturbance, handling and exposure during the site preparation and construction phases. Dust generation should be kept to a minimum in accordance with general industry good practice, as outlined in, for example, ‘Environmental Good Practice on Site Guide’, CIRIA Publication C741 (Ref. 37).

9.4.4 The risk to construction workers during the site preparation and construction phases in terms of potential exposure to high concentrations of contaminants is considered to be low given the historic and current land uses identified at the Grid Connection Corridor. Should gross contamination be identified, this may pose a potential acute risk to construction works. It is likely that the risks to construction workers can be effectively managed through good health and safety practices and protocols. Adoption of appropriate dust suppression techniques would also mitigate the degree of potential particulate migration off-site; these will be included within the CEMP.

Table 9-4: Potential Sources, Pathways and Receptors for the Grid Connection Corridor

Source	Pathway	Receptor	Potential Severity	Likelihood of Occurrence	Potential Risk	Justification
S1: On-site, former Thorpe Marsh Power Station. *Metals, polyaromatic hydrocarbons (PAH), total petroleum hydrocarbon (TPH), Polychlorinated biphenyls (PCB), inorganic compounds (ammonium salts, boron, hydrazine, sulphide, sulphate, phosphate, chloride), asbestos* *Ground gases (such as methane or carbon dioxide) and leachate.*	P4: Leaching of chemicals and vertical migration via permeable unsaturated strata to shallow groundwater P5: Direct Pathway: spillage/loss/run off from surface direct to receiving water	R3: Aquifers	Medium	Unlikely	Low	The area of the former Thorpe Marsh Power Station and of the current and former railway lines is underlain by the Secondary A Aquifer of the Alluvium over the Principal aquifer of the Sherwood Sandstone Group. Drift deposits of the Alluvium are indicated up to 8.2 m thick in BGS borehole SE60NW178 located in this part of Grid Connection Corridor. The depth of cable installation is dependent upon many factors such as ground conditions and what is encountered on the route (e.g. it may need to go deeper beneath any cables/utilities that are crossed) and is therefore variable. The installation depth is up to 1.4 m and utility surveys would inform final positioning (refer to **ES Volume I Chapter 2: The Scheme [EN010152/APP/6.1]).** The proposed works would therefore be carried out across the

Source	Pathway	Receptor	Potential Severity	Likelihood of Occurrence	Potential Risk	Justification
S2: On-site, current and former railway lines. *Metals, TPH, PAH, semi-volatile organic compound (SVOCs), Volatile Organic Compound (VOCs), asbestos and asbestos containing materials (ACMs), sulphate.* *Glycols.* *Herbicides.* *Creosote (includes phenolic compounds).*	P6: Lateral migration in groundwater and baseflow into surface waters P5: Direct Pathway: spillage/loss/run off from surface direct to receiving water	R4: Surface waters	Medium	Unlikely	Low	low permeability deposits of the Alluvium. Contaminant linkage may be present but the circumstances under which harm would occur even in the long-term are improbable, given the proposed use of the site as a Grid Connection Corridor. The risk of harm to groundwater from leaching of contaminants or from spillage/loss/run off from surface is considered low. River Don borders the Grid Connection Corridor to the east of former Thorpe Marsh Power Station and to the east of the current railway line. Contaminant linkage may be present but the circumstances under which harm would occur even in the long-term are improbable, given the proposed use of the site as a Grid Connection Corridor.

Source	Pathway	Receptor	Potential Severity	Likelihood of Occurrence	Potential Risk	Justification
						The risk of harm to surface waters from lateral migration in groundwater and baseflow into surface waters is considered low. The risk of harm from spillage/loss/run off from surface direct to receiving water is also low.
	P7: Direct contact of proposed cables with contaminated soils (i.e. hydrocarbons) and aggressive ground conditions (pH and sulphate).	R5: Buildings and Infrastructure: proposed cables	Minor	Low	Very Low	Contaminant linkage may be present and there is a possibility of the risk occurring, although there is no certainty that it will do so. Potential risk from direct contact with contaminated soils for infrastructure (cables) is considered very low.
	P8: Migration of hazardous gases/vapours via permeable strata into enclosed spaces and service/utility trenches	R6: Buildings and Infrastructure: Structures	Minor	Low	Very low	Risk from ground gas may be present during construction within service/utility trenches and buildings located adjacent the construction area.

Source	Pathway	Receptor	Potential Severity	Likelihood of Occurrence	Potential Risk	Justification
S3: On-site, Made Ground (associated with former pits/ponds). *Heavy metals and inorganics (including sulphate, nitrate, phosphate, ammoniacal nitrogen, acidic/alkaline pH), TPH, PAH, SVOCs, VOCs, asbestos and ACMs.* *Ground gases (such as methane or carbon dioxide) and leachate.*	P4: Leaching of chemicals and vertical migration via permeable unsaturated strata to shallow groundwater P5: Direct Pathway: spillage/loss/run off from surface direct to receiving water	R3: Aquifers	Medium	Unlikely	Low	Contaminant hotspot and Made Ground may be associated with the former pit/infilled ponds. Contaminant linkage may be present but the circumstances under which harm would occur even in the long-term are improbable. The risk of harm to groundwater from leaching of contaminants or from spillage/loss/run off from surface is considered low.
	P6: Lateral migration in groundwater and baseflow into surface waters P5: Direct Pathway: spillage/loss/run off from surface direct to receiving water	R4: Surface waters	Medium	Unlikely	Low	Contaminant linkage may be present but the circumstances under which harm would occur even in the long-term are improbable, given the proposed use of the site as a Grid Connection Corridor. The risk of harm to surface waters from lateral migration in groundwater and baseflow into surface waters is considered low. The risk of harm from spillage/loss/run off from surface direct to receiving water is also low.

Source	Pathway	Receptor	Potential Severity	Likelihood of Occurrence	Potential Risk	Justification
	P7: Direct contact of proposed cables with contaminated soils (i.e. hydrocarbons) and aggressive ground conditions (pH and sulphate).	R5: Buildings and Infrastructure: proposed cables	Minor	Low	Very Low	Contaminant linkage may be present and there is a possibility of the risk occurring, although there is no certainty that it will do so. Potential risk from direct contact with contaminated soils for infrastructure (cables) is considered very low.
	P8: Migration of hazardous gases/vapours via permeable strata into enclosed spaces and service/utility trenches	R6: Buildings and Infrastructure: Structures	Minor	Low	Very low	Contaminant linkage may be present and there is a possibility of the risk occurring, although there is no certainty that it will do so. Risk from ground gas may be present during construction within service/utility trenches and buildings located adjacent the construction area. The Scheme will include temporary construction compound in term of structures.
S4: Off-site, farm buildings and yards where fuel and agricultural materials were/are stored.	P4: Leaching of chemicals and vertical migration via permeable unsaturated strata to shallow groundwater	R3: Aquifers	Medium	Unlikely	Low	Some areas of potentially contaminated land have been identified adjacent to the Grid Connection Corridor. Contaminant linkage may be present but the circumstances

Source	Pathway	Receptor	Potential Severity	Likelihood of Occurrence	Potential Risk	Justification
Off-site, former good station, railway buildings and railway sidings Off-site, current distribution and haulage. Off-site, current Trumfleet Power Station. Current electrical substation. *Heavy metals and inorganics (including sulphate, nitrate, phosphate, ammoniacal nitrogen, acidic/alkaline pH), PCB, TPH, PAH, SVOCs, VOCs, asbestos and ACMs.* *Ground gases (such as methane*	P5: Direct Pathway: spillage/loss/run off from surface direct to receiving water					under which harm would occur even in the long-term are improbable. The risk of harm to groundwater from leaching of contaminants or from spillage/loss/run off from surface is considered low.

Source	Pathway	Receptor	Potential Severity	Likelihood of Occurrence	Potential Risk	Justification
or carbon dioxide) and leachate.						

10. Decommissioning

10.1.1 Potential impacts from the decommissioning of the Site are similar in nature to those during construction, as some ground works would be required to remove infrastructure installed. A detailed Decommissioning Environmental Management Plan (DEMP) will be prepared to identify required measures to prevent pollution during this phase of the development, based on the detailed decommissioning plan.

10.1.2 As a result, it is considered the decommissioning impacts and effects would mirror those of the construction phase. Standard mitigation measures are expected to be applied during decommissioning.

11. Conclusions

11.1.1 The potential risks that have been identified from potential land contamination have been assessed by the PRA as being very low to low.

11.1.2 A number of environmental design and management measures will be employed as standard good practice to minimise impacts to both human health and controlled waters during the construction and decommissioning phases. These will be incorporated into the Framework CEMP which is provided alongside this ES **(Framework CEMP [EN010152/APP/7.7]).**

11.1.3 The information collected as part of this PRA suggests that there are no significant constraints with regards to contamination of soil and groundwater that would limit the development of the Grid Connection Corridor.

12. Recommendations

12.1.1 It is assumed that information may be required along the Grid Connection Corridor to inform soil disposal and health and safety of construction workers and limited intrusive ground investigation is therefore likely to be required.

12.1.2 Limited intrusive ground investigation and Generic Quantitative Risk Assessment (GQRA) is recommended in the selected areas of potential contamination. Figure 3 shows the location of the areas of potential contamination relevant for the Grid Connection Corridor. Where features are off-site, the investigation locations will be on-site but adjacent or around the feature.

12.1.3 Areas recommended to be included within the ground investigation related to the Grid Connection Corridor are:

a. Near the current Carcroft Junction to Stainforth Junction railway (and former railway buildings) (on-site) (but not within the railway land itself);

b. Near the former Thorpe Marsh Power Station (on-site);

c. Near the former Gowdall and Braithwell railway line (on-site);

d. Near Pit Bridge (on-site);

e. Near the current Trumfleet Power Station (adjacent east of Section C);

f. Near the former good station and railway sidings (adjacent west of Section C); and

g. Near the current transport, storage and delivery site/distribution and haulage (adjacent north of Section A).

12.1.4 The results of the ground investigation can be used to refine the findings of this PRA, allow for any recommendations for further works, and allow for considering options for appropriate reuse (following CL:AIRE DoW:CoP (Ref. 38), or treatment and disposal of any material to an appropriate facility, prior to construction. The investigation could also be combined with the geotechnical assessment to be more cost effective.

12.1.5 The Grid Connection Corridor is within the Nottinghamshire Coal Mining Reporting Area (Ref. 20). It is recommended that a coal mining report from the Coal Authority is commissioned to further assess coal mining issues at the Grid Connection Corridor. There are no DHRAs within the Grid Connection Corridor (Ref. 20). In additions, the Carboniferous Rocks are overlain by significant thicknesses of Sherwood Sandstone Group, overlying mudstone and limestone formations.

13. References

Ref. 1 Environment Agency (2020). Land Contamination Risk Management (LCRM). Available at: https://www.gov.uk/government/publications/land-contamination-risk-management-lcrm [Accessed 30 January 2023].

Ref. 2 His Majesty's (HM) Government (2008). Planning Act 2008. Available at: https://www.legislation.gov.uk/ukpga/2008/29/contents [Accessed 30 January 2024].

Ref. 3 Ministry of Housing, Communities and Local Government (MCHLG) (December 2023). National Planning Policy Framework (NPPF). Available at: https://www.gov.uk/guidance/national-planning-policy-framework [Accessed 30 January 2024].

Ref. 4 Department for Environment, Food and Rural Affairs (Defra) (2012). Environmental Protection Act 1990: Part 2A Contaminated Land Statutory Guidance. Available at: https://www.legislation.gov.uk/ukpga/1990/43/contents [Accessed 30 January 2024].

Ref. 5 HM Government (2012). The Contaminated Land (England) (Amendment) Regulations 2012. Available at: https://www.legislation.gov.uk/uksi/2012/263/made [Accessed 30 January 2024].

Ref. 6 National Planning Statement (NPS) for Overarching National Planning Statement for Energy EN-1 (November 2023). Available at https://assets.publishing.service.gov.uk/media/64252f3b60a35e00120cb158/NPS_EN-1.pdf [Accessed 30 January 2024].

Ref. 7 National Policy Statement (NPS) for Renewable Energy Infrastructure (EN-3) (November 2023). Available at https://assets.publishing.service.gov.uk/media/65a7889996a5ec000d731aba/nps-renewable-energy-infrastructure-en3.pdf [Accessed 13 February 2024].

Ref. 8 National Planning Statement (NPS) for Electricity Networks EN-5 (November 2023). Available at

https://assets.publishing.service.gov.uk/media/64252f852fa848000cec0f53/NPS_EN-5.pdf [Accessed 30 January 2024].

Ref. 9 British Standard 5930:2015+A1:2020 ‘Code of Practice for Ground Investigations’.

Ref. 10 British Standard 10175 2011+A2:2017 ‘Investigation of Potentially Contaminated Sites – Code of Practice’.

Ref. 11 Groundsure (2023). Enviro + Geo Insight. Order Numbers: GSIP-2023-13870-14752_A_1; GSIP-2023-13870-14752_B; and GSIP-2023-13870-14752_C. Ordered 31 July 2023.

Ref. 12 City of Doncaster Council. Contaminated Land Search. Available at https://www.doncaster.gov.uk/services/environmental/register-of-contaminated-land [Accessed 30 December 2023].

Ref. 13 Zetica (n.d.). Zetica Risk Map. Available at: https://zeticauxo.com/downloads-and-resources/risk-maps/ [Accessed 30 September 2023].

Ref. 14 Ordnance Survey (OS) (2021). Open Data. Available at: https://www.ordnancesurvey.co.uk/opendata/viewer/. [Accessed 30 January 2024].

Ref. 15 Google Earth Pro v7.3.6.9285. [Accessed 30 September 2023].

Ref. 16 British Geological Survey (BGS) (2008). Geological Survey of Great Britain (England and Wales). Sheet 71 Selby. Scale 1:50 000. Solid and Drift Editions. Available at

https://largeimages.bgs.ac.uk/iip/mapsportal.html?id=1001554 [Accessed 30 September 2023].

Ref. 17 BGS (2023). Geoindex Onshore online geological mapping viewer. Available at: https://mapapps2.bgs.ac.uk/geoindex/home.html [Accessed 30 September 2023].

Ref. 18 Natural England (2010). Agricultural Land Classification Map East Midlands Region (ALC005). Available at: https://naturalengland.org.uk [Accessed 30 January 2024].

Ref. 19 LandIS (n.d.). Soilscapes. Available at: https://www.landis.org.uk/soilscapes/ [Accessed 30 January 2024].

Ref. 20 BGS (2020). The Coal Authority Interactive Map. Available at https://mapapps2.bgs.ac.uk/coalauthority/home.html [Accessed 30 September 2023].

Ref. 21 UK Health Security Agency (UKHSA) and BGS. UK Maps for Radon. Available at https://www.ukradon.org/information/ukmaps [Accessed 30 September 2023].

Ref. 22 Environment Agency (n.d.). Environment Agency. Available at: https://www.gov.uk/government/organisations/environment-agency [Accessed 30 September 2023].

Ref. 23 Defra (n.d.). Multi-Agency Geographic Information for the Countryside (MAGIC) map. Available at: https://magic.defra.gov.uk/MagicMap.aspx [Accessed 30 September 2023].

Ref. 24 Environment Agency (2023). Catchment Data Explorer Tool. Available at: https://environment.data.gov.uk/catchment-planning/ , https://environment.data.gov.uk/catchment-planning/WaterBody/GB104027064260, https://environment.data.gov.uk/catchment-planning/WaterBody/GB104027064243 [Accessed 30 September 2023].

Ref. 25 Environment Agency (2023). Flood map for planning. Available at: https://check-long-term-flood-risk.service.gov.uk/map?easting=460833&northing=416324&map=SurfaceWater [Accessed 30 September 2023].

Ref. 26 City of Doncaster Council (2023) Planning Application Search. Available at: https://www.doncaster.gov.uk/services/planning/planning-applications-online-public-access [Accessed 30 September 2023].

Ref. 27 City of Doncaster Council (2021). Doncaster Local Plan 2015-2035 (Adopted) Policies Map. Available at https://maps.doncaster.gov.uk/portal/apps/webappviewer/index.html?id=c8073f15e63849d6a28a509e1eec6c76 [Accessed 30 September 2023].

Ref. 28 CL:AIRE (2012). Research Bulletin RB17. A Pragmatic Approach to Ground Gas Risk Assessment.

Ref. 29 City of Doncaster Council (2023). Public Access. Available at https://www.doncaster.gov.uk/ [Accessed 30 September 2023].

Ref. 30 HM Government (2015). Environmental Damage (Prevention and Remediation) Regulations 2015. Available at:

https://www.legislation.gov.uk/uksi/2015/810/contents [Accessed 30 January 2024].

Ref. 31 HM Government (1991). The Water Resources Act 1991. Available at: https://www.legislation.gov.uk/ukpga/1991/57/contents [Accessed 30 January 2024].

Ref. 32 HM Government (2003). The Water Act 2003. Available at: https://www.legislation.gov.uk/ukpga/2003/37#:~:text=An%20Act%20to%20amend%20the,for%20Water%2C%20and%20for%20the [Accessed 30 January 2024].

Ref. 33 Environment Agency (2009). Updated technical Background to the CLEA model; Science Report: SC050021/SR3 (Contaminated land exposure assessment (CLEA) spreadsheet based tool). Available at: https://assets.publishing.service.gov.uk/media/5a7ce9eae5274a724f0be48b/scho0508bnqw-e-e.pdf [Accessed 30 January 2024].

Ref. 34 Environment Agency, NHBC, Chartered Institute of Environmental Health (2008). Guidance for the Safe Development of Housing on Land Affected by contamination. R&D Publication 66: 2008. Available at: https://www.middevon.gov.uk/media/114549/volume-1-guidance-for-the-safe-development-of-housing-on-land-affected-by-contamination.pdf [Accessed 30 January 2024].

Ref. 35 HM Government (2015). The Construction (Design and Management) Regulations 2015. Available at: https://www.legislation.gov.uk/uksi/2015/51/contents/made [Accessed 30 January 2024].

Ref. 36 Institunowte of Environmental Management and Assessment (IEMA) (2016). Environmental Impact Assessment Guide to Delivering Quality Development. Available at: https://www.iema.net/download-document/328273 [Accessed 30 January 2024].

Ref. 37 CIRIA (2015). PUB C741 Environmental good practice on site guide. Fourth edition.

Ref. 38 CL:AIRE (March 2011) Definition of Waste: Development Industry Code of Practice (DoW:CoP). Available at: https://www.claire.co.uk/projects-and-initiatives/dow-cop/28-framework-and-guidance/111-dow-cop-main-document [Accessed 30 September 2023].

Ref. 39 Department of the Environment Industry Profile. Power Stations (Excluding Nuclear Power Station). Available at: https://webarchive.nationalarchives.gov.uk/ukgwa/20140328084622/http://publications.environment-agency.gov.uk/pdf/SCHO0195BJKY-e-e.pdf. [Accessed 1 February 2023].

Figures

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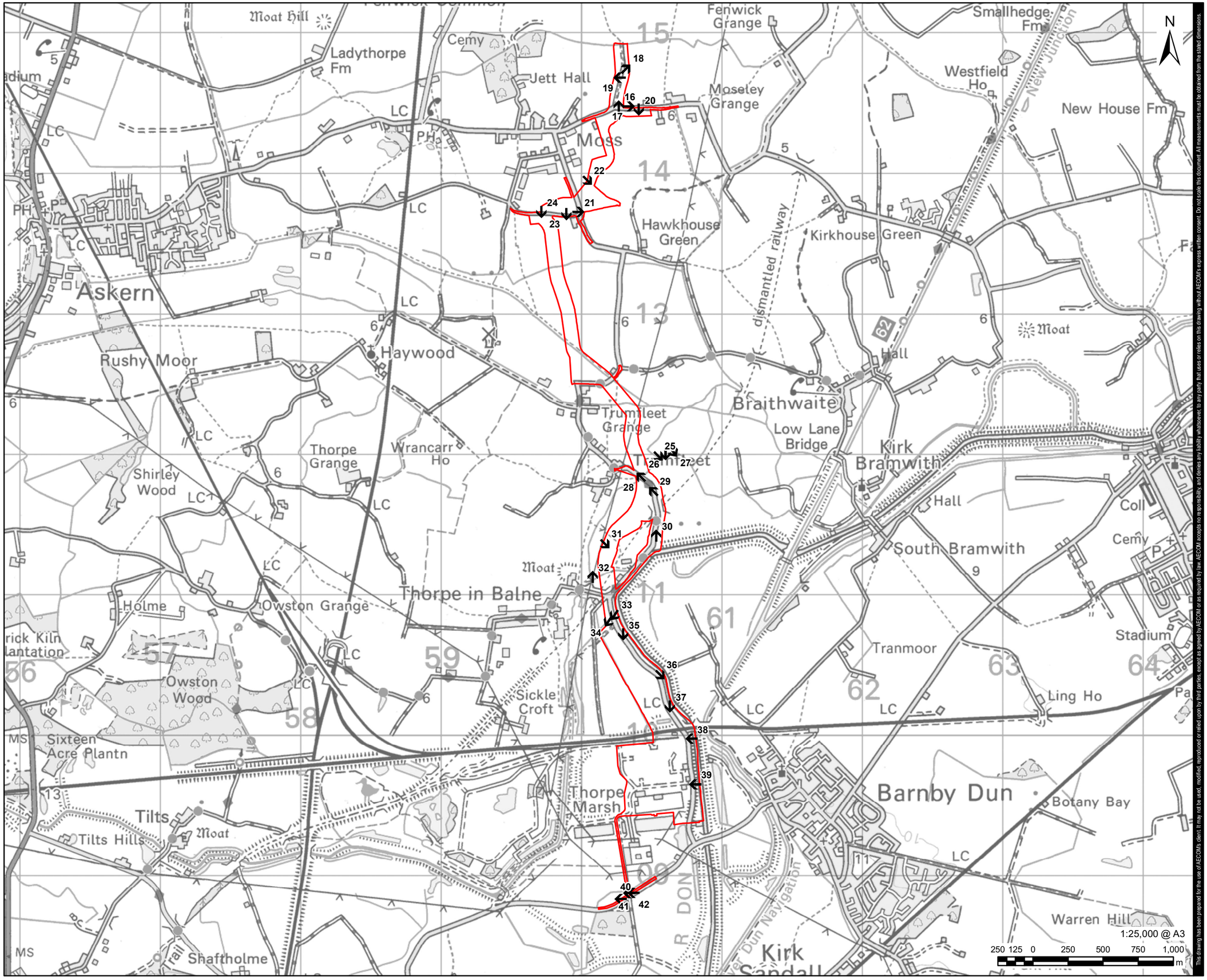

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LEGEND

- Grid Connection Corridor
- Site Walkover Photograph Location

NOTES

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ISSUE PURPOSE

Phase 1 PRA - Grid Connection Corridor

PROJECT NUMBER

60698207

FIGURE TITLE

Grid Connection Corridor - Site Walkover Photographs

FIGURE NUMBER

Figure 1

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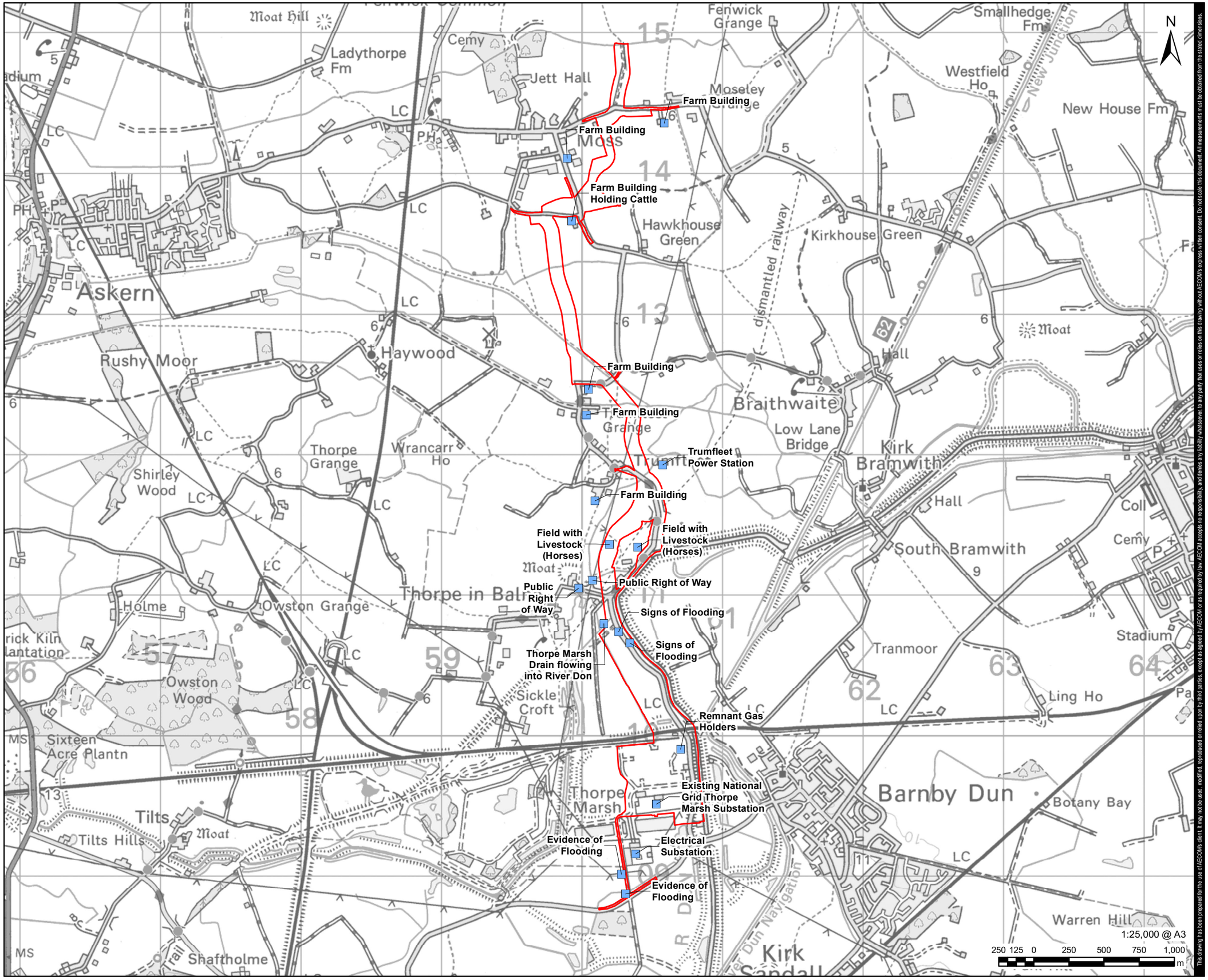

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LEGEND
- Grid Connection Corridor
- Site Walkover Observation

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ISSUE PURPOSE
Phase 1 PRA - Grid Connection Corridor

PROJECT NUMBER
60698207

FIGURE TITLE
Grid Connection Corridor - Site Walkover Observations

FIGURE NUMBER
Figure 2

Filename: I:\5004 - Information Systems\60698207_Fenwick_Solar_Farm\02_Maps\PEIR\PRA Appendices\SAA_PRA_Fig2_GC_SiteWalkoverObservations_A3L_20240213_R0.mxd

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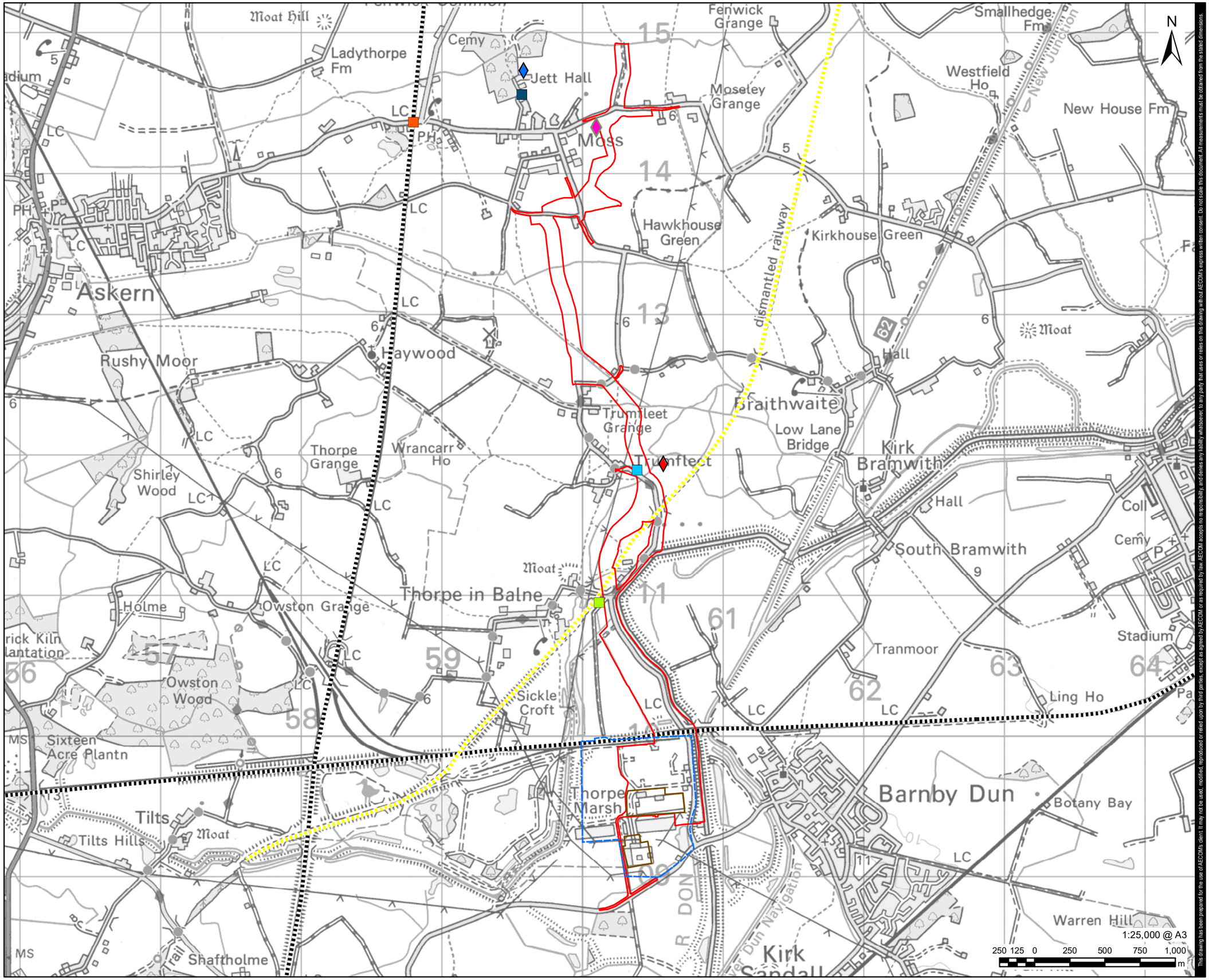
Filename: I:\5004 - Information Systems\60698207_Fenwick_Solar_Farm\02_Maps\PEIR\PRA Appendices\SAA_PRA_Fig3_GC_PotentiallyContaminatedSources_A3L_20240213_R0.mxd



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LEGEND

- Grid Connection Corridor

Potentially Contaminative Source

- Current Shooting Range
- Current Transport, Storage and Delivery Site
- Current Trumfleet Power Station
- Foremer Pit (Pit Bridge)
- Former Good Station and Railway Sidings
- Former Train Station
- Unspecified Tanks
- Current Railway Line
- Former Railway Line
- Current Electrical Substation
- Former Power Station

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ISSUE PURPOSE

Phase 1 PRA - Grid Connection Corridor

PROJECT NUMBER

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FIGURE TITLE

Grid Connection Corridor - Potentially Contaminated Sources

FIGURE NUMBER

Figure 3

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