Environmental Statement
Chapter 24  Appendix A - Phase 1 Contaminated Land Desk Study

Application Reference: 6.24.1
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<th>Date</th>
<th>Issue No.</th>
<th>Remarks / Reason for Issue</th>
<th>Author</th>
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## SUMMARY

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<tr>
<th>Location</th>
<th>Dogger Bank Creyke Beck is the proposed development and comprises two offshore wind farm projects and associated onshore infrastructure. The purpose of the onshore infrastructure is to link the offshore wind farms into the existing Creyke Beck substation, near Cottingham in the East Riding of Yorkshire. The cable route is approximately 30 km long and up to 50m wide and encompasses the construction working width required to install two cable systems. For the purposes of this desk based assessment, a 1 km cable corridor has been defined, within which potential sources of contamination have been identified and an assessment of potential risks have been made. The onshore development will also include the construction of two converter stations. As the exact site of the converter stations has yet to be decided, an area encompassing the potential converter station sites has been defined and assessed (the Converter Station Study Area).</th>
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<tr>
<td>Description</td>
<td>The proposed onshore buried cable route crosses through arable and horticultural land, with small pockets of improved and rough grassland. Land within the 1km cable corridor generally comprises fields, drains, springs, roads and a limited number of residential properties comprising predominately farms. Historical maps show limited development within the cable corridor. However, due to the nature of the geology underlying the cable corridor, gravel pits have been identified at a number of locations. A number of these are recorded as historical landfills or possible landfills; others are now shown as ponds / lakes.</td>
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<td>Potentially contaminate land uses</td>
<td>Several potentially contaminative current and historical land uses have been identified crossing the cable route, within the 1m cable corridor and within the Converter Station Study Area. Those considered to pose a potentially significant risk to the scheme include:</td>
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<td>- Known historical landfills</td>
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<td>- Possible landfills (categorised based on land use data provided by East Riding of Yorkshire Council)</td>
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<td>- Old gravel pits</td>
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<td>- Transport links (roads, railway line, canals, with associated embankments)</td>
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<td>- Electricity substations</td>
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<td>Geology, Hydrogeology, Hydrology and Environmental Setting</td>
<td>The drift geology across the area generally comprises glacial till with outcrops of alluvium and glacial sand and gravels. The underlying bedrock geology across the study area is characterised by Chalk of the Cretaceous period. The area of the cable corridor is relatively flat and low lying, is drained by two main catchments, and is actively managed through drainage channels. Streams and drains located north and east of Skipsea Road drain towards the coast, whereas any streams or drains south and west of this point eventually drain towards the River Hull. Where the corridor is underlain by Glaciofluvial Deposits or Alluvium, the drift deposits are classified by the Environment Agency as Secondary A aquifers. Approximately 42% of the proposed cable route and Converter Station Study Area is underlain by a Secondary A aquifer. Boulder clay occurs across the majority of the area (approximately 58% of the cable route and Converter Station Study Area) and predominately comprises poorly sorted clays and silts, however, interbedded sand and gravel layers can occur, which may comprise a source of groundwater. The Chalk Group is defined by the Environment Agency as a Principal Aquifer. There are no designated sites for nature conservation within the cable corridor, with the exception of the Leven Canal which is a designated site of special scientific interest (SSSI).</td>
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<td>Risk Assessment (prior to implementation of mitigation measures)</td>
<td>Conclusions and recommendations</td>
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<td>Risks to Human Health (future site users / land owners) – Moderate to Low Risk</td>
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<td>Risks to Groundwater – Moderate to High Risk</td>
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<td>Risks to Surface Water – Moderate to Low Risk</td>
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<td>Risks to Ecological receptors – Moderate Risk</td>
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<td>Risks to Buildings and structures – Moderate to Low Risk</td>
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**Conclusions**

Prior to implementation of any mitigation measures, the greatest risks are associated with groundwater (both Secondary A and Principal Aquifers) and the health and safety of construction workers. However, implementation of appropriate mitigation measures will result in all potential risks being assessed as low. Within the cable route, the gas risk to human health / structures is considered very low as there will be no confined spaces within which gases may accumulate and into which human entry will be possible. However as part of the overall development, a number of confined spaces into which human entry will be possible and required will be present i.e. future buildings in the Converter Station Study Area. As there are two known historic landfills within 500m of the Converter Station Study Area and given the precise nature of the material in the landfill sites is not known, the landfills have the potential to generate hazardous gas which may migrate via permeable strata and accumulate in confined spaces and / or buildings on site. Gas risks should also be considered for all construction workers wherever there is a requirement to enter confined spaces as part of the construction works. An assessment of such risks should be undertaken as part of the Construction Phase Health and Safety Plan.

**Recommendations**

- It is recommended that the cable route is moved to avoid passing through Woodmansey landfill (site D, Figure 6.2). This will significantly reduce the potential risk to construction workers and controlled waters.
- Alternatively the potential risks relating to the presences of the landfills could be reduced by incorporating mitigation measures within the design i.e. lining the trench, disposal of waste materials, use of clean backfill and incorporation of bentonite plugs to prevent preferential pathways in the vicinity of the landfill.
- The converter stations should be sited to the north of the A1079, this will significantly reduce the potential risk to construction workers, with respect to the historical landfill sites located to the south, south east and associated gas risk. In addition all buildings / foundations should be designed with gas venting measures, where applicable in-line with building regulations.
- Implementation of good site practice and hygiene, in addition to the use of appropriate Personal Protective Equipment (PPE) and Respiratory Protective Equipment (RPE), where necessary (to be decided by contractor).
- Method statements and risk assessments will be developed for all site works to aid identification of such risks and appropriate risk avoidance and reduction measures. The works should be undertaken in accordance with the requirements of the Construction (Design & Management) Regulations 2007 where appropriate.
- Complete a Materials Reuse Risk Assessment.
- Use the results of the Materials Reuse Risk Assessment to complete a Materials Management Plan.
- Complete a Site Waste Management Plan (to be undertaken as part of the EIA).
- Characterisation of any material excavated and disposal off site of any materials demonstrated not to be suitable for reuse.
- Pre-treatment prior to disposal to either reduce the volume of hazardous waste requiring disposal or to reduce the hazardous nature of the material.
- Testing and verification of any soils imported to the site to ensure that they do not pose a risk to human health or controlled waters. They will also need to be accompanied by all relevant waste Duty of Care documentation.
- If dewatering of excavations is undertaken as part of the proposed scheme these should be contained and disposed of appropriately in accordance with best practice guidance, CIRIA 648 and Pollution Prevention Guidance Note (PPG) 5: Works in, near or liable to affect watercourses.
- Best practice guidance should be followed (for example PPG5, and PPG6: Working at construction and demolition sites).

This tabulated page is a summary of the assessment of the site. It does not provide a definitive analysis.
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1 INTRODUCTION

1.1 Background

This report has been prepared by Royal Haskoning on behalf of Forewind (‘the Client’) as part of the Environmental Impact Assessment (EIA) for Dogger Bank Creyke Beck. This will be the first stage of the Dogger Bank development and comprises two wind farm projects of up to 2.8 gigawatts (GW) of combined generating capacity. It will comprise two offshore wind farms and associated onshore infrastructure, each project having a maximum generating capacity of up to 1.4GW. The onshore element comprises all infrastructure landward of the mean high water mark including the onshore transition pit, 30km long buried cable systems, and two converter stations. The converter stations will be located near to Creyke Beck, and convert the electricity exported as ‘direct current’ back to ‘alternating current’ prior to connection into the National Grid Creyke Beck substation, Cottingham in the East Riding of Yorkshire.

1.2 Site Location and Development Description

The onshore cable corridor begins at the landfall near the village of Ulrome, where the export cables come ashore. It is likely that the overall construction working width (including soil storage, haul roads and trenches) will be up to 50m wide. The working width has not yet been finalised and thus a conservative worst case width has been assumed in this report. The two main cable construction techniques proposed are trenching and horizontal direction drill (HDD). HDD will be used to cross significant obstacles such as rivers, streams and major roads where trenching cannot be achieved. During HDD tunnels are bored under the structure and the cables pulled through the underlying geology.

For the purposes of this desk based assessment, a 1 km cable corridor has been defined, within which potential sources of contamination have been identified and an assessment of potential risks has been made. The development will also include the construction of two converter stations. As the exact site of the converter stations has yet to be decided, an area encompassing the potential converter station sites has been defined; the Converter Station Study Area. The cable corridor, cable route and Converter Station Study Area are shown on Figure 1.1.

1.3 Objectives

The objectives of the report are to identify, as far as is reasonably possible, any potential sources of environmental contamination within or around the site which could:

- Adversely affect the health or safety of any users of the site;
- Migrate from the site and either adversely affect the environment or migrate towards other interests such as property; or
- Give rise to legal liability to the Client or prompt regulatory action pursuant to any land and water quality environmental laws, including Part 2A of the Environmental Protection Act 1990 (EPA 1990).
The data from this desk study and the site walkover will enable the conceptual model for the site to be developed and determine if there are any potential source-pathway-receptor linkages present (as required to ensure compliance with EPA 1990).

1.4 Limitations

This report has been prepared by Royal Haskoning with all reasonable skill and care, within the terms of the contract with the Client. The conclusions in this report are professional opinions, based solely on visual observations by Royal Haskoning of the site and immediate vicinity at the time of a site visit, reasonably foreseeable issues, and interpretation of the environmental and historical information identified in this report.

The direct assessments and judgements given in this report are limited by both the finite data on which they are based and the proposed works to which they are addressed. The acquisition of data is constrained by both physical and economic factors and, by definition, is subject to the limitations imposed by the methods of investigations employed. Conditions at the site will change over time due to natural variations and may be affected by human activities.

This document has been prepared for the titled project and should not be relied upon or used for any other project. This document is confidential and has been prepared for the sole benefit of Forewind. Royal Haskoning accepts no responsibility or liability for the consequences of this document being used for a purpose other than that purpose for which it was commissioned. The assessments and judgements contained herein should not be relied upon as legal opinion.

The findings and opinions are relevant to the dates of the site visit and information reviewed and should not be relied upon to represent conditions at substantially later dates. The opinions included herein are based on the information obtained from the assessments undertaken at the site and from the experience of the reviewers. If additional information becomes available which may alter the conclusion, Royal Haskoning requests the opportunity to review the information, re-assess the potential concerns and modify its opinion, if warranted.

This Phase 1 Report has utilised historical maps obtained from the Landmark Group, and other available sources such as the Environment Agency (EA), Local Authority and British Geological Survey (BGS). Therefore, the study is limited by the age and limitations inherent in the data described.

This Phase 1 Report does not address potential geotechnical risks associated with the construction of the proposed cable route and converter stations.
2 METHODOLOGY

In order to establish if there are any potential risks associated with the current soil, groundwater and surface water conditions, and to provide any conclusions and recommendations to be considered within the future stages of the scheme, the following desk based sources have been reviewed:

- Landmark report, Historical Map Data for pipeline route, Order Number 36741899
- Landmark report, Ordnance Survey Map Data for pipeline route, Order Number 36741899
- British Geological Survey (BGS) Solid and Drift Geology, Sheet 72 Beverley (1:50,000);
- Environment Agency Website ‘What’s in your backyard’ http://maps.environment-agency.gov.uk/wiyby; and
- Data provided by the Environment Agency and Local Authority relating to:
  - historic landfills; and
  - discharge consents.

On the basis of the review of the above sources, a conceptual site model was determined. As per best practice guidance outlined in CLR11 (Model Procedures for Management of Land Contamination, Contaminated Land Report 11, September 2004) this conceptual model was developed to represent the characteristics of the potential cable route and the 1 km cable corridor and Converter Station Study Area to show the potential relationships between contaminants, pathways and receptors.

Although all potential contaminative sources within the 1 km cable corridor have been identified based on historic and current land uses, it is acknowledged that, depending on the size and nature of the contaminative sources, sources within 250 m of the cable route and Converter Station Study Area are considered to be of greater potential risk to human health and the environment as a result of construction and operation of the onshore infrastructure. As such, the potential risks associated with sources within 250 m of the cable route are considered in greater detail than those outside the 250 m buffer.

This report also comprises the findings of a site walkover, the specific aim of which was to investigate the historic and possible landfills along the proposed cable route. The scope of the walkover was identified based on an initial identification of potential sources of contamination. The findings of the walkover were then used to inform the conceptual site model.
3 DESK STUDY

3.1 Current Land Uses and Topography

The cable corridor crosses arable and horticultural land, with small pockets of improved and rough grassland.

The cable corridor and Converter Station Study Area is relatively flat and low lying and is drained by two main catchments. The area of the cable corridor is actively managed through drainage channels. Streams and drains located north and east of Skipsea Road drain towards the coast, whereas any streams or drains south and west of this point eventually drain towards the River Hull.

The proposed cable route crosses a number of drains, streams, canals and ditches.

Of note, the proposed route crosses in the vicinity of a series of lakes near Brandesburton at approximate NGR TA 097 486. Although the route does not cross directly through any of the lakes, the proposed route passes within close proximity of two of the lakes. These lakes comprise a long chain of flooded former gravel pits, now primarily used by anglers.

3.2 Geology and Hydrogeology

Information is based on British Geological Survey (BGS) published digital mapping at a 1:50,000 scale and Beverley Sheet 72 1:50,000 scale (solid and drift) and Hornsea Sheet 73 (drift).

<table>
<thead>
<tr>
<th>Table 3.1 Summary of Underlying Geology and Aquifer Properties</th>
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<tbody>
<tr>
<td><strong>Stratum</strong></td>
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<tr>
<td>Drift</td>
</tr>
<tr>
<td>Alluvium</td>
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<tr>
<td>Glaciofluvial Deposits (probably including post-glacial river terrace deposits)</td>
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<td>Till</td>
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</tbody>
</table>
Stratum | Age | Description | Aquifer properties
--- | --- | --- | ---
Rowe Chalk Formation | Cretaceous | White, flint bearing chalk with sporadic marl bands. | Cretaceous Chalk is defined as a Principal Aquifer. This rock has high fracture permeability and can provide a high level of water storage. This aquifer supports water supply and base flow to rivers.
Flamborough Chalk | Cretaceous | White flintless chalk with thin marl beds. | 
Burnham Chalk Formation | Cretaceous | White flinty chalk with thin marl beds. | 

The drift geology across the cable corridor generally comprises glacial till with outcrops of alluvium and glacial sand and gravels. The underlying bedrock geology across the cable corridor is characterised by Chalk of the Cretaceous period. For the purposes of describing the drift geology, the corridor has been split into five sections. Given that there are limited changes in solid geology along the cable corridor, the solid geology is described for the entire length.

### 3.2.1 Drift Deposits

**Landfall to Skipsea Road**

The drift deposits in this section of the cable corridor comprise predominantly till (stoney clay), with small outcrops of alluvium (clay, silt, sand and gravel) and glaciofluvial deposits (undifferentiated: sands and gravels). Alluvial and glaciofluvial deposits are mapped adjacent to the coast line / landfall and as a linear feature along the approximate route of Skipsea drain (*Figure 3.1 Drift Geology Landfall to Skipsea Road*).

The outcrops of alluvial and glaciofluvial deposits mapped at the coast are shown to extend approximately 400m inland (*Figure 3.1 Drift Geology Landfall to Skipsea Road*), with alluvial deposits limited to the area adjacent to the landfall (landfall to 90m inland). The outcrops of alluvial and glaciofluvial deposits shown along Skipsea Drain are approximately 400m in width with alluvial deposits limited to a corridor surrounding the Skipsea Drain with the glaciofluvial deposits outcropping to the north. Pockets of lacustrine deposits (deposited as a result of lake formation) are also mapped within 500m of the route (*Figure 3.1 Drift Geology Landfall to Skipsea Road*). BGS logs TA16SE29 and TA15NE12 record drift from ground level to a maximum of 25m bgl comprising clay, sand and gravel.

Where the cable corridor is underlain by Glaciofluvial Deposits or Alluvium, the drift deposits are classified by the Environment Agency as Secondary A aquifers. As such they have permeable layers capable of supporting water supplies at a local rather than strategic scale. In some cases these aquifers may provide an important base flow contribution to rivers.
The alluvium, which underlies the major stream valleys, is described on the hydrogeological map as comprising clays and silts at thicknesses of up to 20 m with occasional layers of peat (up to 7 m thick). Interbedded sand layers may provide small supplies of groundwater. However, in the area of the proposed cable route, review of the available BGS borehole logs (see Figure 3.1 Drift Geology Landfall to Skipsea Road), indicates that no peat has been encountered in this section. If present, it is only likely to comprise thin layers and be present in discrete pockets. The BGS logs indicate that peat has been observed in the area of the River Hull at NGR TA 0755 3758 as well as in an area near Routh at NGR TA 08920 42780. Two boreholes, references TA03NE203 and TA03NE221, as shown in Figure 3.1 Drift Geology Landfall to Skipsea Road identified traces of peat at thicknesses of 0.3 m and 0.61 m at depths of 1.83 m bgl and 3.05 m bgl, respectively. A further borehole, reference TA04SE8B identified peat at a depth of 8.8 m at a thickness of 0.6 m. No other evidence of peat deposits is indicated in British Geological Survey (BGS) borehole logs along the proposed route (Appendix B).

The glaciofluvial deposits, comprising sands and gravels, occur mainly as flood plain deposits. In this area, they are likely to occur in dry valleys. Glacial sands and gravels are mainly locally derived and may have the potential to yield groundwater.

In this section of the cable corridor, the majority of underlying superficial deposits comprise glacial till, i.e. approximately 86% of the cable corridor is underlain by till, with only 6% and 8% underlain by alluvium and glaciofluvial deposits respectively. The majority of the cable corridor, which is underlain by till, in this section is defined by the Environment Agency as unproductive strata. This till has a low permeability and has negligible significance for water supply or base flow to rivers. However, interbedded sand and gravel layers can occur within the till deposits, which may comprise a source of groundwater.

The drift deposits underlying the cable corridor are illustrated in Figure 3.1 Drift Geology Landfall to Skipsea Road. All BGS borehole logs are presented in Appendix B and are indicated in Figure 3.1 Drift Geology Landfall to Skipsea Road.

Skipsea Road to Burshill
The drift deposits predominantly comprise till (approximately 86%) with outcrops of alluvium (approximately 10%) and glaciofluvial deposits (approximately 4%). Alluvial and glaciofluvial deposits are mapped from King’s Oxgang (approximate NGR TA 099 488) to south of Burshill as shown in Figure 3.1 Drift Geology Skipsea Road to Burshill. BGS logs TA15SW5, TA14NW26 and TA14NW71 record drift (described as boulder clay, sand and gravel) to depths of up to a maximum of 27 m bgl.

The drift deposits underlying the cable corridor are illustrated in Figure 3.1 Drift Geology Skipsea Road to Burshill. All BGS borehole logs are presented in Appendix B.

Burshill to Routh
Alluvial (approximately 48%) and glaciofluvial deposits (approximately 27%) are mapped from north of Burshill (approximate NGR TA 099 488) to north west of Routh (approximate NGR TA 086435). Till (approximately 25%) is mapped from the edge of the glaciofluvial outcrop to approximate NGR TA 077 418 as shown in Figure 3.1 Drift Geology Burshill to Routh. BGS logs TA04SE36 and TA04SE8 record drift from ground level to a maximum depth of 13.7 m bgl. The drift deposits include peat, peaty clay, sand, gravel and boulder clay.
BGS logs TA04SE68 for Routh Quarry, at approximate NGR TA 089 436 as shown in Figure 3.1 Drift Geology Burshill to Routh records overburden to a maximum depth of 6.5m bgl underlain by sands and gravel to a maximum of 11 m bgl. The depth of borehole at this site was 12 m and as such the total thickness of the superficial deposits was not determined.

The drift deposits underlying the cable corridor are illustrated in Figure 3.1 Drift Geology Burshill to Routh. All BGS borehole logs are presented in Appendix B.

Routh to Woodmansey
The drift deposits comprise predominately till (approximately 45%) with outcrops of alluvial (approximately 53%) and glaciofluvial deposits (approximately 3%). Alluvial deposits outcrop from approximate NGR TA 077 418 to approximate NGR TA 071 408 for approximately 1.2 km (Glaciofluvial deposits limited to north eastern extent) as shown in Figure 3.1 Drift Geology Routh to Woodmansey. Further alluvial deposits outcropping for approximately 1.5 km are located at approximate NGR TA 073 391 to TA 066 379, surrounding the River Hull as shown in Figure 3.1 Drift Geology Routh to Woodmansey. BGS log TA03NE163 record drift deposits in this area to a maximum depth of 8.8m bgl. The BGS logs describe the drift deposits as peat, clay and gravel.

The drift deposits underlying the cable corridor are illustrated in Figure 3.1 Drift Geology Routh to Woodmansey. All BGS borehole logs are presented in Appendix B.

Woodmansey to Creyke Beck substation
The drift deposits mainly comprise outcrops of glaciofluvial deposits (approximately 37%, probably including post-glacial river terrace deposits, sands and gravels). These deposits are shown to outcrop along the majority of the route with the exception of three areas NGR TA 063 379 to TA 058 378; NGR TA 057 376 to TA 055 374 and NGR TA 047 360 to TA 046 353, as shown on Figure 3.1 Drift Geology Woodmansey to Creyke Beck substation where the mapping indicates that till outcrops. Alluvial deposits comprising clay and silt outcrop for a limited distance (approximately 100 m, equating to approximately 3% of this section) in the northern extent of this section as shown on Figure 3.1 Drift Geology Woodmansey to Creyke Beck substation.

The drift deposits underlying the cable corridor are illustrated in Figure 3.1 Drift Geology Woodmansey to Creyke Beck substation. All BGS borehole logs are presented in Appendix B.

Converter Station Study Area
The drift deposits underlying the Converter Station Study Area are shown in Figure 3.1 Drift Geology Woodmansey to Creyke Beck substation. The eastern extent of the study area is shown to be underlain by Glaciofluvial Deposits, probably including post-glacial river terrace deposits, comprising sand and gravel of the Devensian Formation. Where encountered, the Glaciofluvial Deposits are underlain by Glacial Till, described as stony clay. This Glacial Till, outcrops in the west of the Converter Station Study Area and underlies the entire potential study area.

The drift deposits which underlie the cable corridor and Converter Station Study Area are shown in Figure 3.1. Drift Geology Woodmansey to Creyke Beck substation. All BGS borehole logs are presented in Appendix B.
3.2.2 Solid Geology

The entire extent of the cable corridor is underlain by Cretaceous Chalk, as indicated in Figure 3.2. The northern extent of the route is underlain by Rowe Chalk Formation of the Chalk Group. The depth of chalk is estimated to be around 25 m bgl based on the BGS logs in the vicinity of the proposed route (TA16SE29, TA15NE12 and TA15SW5) and is described as soft fissured chalk.

East of Beeford (south of approximate NGR TA 137 542) the underlying Chalk aquifer changes to Flamborough Chalk Formation as shown on Figure 3.2 Bedrock Geology for Landfall to Skipsea Road area. The Flamborough Chalk Formation is described as white flintless chalk with thin marl beds. It is interesting to note that the depth of the top of the chalk decreases as the route continues south. The Flamborough Chalk Formation is found at a depth of approximately 14 m bgl as recorded in BGS logs TA04SE36 and TA04SE8 in the section from Burshill to Routh; whereas it is recorded at a depth of approximately 8 m bgl in the section from Routh to Woodmansey.

The majority of the corridor is underlain by Flamborough Chalk Formation, only the most southerly extent (from approximate NGR TA 046 353) North Moors and Cottingham Parks is underlain by the older Chalk formation, namely Welton and Burnham Chalk Formations, which is described as white flinty chalk with thin marl beds as shown on Figure 3.2 Bedrock Geology for woodmansey to Substation area. All BGS borehole logs are presented in Appendix B.

The Chalk Group is defined by the Environment Agency as a Principal Aquifer; i.e. it is highly productive with regards to groundwater resources and is able to supply large abstractions for public supply and other purposes. In the area of the cable corridor the chalk is confined. As such, the response time of water level fluctuations due to recharge is relatively slow (lags of up to several months). Springs located along the boundary between the confined and unconfined chalk comprise up to 90% of the dry weather flow in the River Hull. Abstraction of groundwater in the area south of Beverley has reduced groundwater levels below ordnance datum and has resulted in saline intrusion from the Humber. Groundwater yields are generally higher in valleys and the maximum yields can be noted at the junction of the confined and unconfined aquifers.

The chemistry of the groundwater from the chalk is dominated by calcium bicarbonate ions and reducing conditions may occur in areas of chalk confined beneath boulder clay.

The direction of groundwater flow is generally towards the coast. However, public water supply abstractions in the area of Cottingham have reduced the Chalk groundwater table locally.

The groundwater potentiometric surface (defined as the height at which the water level would stand if the aquifer was penetrated) is relatively near the ground surface and could be as high as 0 m AOD. The surface water features within the vicinity of the proposed route are likely to have a significant groundwater baseflow component.
3.2.3 Groundwater Abstractions

There are 88 licensed groundwater abstractions within the vicinity of the cable corridor and Converter Station Study Area. There are 21 unlicensed groundwater abstractions for domestic use within the cable corridor as indicated on Figure 4.1. Reference Geology, Water Resources and Land Quality Technical Report, Royal Haskoning, February 2012 for further details of groundwater abstractions.

3.2.4 Surface Water Abstractions

There are 17 surface water abstractions within the vicinity of the cable corridor and Converter Station Study Area. The abstractions are shown in Figure 4.1. Reference Geology, Water Resources and Land Quality Technical Report, Royal Haskoning, February 2012 for further details of surface water abstractions.

3.2.5 Licensed Discharge Consents

The Environment Agency has provided details of eight active discharge consents within the 1 km cable corridor and the 1 km converter stations site buffer. Of these, two are operated by water companies relating to sewage network pumping stations, two are associated with Creyke Beck electricity substation, two apply to domestic properties, one applies to a public house and one to a trade (specific trade type is unrecorded).

3.3 Current and Historical Land Uses

Potentially contaminative current and historical land uses identified within the cable corridor and Converter Station Study Area are summarised below. These are land uses which are considered to have the potential to pose a significant risk to the scheme in terms of land or water quality. Historical and land use mapping, used in this review has been obtained from the Landmark Information Group.

The proposed cable route crosses arable and horticultural land, with small pockets of improved and rough grassland.

There are no designated sites for nature conservation within the cable corridor, with the exception of the Leven Canal which is a designated SSSI. For further information on ecology and nature conservation, reference should be made to the Ecology Desk Study, Peak Ecology (2011).

A site walkover was undertaken by two Royal Haskoning Environmental Consultants on 23rd January 2012. The aim of the walkover was to gain an understanding of the site environs with particular focus on historic landfill sites.

There are no operational or licensed landfill sites within the cable corridor or Converter Station Study Area. However, there are six historical landfills recorded within the cable corridor, four of which are located at Woodmansey Grange. Historical landfill sites are locations where there are records of waste being received to be buried but are now closed or covered. Of these, the proposed cable route passes through one site, namely Woodmansey Grange (Site D) and passes within 10m of Woodmansey Grange (Site B), the four Woodmansey Grange Landfills (A to D) are shown on Figure 6.2 Woodmansey Historical Landfill and proposed Cable Route with Alternative Cable Option. These are reported to have been filled with inert and general industrial waste including agricultural waste, but anecdotal information suggests it is likely to be more inert rubble than chemical waste.
The precise nature of the material used to infill these locations are not known. Therefore, this Made Ground may contain a variety of contaminants depending on the nature of the material. There is potentially a risk associated with the presences of asbestos in these landfills as East Riding of Yorkshire Council’s records indicate that industrial waste was accepted at these sites.

During the walkover, no olfactory or visual evidence of former landfills at Woodmansey B and D locations was noted; however, anecdotal information from the current landowner indicates that waste was formerly buried at these two sites. During excavation works carried out by the land owner, waste, such as bricks have been encountered. The current land uses at Woodmansey B and D comprise a paddock and an arable field.

The other four historic landfill sites at located at distances ranging from 110m to 489m from the route and are therefore not considered to pose significant risk to the route and are therefore not considered further with respect to the route, however given the proximity of one landfill site (Cottingham Dunswell Road), historical landfill sites are considered as a potential source in the Conceptual Site Model as outlined in Section 5. Historic landfill sites are shown on Figure 6.1.

Photographs taken during the walkover are contained in Appendix A.

There are 111 possible landfill sites recorded within the cable corridor, nine of which are reported in the Converter Station Study Area, these include former sand, gravel and chalk pits, former ponds and former drains. Possible landfill sites are locations where the Local Authority believes waste may have been buried, however, no records are currently available. The cable route actually passes through 5 areas reported as possible landfills as indicated in Table 3.2. Possible landfills are also indicated on Figure 6.1.

<table>
<thead>
<tr>
<th>Location</th>
<th>Description</th>
<th>NGR</th>
<th>Cable Route Section</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crow Grange</td>
<td>Possible landfill - drain infilled</td>
<td>TA 137 546</td>
<td>Landfall to Skipsea Road</td>
</tr>
<tr>
<td>Happy Lands Farm</td>
<td>Possible landfill - drain infilled</td>
<td>TA 147 559</td>
<td>Landfall to Skipsea Road</td>
</tr>
<tr>
<td>Hempholme Road</td>
<td>Possible landfill - drain infilled</td>
<td>TA 095 487</td>
<td>Burshill to Routh</td>
</tr>
<tr>
<td>Weel Stone Carr</td>
<td>Possible landfill - drain infilled</td>
<td>TA 071 386</td>
<td>Routh to Woodmansey</td>
</tr>
<tr>
<td>Creyke Beck</td>
<td>Possible landfill - drain infilled</td>
<td>TA 046 349</td>
<td>Woodmansey to Creyke Beck substation</td>
</tr>
</tbody>
</table>

Figure 6.1 shows a summary of the current and historic potentially contaminative land uses. These sites are described in more in the following sections.

3.3.1 Landfall to Skipsea Road

From the landfall to Skipsea Road the cable route passes through a number of fields, Skipsea Drain and crosses a number of small to medium size roads. The current cable route also passes through two infilled drains at Crow Grange and Happy Lands Farm, both reported as possible landfills. As the current cable route passes through / crosses the possible landfills (infilled drains), road and fields (agricultural land) these land uses are considered as a potential source in the Conceptual Site Model as outlined in Section 5.
Land within the cable corridor generally comprises fields, drains, springs, roads and a limited number of residential properties comprising predominately farms. Historical maps show limited development within the cable corridor. Allotment gardens are shown to the south of the cable route from circa 1893 and a lagoon is shown from circa 1976 (NGR TA 143 550).

Within this section one substation has been identified within the cable corridor. As the substation is located in excess of 250m from the cable route it is not considered to pose a significant risk and is therefore not considered further.

One tank is also reported within the cable corridor associated with Ulrome Grange. However as above, the tank is located in excess of 250m from the cable route it is not considered to pose a significant risk and is therefore not considered further.

Current and historical potentially contaminative land uses including the location of the electricity substations and tanks are shown on Figure 6.1 Landfall to Skipsea Road.

3.3.2 Skipsea Road to Burshill

From Skipsea Road to Burshill the route continues to pass predominately through fields / farmland, and cross drains, rivers and roads. A number of rural properties and small villages are also located within the cable corridor. As the current cable route passes through / crosses the drains, roads and fields (agricultural land) these land uses are considered as a potential source in the Conceptual Site Model as outlined in Section 5.

Historical maps show gravel pits north east of Burshill from circa 1855, shown on Figure 6.1 Skipsea Road to Burshill as a chain of possible landfills. Old gravel pits are considered as a potential source in the Conceptual Site Model as outlined in Section 5.

Some potential contaminative land uses including a smithy are shown historically associated with the towns and villages, however, given the distance from the cable route are not considered to pose significant risk.

One tank is shown within the cable corridor associated with Southfield Farm. The tank is located in excess of 250m from the cable route it is not considered to pose a significant risk and is therefore not considered further.

There is a registered sheep dip location point at NGR TA 132 530, approximately 500 m west of the cable route. Although this is a potentially contaminative activity, it is considered unlikely to be a risk to the cable route given that it is downstream of the route and at a significant distance from the route. As such, this is not considered further.

Current and historical potentially contaminative land uses including the location of the electricity substations and tanks are shown on Figure 6.1 Skipsea Road to Burshill.

3.3.3 Burshill to Routh

From Burshill to Routh the route continues to pass predominately through fields / farmland, and cross drains, rivers and roads, including the Level Canal. A number of rural properties and small villages and towns are also located within the cable corridor. The current cable route passes through an infilled drain at Hempholme Road which is recorded as a possible landfill. As the current cable route passes through / crosses the possible landfill (infilled drain), fields (agricultural land), rivers, roads and canal these land uses are considered as a potential sources in the Conceptual Site Model as outlined in Section 5.
Three tanks are shown within the cable corridor one is associated with Heigholme Hall and two are associated with High Farm. However as the tanks are all located in excess of 250m from the cable route they are not considered to pose a significant risk and are therefore not considered further.

Two areas north of Routh are reported as unspecified quarries or mines, and are shown on current mapping as ponds. Located from 40m west of the cable route, these ponds start to appear on historical maps from circa 1999 to present day. Historical maps show a number of sand pits from circa 1892, south of Fox Covert, located within 30m of the cable route. Old pits (including quarries and sand pits) are considered as a potential source in the Conceptual Site Model as outlined in Section 5.

Current and historical potentially contaminative land uses including the location of the electricity sub-stations and tanks are shown on Figure 6.1 Burshill to Routh.

3.3.4 Routh to Woodmansey

From Routh to Woodmansey the route continues to pass predominately through fields / farmland, and cross drains, rivers and roads, including the River Hull and Holderness Drain. The current cable route passes through an infilled drain at Weel Stone Carr which is recorded as a possible landfill. As the current cable route passes through / crosses the possible landfill (infilled drain), fields (agricultural land), rivers and roads they are considered as potential sources in the Conceptual Site Model as outlined in Section 5.

There is a registered sheep dip location point at NGR TA 066 403, approximately 300 m west of the cable route. Although this is a potentially contaminative activity, it is considered unlikely to be a risk to the cable route given that it is downstream of the route and at a significant distance from the route. As such, this is not considered further.

Current and historical potentially contaminative land uses including the location of the electricity sub-stations and tanks are shown on Figure 6.1 Routh to Woodmansey.

3.3.5 Woodmansey to Creyke Beck substation

From Woodmansey to Creyke Beck substation the route continues to pass predominately through fields / farmland, drains, rivers, roads, a railway line and drains, including the Beverley and Barmston Drain. Land within the cable corridor generally comprises fields, drains, springs, roads, a railway line and a limited number of residential properties comprising predominately farms. Historical maps show limited development within the cable corridor. Green house / glass houses shown to the east and west of the cable route from circa 1968/69. As the current cable route passes through / crosses the fields (agricultural land), rivers, drains, roads and a railway line they are considered as potential sources in the Conceptual Site Model as outlined in Section 5.

Old sand pits are shown west of Hampston Hill from circa 1910 and gravel pits are shown north of North Moor from circa 1928, both areas are shown on Figure 6.1 Woodmansey to Creyke Beck substation as possible landfills. Possible landfills are considered as a potential source in the Conceptual Site Model as outlined in Section 5.
As outlined above there are six historical landfills recorded within the cable corridor, of these the cable route passes through one site; Woodmansey Grange (Site D) and passes within 10m of Woodmansey Grange (Site B). Both sites are recorded as accepting inert and general industrial waste from 1985 to 1990 and 1985 to 1986, respectively. The sites are recorded as comprising man-made voids resulting from mineral extraction. The side wall and base geology is reported to comprise alluvium and boulder clay. The sites are reported as having 100% natural containment with a permeable cap. Correspondence with the East Riding of Yorkshire Council indicates that no monitoring data is available for these landfill sites. The cable route also passes through an infilled drain within this section at Creyke Beck, recorded as a possible landfill, which comprises a potential source of contamination. The historic and possible landfills are all indicated on Figure 6.1 Woodmansey to Creyke Beck substation. Historical and possible landfill sites are considered as a potential source in the Conceptual Site Model as outlined in Section 5.

Within this section four substations have been identified within the cable corridor. Two substations are located near Woodmansey approximately 150m and 290m north west of the cable route, respectively. The third substation is located to the south of the cable route at a distance of greater than 250m. Substations located in excess of 250m from the cable route are not considered to pose a significant risk and are therefore not considered further. The forth substation is the National Grid 400kV Creyke Beck substation, located in Cottingham. Substations within 250m on the current cable route are considered as a potential source in the Conceptual Site Model as outlined in Section 5.

Two tanks (generic) are shown within the cable corridor, associated with a nursery. However, as the tanks are both located in excess of 250m from the cable route they are not considered to pose a significant risk and are therefore not considered further.

### 3.3.6 Converter Station Study Area

There are two known historic landfills within 500m of the Converter Station Study Area, namely Cottingham Dunswell Road and Cottingham Dunswell Quarry, located approximately 160m south east and 500m south east respectively. Historical landfill sites within 500m of the Converter Station Study Area are considered as a potential source in the Conceptual Site Model as outlined in Section 5.

There are nine possible landfill sites recorded within the Converter Station Study Area, comprising one old gravel pit, two former ponds and six former drains. In additional there are 16 possible landfill sites recorded in a 500m buffer zone of the Converter Station Study Area, including old sand pits and gravel pits and former ponds and drains. Possible landfill sites and old gravel pits are considered as potential sources in the Conceptual Site Model as outlined in Section 5.

Seven shafts are recorded from 40m south of the Converter Station Study Area. These shafts are associated with Yorkshire Water public water abstractions. Given the location of the shafts and there use for public water abstractions, they are not considered to pose a significant risk and are therefore not considered further.
Four substations have been identified within the 500m buffer zone of the Converter Station Study Area. One is located 100m south east and the remaining two are located in excess of 250m from the study area. The forth substation is National Grid Creyke Beck substation. Substations located in excess of 250m away are not considered to pose a significant risk and are therefore not considered further, however substations within 250m on the current cable route are considered as a potential source in the Conceptual Site Model as outlined in Section 5.

Five tanks are shown within the 500m buffer zone for the Converter Station Study Area. These tanks are associated with farms and nurseries. Two of the tanks are recorded within 250m, one is located approximately 190m north of the Converter Station Study Area and is associated with Model Farm. The other is located approximately 200m east and is associated with a nursery. The remaining tanks are all located in excess of 250m away. Tanks located in excess of 250m away are not considered to pose a significant risk and are therefore not considered further.

Current and historical potentially contaminative land uses including the location of the landfill sites are shown on Figure 6.1 Woodmansey to Creyke Beck substation.

4 SITE WALKOVER

A site walkover was undertaken by two Royal Haskoning Environmental Consultants on 23rd January 2012. The aim of the walkover was to gain an understanding of the site environs with particular focus on historic landfill sites.

The historic landfill sites of concern, which are in the vicinity of the proposed cable route, comprise Woodmansey B and D landfills, as shown on Figure 6.2 Woodmansey Historical Landfill and proposed Cable Route with Alternative Cable Option. During the walkover, no olfactory or visual evidence of former landfills was noted, however, anecdotal information from the current landowner indicates that waste was formerly buried at these two sites, as during excavation works carried out by the land owner, waste, such as bricks have been encountered. The current land uses at Woodmansey B and D comprise a paddock and an arable field.

Photographs taken during the walkover are contained in Appendix A.
5 RESULTS OF DESK STUDY AND SITE WALKOVER

5.1 Conceptual Site Model

In accordance with the Environmental Protection Act 1990, for contaminated land to exist there should be a source of contamination, a receptor where 'significant harm' or 'significant possibility of harm' may be caused or significant pollution of controlled waters is being or is likely to be caused, and a pathway which connects the two. Should any element of this contaminant linkage not be present (or be severed) then the land may not be regarded as contaminated land, as defined in Part 2A of the Environmental Protection Act 1990.

Contamination is described within Part 2A as a substance or substances that can be introduced to the land where they would not normally be. These substances are often associated with industrial processes or activities that have now ceased, but where remnant waste products or residues may present a hazard to the general environment.

In accordance with the above approach, a conceptual model of the site has been produced and a risk assessment undertaken to assess the potential for source-pathway-receptor linkages to occur at the site as a result of the proposed development.

5.2 Sources

Contamination sources can include current land uses and historical activities both on and off the site. For the purpose of this report, to identify potential sources of contamination a 1km buffer zone, known as the cable corridor, has been applied to the proposed cable route. This report covers the cable corridor study area, cable route and Converter Station Study Area.

Historical Landfills - The cable route currently passes through one landfill site namely Woodmansey Grange (Site D) and passes within 10m of Woodmansey Grange (Site B). These are reported to have been filled with inert and general industrial waste including agricultural waste, but anecdotal information suggests it is likely to be more inert rubble than chemical waste. However, the precise nature of the material used to infill these locations are not known. Therefore, this Made Ground may contain a variety of contaminants depending on the nature of the material. There are two known historic landfills within 500m of the Converter Station Study Area, namely Cottingham Dunswell Road and Cottingham Dunswell Quarry, located approximately 160m south east and 500m south east respectively. The precise nature of the material used to infill these locations is not known. Therefore as above, this Made Ground may contain a number of contaminants depending on the nature of the material. Landfills also have the potential to produce landfill leachate and hazardous gases, with the potential to migrate and impact nearby receptors.

Possible Landfills – The cable route passes through five areas reported as possible landfills. These are described as ‘possible landfills – drain infilled’. The precise nature of the materials used to infill these locations is not known. Made Ground used to infill the drains may contain a number of contaminants depending on the source of the material.
Old Pits (gravel and sand) – Gravel and sand pits have been identified at a number of locations within the cable corridor including the Brandesburton pits north of Burshill, areas north of Routh, west of Hampton Hill and north of North Moor. A number of these are recorded as historical landfills or possible landfills (see above); others are now shown as ponds / lakes. Due to the nature of the geology underlying the cable corridor there is the potential for unidentified historical gravel pits to be present which may have subsequently been infilled. The precise nature of the material used to infill these locations is not known. Any Made Ground used to infill these former gravel pits may contain a number of contaminants depending on the source of the material. Backfilled pits also have the potential to produce landfill leachate and hazardous gases, which subsequently have the potential to migrate and impact nearby receptors.

Agricultural land / tanks (generic) – The use of land for farming activities can result in the release of contamination, for example by applications of pesticides, leaks or spills from tanks, farm machinery or from uncontrolled burial of waste materials.

Roads – The cable route crosses a number of A roads, B roads and minor roads. Made Ground may be present associated with the construction of these roads and as such there may be a number of contaminants depending on the source of the material. Run-off may have also caused localised contamination. Potential contaminants associated with roads may contain fuels, oils and antifreeze.

Railways – The Yorkshire Coast Line operated by Northern Rail trends north to south, though Woodmansey through the Converter Station Study Area. Some leakage of fuel oils and lubricants may have occurred from trains using this section of track. The use of herbicides is also common on railways and adjacent land (embankments).

Canal / Drain / Road Embankments - The cable route crosses a number of roads, drains, the Leven Canal and a railway line with associated embankments. Made Ground may be present associated with the construction of these embankments, has the potential to contain a number of contaminants depending on the source of the material.

Electricity substations – Seven electricity substations (including Creyke Beck substation) are reported within the cable corridor and Converter Station Study Area, two of which are within 250m and are therefore considered as potential sources. It is possible that leaks and spills may have occurred at these locations during the operation and repairs of the substations. Any spills or leaks are likely to be small in nature. It is considered that there is limited risk of the presence of mineral oils and polychlorinated biphenyls (PCB) in the soils at these locations.

5.3 Pathways

The potential migration pathways that may be present at the site include:

Permeable ground – The underlying drift geology generally comprises glacial till with outcrops of alluvium and glacial sands and gravels. Alluvial deposits and glacial sands and gravel are relatively permeable in nature these deposits are thought to underlie approximately 42% of the proposed cable route and Converter Station Study Area. There is also the possibility of areas of Made Ground / fill associated with historical gravel pits, embankments etc. to be present within the cable corridor. These permeable drift deposits and Made Ground / fill materials may be of a sufficiently permeable nature to enable migration of contaminants (if present).
Surface Water – Surface water may be directly contaminated by on site activities and enable contaminants, if present, to migrate away or to the site.

Shallow groundwater – It is anticipated that shallow groundwater will be present beneath the site, especially in the Secondary A aquifers (Alluvium and Glaciofluvial deposits). This shallow groundwater may provide a route by which mobile contaminants (if present) can migrate.

Deeper Groundwater – The entire extent of the cable corridor is underlain by Cretaceous Chalk. The Chalk Group is classified as being a Principal Aquifer. The depth of the chalk is estimated to range from 8 - 25m below ground level (bgl) along the proposed route. As the overlying drift deposits are anticipated to be of variable permeability, vertical and lateral migration of contamination (if present) within the deep groundwater cannot be discounted.

Drains and Underground Services (including the buried cable systems proposed as part of this development) – Given the current land uses within the study area including agricultural land, drains, rivers, canals, roads and railways with associated embankments; drains and other underground services are anticipated to be present. Drains and underground services may act as a pathway for migration of any mobile contaminants as a result of leakages or contaminants entering the surrounding fine gravel bedding that the pipes may be laid in.

Direct Contact – Ingestion or physical contact of contaminants that are present at or near the surface.

Inhalation – From airborne particles, ground gases and vapours which may be present on site.

5.4 Receptors

The receptors that may be significantly harmed or polluted by potential contaminative materials (if present) are considered to be:

Human Health (Future Site Users / Land Owners) – Future site users / land owners will only have access to the cable route post construction, therefore, assuming that the soils are placed appropriately during construction works, the risk to human health is not considered to be significant.

Human Health (Construction Workers) – Construction workers are considered to be a sensitive receptor due to the close proximity in which they are required to work with potentially contaminated soils and surface water. However, it is recognised that exposure will be short term only.

Groundwater – Secondary A Aquifer (Alluvium and Glaciofluvial Deposits) and a Principal Aquifer (the Chalk) are present beneath the cable route, therefore, ground waters are considered to be of high sensitivity.

Surface Waters – A number of surface water bodies, including the Leven Canal, River Hull, Beverley and Barmston Drain as well as many smaller drains have been identified throughout the cable corridor, therefore, surface waters are considered to be of high sensitivity.
Ecological Receptors (i.e fauna and flora) – The Leven Canal is a designated SSSI, therefore, this receptor is considered to be a sensitive receptor.

Buildings, Structures and Construction Materials – The cable and associated infrastructure are considered to be moderately sensitive receptors.

5.5 Environmental Risk Assessment

5.5.1 Terminology

The risk evaluation methodology is a qualitative assessment and is based on CIRIA C552 ‘Contaminated Land Risk Assessment’, London 2001. The process involves the classification of the following:

- The magnitude of the potential consequence, which takes into account both the potential severity of the hazard and the sensitivity of the receptor; and

- The magnitude of the probability (likelihood) which takes into account both the presence of the hazard and the receptor and the integrity of the pathway.

The resultant risk categories are shown in Table 5.1.

<table>
<thead>
<tr>
<th>Probability</th>
<th>Consequence</th>
<th>Severe</th>
<th>Medium</th>
<th>Mild</th>
<th>Minor</th>
</tr>
</thead>
<tbody>
<tr>
<td>High Likelihood</td>
<td>Very High Risk</td>
<td>High Risk</td>
<td>Moderate Risk</td>
<td>Moderate / Low Risk</td>
<td></td>
</tr>
<tr>
<td>Likely</td>
<td>High Risk</td>
<td>Moderate Risk</td>
<td>Moderate / Low Risk</td>
<td>Low Risk</td>
<td></td>
</tr>
<tr>
<td>Low Likelihood</td>
<td>Moderate Risk</td>
<td>Moderate / Low Risk</td>
<td>Low Risk</td>
<td>Very Low Risk</td>
<td></td>
</tr>
<tr>
<td>Unlikely</td>
<td>Moderate / Low Risk</td>
<td>Low Risk</td>
<td>Very Low Risk</td>
<td>Very Low Risk</td>
<td></td>
</tr>
</tbody>
</table>

Within this assessment the terminology presented in Table 5.2 has been adopted.
### Table 5.2 Contamination Risk Rating Terminology

<table>
<thead>
<tr>
<th>Risk rating</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Very High Risk</td>
<td>There is a high probability that severe harm could arise to a designated receptor from an identified hazard or there is evidence that severe harm to a designated receptor is currently happening. The risk, if realised is likely to result in a substantial liability. Urgent investigation (if not undertaken already) and remediation are likely to be required</td>
</tr>
<tr>
<td>High Risk</td>
<td>Harm is likely to arise to a designated receptor from an identified hazard. Realisation of the risk is likely to present a substantial liability. Urgent investigation (if not undertaken already) is required and remedial works may be necessary in the short term and are likely over the longer term</td>
</tr>
<tr>
<td>Moderate Risk</td>
<td>It is possible that, harm could arise to a designated receptor from an identified hazard. However it is either relatively unlikely that any such harm would be severe, or if any harm were to occur, it is more likely that the harm would be relatively mild. Investigation (if not already undertaken) is normally required to clarify the risk and to determine the potential liability. Some remedial works may be required in the longer term</td>
</tr>
<tr>
<td>Low Risk</td>
<td>It is possible that harm could arise to a designated receptor from an identified hazard but it is likely that at worst this harm if realised would at worst normally be mild</td>
</tr>
<tr>
<td>Very Low Risk</td>
<td>There is a low probability that harm could arise to a receptor, in the event of such being realised it is not likely to be severe</td>
</tr>
</tbody>
</table>

#### 5.5.2 Assessment

Through the review of historic and current environmental information, and the development of the conceptual site model (source, pathway and receptor contaminant linkage model), the following risks have been identified in relation to the land uses within the cable route and Converter Station Study Area and proposed construction and operation.
### Table 5.3 Summary of Potential Pollutant Linkages

<table>
<thead>
<tr>
<th>Receptor</th>
<th>Risk</th>
<th>Comment / Linkage</th>
<th>Potential Mitigation Measures</th>
<th>Revised Risk Rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>Human Health (Future Site Users / Land Owners)</td>
<td>Moderate / Low Risk</td>
<td>The future site users and land owners may come into contact with potentially contaminated soil following construction; however, any contact is considered to be short term. There are two known historic landfills within 500 m of the Converter Station Study Area. The precise nature of the material in the landfill sites is not known, landfills have the potential to generate hazardous gas which may migrate via permeable strata and accumulate in confined spaces and/or buildings.</td>
<td>Ensuring the material for backfilling around the cable is suitable for use as per the Contaminated Land: Applications in Real Environments (CL:AIRE) Development Industry Code of Practice. The converter stations should be sited to the north of the A1079, this will significantly reduce the potential risk to future site users, with respect to the historical landfill sites located to the south, south east and associated gas risk. In addition all buildings/ foundations with confined spaces should be designed and built with gas venting and/or protection measures, where applicable in-line with building regulations.</td>
<td>Low Risk</td>
</tr>
</tbody>
</table>
| Human Health (Construction Workers) | Moderate Risk | The majority of the cable route passes through agricultural land which is considered to present a low risk to the health and safety of construction workers. The current cable route also passes through one landfill site and in close proximity to a second. There are also two known historic landfills within 500 m of the Converter Station Study Area. The precise nature of the material in the landfill sites is not known. Made Ground may contain a number of contaminants depending on the source of the material. The route passes through five areas reported as possible landfills, in addition there are nine possible landfill sites recorded within the Converter Station Study Area. The precise nature of the material in the possible landfill sites is not known. Made Ground used to infill the drains may contain a number of contaminants depending on the source. | The cable route should avoid, where possible, passing through Woodmansey Grange landfills (Sites A - D). This will significantly reduce the potential risk to construction workers. Due to the proximity of the adjacent landfill, it is recommended that prior to the commencement of construction a method statement is prepared which identifies the procedures to be followed should previously unidentified contamination be encountered. Typical measures may include:  
- Assessment of risk of contamination; and  
- Determination of appropriate Personal Protective Equipment (PPE) and mitigation measure to be incorporated in the construction phase. Alternatively the potential risks could be reduced by incorporating mitigation measures within the design i.e. lining the trench, disposal of waste materials, use of clean backfill and incorporation of bentonite plugs to prevent preferential pathways in the vicinity of the landfill. | Low Risk |
The cable route also crosses a number of roads and drains some with associated embankments. Made Ground may be present associated with the construction of these roads and/or embankments and as such there may be a number of contaminants present depending on the nature of the material used. Run-off may have also caused localised point source contamination. Potential contaminants associated with roads include fuels, oils and antifreeze.

Seven electricity substations are reported within the cable corridor and Converter Station Study Area, two of which are within 250 m and are therefore considered as potential sources. It is possible that leaks and spills may have occurred at these locations during the operation and repairs of the substations. Any spills or leaks are likely to be small in nature given the size of the substations. It is considered that there is limited risk of the presence of mineral oils and polychlorinated biphenyls (PCB) in the soils at these locations. The risk from this potential source is considered to be low.

During the construction phase, site workers will be in close/direct contact with the soils and groundwater at the site, for a relatively short length of time.

It is understood that the cable route will be constructed utilising HDD techniques under major crossings including the River Hull, Leven Canal and the railway line. The implementation of this technique will reduce the potential likelihood of risk to construction workers from Made Ground in embankments and subsequently the overall risk rating.

The converter stations should be sited to the north of the A1079, this will significantly reduce the potential risk to construction workers, with respect to the historical landfill sites located to the south, south east and associated gas risk.

If any visual or olfactory evidence of contamination is identified during the construction phase, work should stop immediately, materials stockpiled separately and a qualified Environmental Consultant contacted.

Special care should be taken in areas identified as possible landfills and areas adjacent to roads, drains etc. where embankments are present or point source contamination may have occurred (e.g. run-off from roads).

Appropriate Personal Protective Equipment (PPE) should be worn by construction workers and health and safety measures undertaken to mitigate any short term risk during construction.

<table>
<thead>
<tr>
<th>Receptor</th>
<th>Risk</th>
<th>Comment / Linkage</th>
<th>Potential Mitigation Measures</th>
<th>Revised Risk Rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>Groundwater</td>
<td>Moderate Risk</td>
<td>Secondary A Aquifer (Alluvium and Glaciofluvial Deposits) are present beneath parts of the cable route. The cable route passes through one landfill site and in close</td>
<td>It is understood that the cable route will be constructed utilising HDD techniques under major crossings including the River Hull, Leven Canal and the railway line. The implementation of this technique will reduce the potential likelihood of risk to construction workers from Made Ground in embankments and subsequently the overall risk rating. The converter stations should be sited to the north of the A1079, this will significantly reduce the potential risk to construction workers, with respect to the historical landfill sites located to the south, south east and associated gas risk. If any visual or olfactory evidence of contamination is identified during the construction phase, work should stop immediately, materials stockpiled separately and a qualified Environmental Consultant contacted. Special care should be taken in areas identified as possible landfills and areas adjacent to roads, drains etc. where embankments are present or point source contamination may have occurred (e.g. run-off from roads). Appropriate Personal Protective Equipment (PPE) should be worn by construction workers and health and safety measures undertaken to mitigate any short term risk during construction.</td>
<td>Low Risk</td>
</tr>
</tbody>
</table>

The cable route must avoid, where possible, passing through Woodmansey Grange landfills (Sites A - D). This will significantly reduce the potential risk to the underlying Secondary A Aquifer. Due to the proximity of the adjacent
<table>
<thead>
<tr>
<th>Receptor</th>
<th>Risk</th>
<th>Comment / Linkage</th>
<th>Potential Mitigation Measures</th>
<th>Revised Risk Rating</th>
</tr>
</thead>
</table>
|          |               | and Glaciofluvial Deposits). The precise nature of the material in the landfill sites is not known. Made Ground may contain a number of contaminants depending on the source of the material. The two historic landfill sites are located on Secondary A Aquifer, therefore, there is a risk that a pollutant linkage may arise if excavation is undertaken through the historic landfill sites. | Landfill, it is recommended that prior to the commencement of construction a method statement is prepared which identifies the procedures to be followed should previously unidentified contamination be encountered. Typical measures may include:  
* Assessment of risk of contamination; and  
* Determination of appropriate Personal Protective Equipment (PPE) and mitigation measure to be incorporated in the construction phase.  
Alternatively the potential risks could be reduced by incorporating mitigation measures within the design i.e. lining the trench, disposal of waste materials, use of clean backfill and incorporation of bentonite plugs to prevent preferential pathways in the vicinity of the landfill.  
Adherence to Pollution Prevention Guidance documents and Best Practice.  
Position the contractor’s compound areas away from surface water features.  
Storage of potentially contaminative materials in appropriately bunded areas.  
Where earthworks are undertaken, soil and water should be managed with sufficient care to prevent surface water run-off. | Low Risk                                                      |
<p>| Groundwater Principal Aquifer (Cretaceous Chalk). | High Risk       | Principal Aquifers (Chalk) are present beneath the whole of the cable route and Converter Station Study Area. Drinking Water Abstractions are present in the cable corridor. The current cable route passes through one landfill site and in close proximity to a second. The precise nature of the material in the landfill sites is not known. Made Ground may | The cable route should avoid, where possible, passing through Woodmansey Grange landfills (Sites A - D). This will significantly reduce the potential risk to the underlying Principal Aquifer. Due to the proximity of the adjacent landfill, it is recommended that prior to the commencement of construction a method statement is prepared which identifies the procedures | Low Risk                                                      |</p>
<table>
<thead>
<tr>
<th>Receptor</th>
<th>Risk</th>
<th>Comment / Linkage</th>
<th>Potential Mitigation Measures</th>
<th>Revised Risk Rating</th>
</tr>
</thead>
</table>
|                  | Moderate / Low risk| contain a number of contaminants depending on the source of the material. Cretaceous Chalk underlies the two landfill sites, therefore, there is a risk that a pollutant linkage may arise if excavation is undertaken through the historic landfill sites. | to be followed should previously unidentified contamination be encountered. Typical measures may include:  
• Assessment of risk of contamination; and  
• Determination of appropriate Personal Protective Equipment (PPE) and mitigation measure to be incorporated in the construction phase.  
Alternatively the potential risks could be reduced by incorporating mitigation measures within the design i.e. lining the trench, disposal of waste materials, use of clean backfill and incorporation of bentonite plugs to prevent preferential pathways in the vicinity of the landfill.  
Adherence to Pollution Prevention Guidance and Best Practice.  
Position contractor’s compound areas away from surface water features.  
Storage of potentially contaminate materials in appropriately bunded areas.  
Where earthworks are undertaken, soil and water should be managed with sufficient care to prevent surface water run-off. | Low Risk |
| Surface Waters   |                    | A number of surface water bodies have been identified throughout the cable corridor and Converter Station Study Area. Surface waters may be directly contaminated by on site activities and enable contaminants, if present, to migrate away or to the site.  
The cable route passes through one landfill site and in close proximity to a second. The precise nature of the material in the landfill sites is not known. Made Ground may contain a | The cable route should avoid, where possible, passing through Woodmansey Grange landfills (Sites A - D). This will remove the risk to the adjacent Beverley and Barmston Drain. Due to the proximity of the adjacent landfill, it is recommended that prior to the commencement of construction a method statement is prepared which identifies the procedures to be followed should previously unidentified contamination be encountered. Typical measures may include:  
• Assessment of risk of contamination; | Low Risk |
<table>
<thead>
<tr>
<th>Receptor</th>
<th>Risk</th>
<th>Comment / Linkage</th>
<th>Potential Mitigation Measures</th>
<th>Revised Risk Rating</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Number of contaminants depending on the source of the material. Woodmansey Grange Site D is located immediately adjacent to the Beverley and Barmston Drain, as such any excavation may result in a pollutant linkage and impact to the surface water receptor.</td>
<td>• Determination of appropriate Personal Protective Equipment (PPE) and mitigation measure to be incorporated in the construction phase; and Alternatively the potential risks could be reduced by incorporating mitigation measures within the design i.e. lining the trench, disposal of waste materials, use of clean backfill and incorporation of bentonite plugs to prevent preferential pathways in the vicinity of the landfill. Adherence to Pollution Prevention Guidance and Best Practice. Position contractor’s compound areas away from surface water features. Storage of potentially contaminate materials in appropriately bunded areas. Where earthworks are undertaken, soil and water should be managed with sufficient care to prevent surface water run-off. All discharges should be made with prior consent from the water utility company or the EA as appropriate.</td>
<td></td>
</tr>
<tr>
<td>Ecological Receptors (i.e fauna and flora)</td>
<td>Moderate Risk</td>
<td>The Leven Canal is designated as a SSSI. Soils on site are not expected to be contaminated. However, if earthworks are undertaken, care will be needed to manage spoil and water to ensure that there is no impact on surface water flowing into local watercourses.</td>
<td>It is understood that the cable route will be constructed utilising HDD techniques under the Leven Canal (SSSI). It is considered that the implementation of this technique will reduce the potential likelihood of a pollution event and subsequently the overall risk rating. Hydrophilic grout should be used to reduce the likelihood of pollution.  Adherence to Pollution Prevention Guidance and best practice.</td>
<td>Low Risk</td>
</tr>
<tr>
<td>Receptor</td>
<td>Risk</td>
<td>Comment / Linkage</td>
<td>Potential Mitigation Measures</td>
<td>Revised Risk Rating</td>
</tr>
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<td>------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
<td>--------------------</td>
</tr>
<tr>
<td>Buildings, Structures and Construction Materials</td>
<td>Moderate / Low Risk</td>
<td>Historical evidence does not suggest the presence of land uses that could have resulted in extensive contamination and generation of aggressive soil conditions. However there are two known historic landfills within 500 m of the Converter Station Study Area. The precise nature of the material in the landfill sites is not known, landfills have the potential to generate hazardous gas which may migrate via permeable strata and accumulate in confined spaces and/or buildings.</td>
<td>Appropriate construction materials should be used to account for any aggressive ground conditions. The converter stations should be sited to the north of the A1079, this will significantly reduce the potential risk to structures, with respect to the historical landfill sites located to the south, south east and associated gas risk. In addition all buildings/ foundations with confined spaces should be designed and built with gas venting and/or protection measures, where applicable in-line with building regulations.</td>
<td>Low Risk</td>
</tr>
</tbody>
</table>
CONCLUSIONS AND RECOMMENDATIONS

6.1 Conclusions

A desk-based assessment of contamination risks has been undertaken by Royal Haskoning on behalf of Forewind ('the Client') in order to support an EIA for Dogger Bank Creyke Beck. This included a review of desk based sources, a site walkover specifically aimed at historical and possible landfill sites, production of a conceptual site model, and risk assessment undertaken to assess the potential for the source-pathway-receptor linkage to occur at the site as a result of the proposed development.

For the purpose of this report, in order to identify potential sources of contamination, a 1km buffer zone, known as the cable corridor has been applied to the proposed cable route. The cable corridor, cable route and Converter Station Study Area are shown on Figure 1.1. A number of localised potential sources of contamination have been identified within the cable corridor and Converter Station Study Area. These are principally associated with areas of quarrying, landfilling and transportation links including, roads a canal, and a railway.

Potential sources identified include:

- **Historical Landfills** - The cable route currently passes through one landfill site namely Woodmansey Grange (Site D) and passes within 10m of Woodmansey Grange (Site B). There are also two known historic landfills within 500m of the Converter Station Study Area.

- **Possible Landfills** – The cable route passes through five areas reported as possible landfills, in addition there are nine possible landfill sites recorded within the Converter Station Study Area.

- **Old Pits** - Old pits (sand and gravel) have been identified at a number of locations within the cable corridor. A number of these are recorded as historical landfills or possible landfills (see above); others are now shown as ponds / lakes.

- **Transportation links (Roads / Railways / Canals)** - The cable route crosses a number of A roads, B roads, minor roads, the Yorkshire Coast railway line and the Leven Canal, some with associated embankments.

- **Electricity substations** – Seven electricity substations (including Creyke Beck substation) are reported within the cable corridor and Converter Station Study Area, two of which are within 250m of the Converter Station Study Area.

- **Agricultural land / tanks (generic)** – The majority of the cable route passes through agricultural land which although considered to present a potential source of contamination, the overall risk is considered to be very low.

Within the cable route, the gas risk to human health / structures is considered very low as there will be no confined spaces within which gases may accumulate and into which human entry will be possible. All access within this area will be to cables and trenches exposed to atmospheric conditions. However as part of the overall development, a number of confined spaces into which human entry will be possible and required will be present within the future buildings in the Converter Station Study Area. As there are two known historic landfills within 500m of the Converter Station Study Area and given the precise nature of the material in the landfill sites is not known, the landfills have the potential to generate hazardous gas which may migrate via permeable strata and accumulate in confined spaces and / or buildings on site.
It is recommended that the converter stations should be sited to the north of the A1079, since this will significantly reduce the potential risk to future site users and buildings / structure. In addition all buildings / foundations with confined spaces should be designed and built with gas venting measures as a precautionary measure, where applicable in-line with building regulations.

Gas risks should be further considered for all construction workers whenever there is a requirement to enter confined spaces as part of the construction works, this should be managed through the Construction Phase Health and Safety Plan.

Prior to implementation of any mitigation measures, the greatest risks are associated with groundwater (both Secondary A and Principal Aquifers) and the health and safety of construction workers. However, following implementation of mitigation measures all risks have been assessed as being low.

The cable route currently passes through one landfill site, namely Woodmansey Grange Site D. The current risk to controlled waters, and health and safety of construction workers is considered to be significant. As such it is recommended that the cable route is re-aligned to avoid passing through this landfill site. Alternatively the potential risks could be reduced by incorporating mitigation measures within the design i.e. lining the trench, disposal of waste materials, use of clean backfill and incorporation of bentonite plugs to prevent preferential pathways in the vicinity of the landfill.

Based on the information reviewed, it is not expected that soils within the cable route or Converter Station Study Area will be highly contaminated, however a number of sources have been identified and merit further consideration for the avoidance of doubt (see Section 6.2).

### 6.2 Recommendations

Recommendations for managing risks associated with land quality and materials management are presented in Table 6.1.
<table>
<thead>
<tr>
<th>Aspect of Scheme</th>
<th>Concern</th>
<th>Recommendation</th>
<th>Potential costs and benefits to the scheme</th>
</tr>
</thead>
</table>
| Construction Phase Health and Safety - potential exposure of construction workers to contaminants in soil or water and gas risk including but not limited to confined spaces. | Compliance with Health and Safety Legislation including the Health and Safety at Work Act 1974 and Construction (Design & Management) Regulations 2007 | • The cable route should be moved to avoid passing through Woodmansey landfill (site D) and avoid (site B). This will significantly reduce the potential risk to construction workers. Alternatively the potential risks could be reduced by incorporating mitigation measures within the design i.e. lining the trench, disposal of waste materials, use of clean backfill and incorporation of bentonite plugs to prevent preferential pathways in the vicinity of the landfill.  
• The converter stations should be sited to the north of the A1079, this will significantly reduce the potential risk to construction workers, with respect the historical landfill sites located to the south, south east and associated gas risk.  
• Good site practice and hygiene in addition to the use of appropriate Personal Protective Equipment (PPE) and Respiratory Protective Equipment (RPE), where necessary.  
• Method statements and risk assessments should be developed for all site works to aid identification of such risks and appropriate risk avoidance and reduction measures. The works should be undertaken in accordance with the requirements of the Construction (Design & Management) Regulations 2007 where appropriate. | Current Route  
• Site investigation is recommended in the areas identified as landfills, this will incur additional costs and additional mitigation measures may be required.  
• Costs for provision of PPE, RPE if necessary and for production of method statements and risk assessments.  
• Benefits of compliance with legislation. |
| Re-aligned Route | Compliance with the CL-AIRE Code of Practice entitled ‘The definition of waste: Development Industry Code of Practice’. | • Re-alignment will avoid historic landfill sites Woodmansey D and B. This will negate the need for detailed site investigations, and minimise the mitigation measures, resulting in cost savings.  
• Costs for provision of PPE, RPE if necessary and for production of method statements and risk assessments.  
• Benefits of compliance with legislation. |  
| Materials Reuse | Complete a Materials Reuse Risk Assessment.  
• Use the results of the Materials Reuse Risk Assessment to complete a Materials Management Plan.  
• Complete a Site Waste Management Plan. | • Benefits in avoiding the need to dispose of material which is suitable for reuse.  
• Benefits in avoiding the need for applications for Environmental Permits or Exemptions. |  

*Current Route*

- Site investigation is recommended in the areas identified as landfills, this will incur additional costs and additional mitigation measures may be required.
- Costs for provision of PPE, RPE if necessary and for production of method statements and risk assessments.
- Benefits of compliance with legislation.

*Re-aligned Route*

- Re-alignment will avoid historic landfill sites Woodmansey D and B. This will negate the need for detailed site investigations, and minimise the mitigation measures, resulting in cost savings.
- Costs for provision of PPE, RPE if necessary and for production of method statements and risk assessments.
- Benefits of compliance with legislation.
<table>
<thead>
<tr>
<th>Aspect of Scheme</th>
<th>Concern</th>
<th>Recommendation</th>
<th>Potential costs and benefits to the scheme</th>
</tr>
</thead>
</table>
| Disposal of unsuitable materials and importation of clean fill | Compliance with waste management legislation including the Landfill Regulations 2002 (as amended) and the Hazardous Waste Regulations 2005 | • Characterisation of any material excavated and disposal off site of any materials demonstrated not to be suitable for reuse.  
• Pre-treatment prior to disposal to either reduce the volume of hazardous waste requiring disposal or to reduce the hazardous nature of the material.  
• Testing and verification of any soils imported to the site to ensure that they do not pose a risk to human health or controlled waters. They will also need to be accompanied by all relevant Duty of Care documentation. | • Possible costs for completion of waste characterisation if any soil arisings are proven to be unsuitable for reuse.  
• Benefits of compliance with legislation. |
| Control of groundwater. Potential for environmentally damaging materials or fuels to pollute controlled waters (surface water and groundwater) during construction phase. | Best practice for construction site management. Avoidance of pollution incidents. | • If dewatering of excavations is undertaken as part of the proposed scheme these should be contained and disposed of appropriately.  
• Best practice guidance should be followed (for example, Pollution Prevention Guidance Note (PPG) 5: Works in, near or liable to affect watercourses and PPG6: Working at construction and demolition sites). | • Possible need to supply containment of groundwater and obtain consent to discharge to foul sewer or send for appropriate off-site disposal.  
• Preparation of a method statement prior to construction, identifying the procedures to be followed should previously unidentified contamination be encountered. This should include seeking professional advice from a suitably qualified environmental consultant.  
• The benefits of implementation of the above mitigation comprise ensuring prevention of pollution to groundwater and surface water, specifically protection of Secondary A and Principal Aquifers, drinking water supplies and other sensitive receptors. |
Figures
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Figure 1.1

Converter Station Study Area
Proposed Onshore Cable Route
Proposed Onshore Cable Corridor (1km)
Creyke Beck Substation
Creyke Beck Substation extension area
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Figure 3.1a

DOGGER BANK CREYKE BECK

superficial geology

- Alluvium
- Beach Deposits
- Glaciofluvial Deposits, Devensian
- Head
- Lacustrine Deposits
- Marine Deposits
- Sand and Gravel of Uncertain Age and Origin
- Tidal Flat Deposits
- Till, Devensian

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Regionally Important Geological Sites (RIGS)
- Barmston Mere nr Skipsea
- Skipsea Bail Mere
- Skipsea Low Mere

Legend
- Proposed Onshore Cable Route
- Proposed Onshore Cable Corridor (1km)
- BGS Borehole Logs

PROJECT TITLE: DOGGER BANK CREYKE BECK
DRAWING TITLE: 9W0421/Phase1/3.1a
DRAWING NUMBER: 9W0421/Phase1/3.1a

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A4 A3 OSGB36

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**Figure 3.1b**

**Legend**
- **Proposed Onshore Cable Route**
- **Proposed Onshore Cable Corridor (1km)**
- **BGS Borehole Logs**

**Regionally Important Geological Sites (RIGS)**
- Barmston Mere nr Skipsea
- Skipsea Bail Mere
- Skipsea Low Mere

**Superficial Geology**
- Alluvium
- Beach Deposits
- Glacioluvial Deposits, Devensian
- Head
- Lacustrine Deposits
- Marine Deposits
- Sand and Gravel of Uncertain Age and Origin
- Tidal Flat Deposits
- Till, Devensian

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- DOGGER BANK CREYKE BECK

**DRAWING NUMBER**
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**Scale**
- 1:40,000

**DATUM**
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**PROJECTION**
- BNG

**SUPERFICIAL GEOLOGY**

**REPORTED BY**
- MCG

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**DATE**
- 20/08/2012

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**CHECKED**
- JA
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**DRAWING TITLE**

**PROJECT TITLE**

**DRAWING NUMBER:** 9W0421/Phase1/3.1d

**VER** | **DATE** | **REMARKS** | **Drawn** | **Checked**
---|---|---|---|---

**DATUM PROJECTION**

**SCALE PLOT SIZE**

**Legend**

- **Proposed Onshore Cable Route**
- **Proposed Onshore Cable Corridor (1km)**
- **BGS Borehole Logs**
- **Regionally Important Geological Sites (RIGS)**
  - Barmston Mere nr Skipsea
  - Skipsea Bail Mere
  - Skipsea Low Mere

**Superficial Geology**

- **Alluvium**
- **Beach Deposits**
- **Glaciofluvial Deposits, Devensian**
- **Head**
- **Lacustrine Deposits**
- **Marine Deposits**
- **Sand and Gravel of Uncertain Age and Origin**
- **Tidal Flat Deposits**
- **Till, Devensian**

**Figure 3.1d**
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Figure 3.1e

Legend
- Converter Station Study Area
- Proposed Onshore Cable Route
- Proposed Onshore Cable Corridor (1km)
- Creyke Beck Substation
- Creyke Beck substation extension area
- BGS Borehole Logs

Regionally Important Geological Sites (RIGS)
- Barmston Mere nr Skipsea
- Skipsea Bail Mere
- Skipsea Low Mere

Superficial Geology
- Alluvium
- Beach Deposits
- Glaciofluvial Deposits, Devensian
- Head
- Lacustrine Deposits
- Marine Deposits
- Sand and Gravel of Uncertain Age and Origin
- Tidal Flat Deposits
- TL, Devensian

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DRAWING NUMBER: 9W0421/Phase1/3.1e

Superficial Geology: Alluvium, Beach Deposits, Glaciofluvial Deposits, Devensian, Head, Lacustrine Deposits, Marine Deposits, Sand and Gravel of Uncertain Age and Origin, Tidal Flat Deposits, TL, Devensian

Converter Station Study Area, Proposed Onshore Cable Route, Proposed Onshore Cable Corridor (1km), Creyke Beck Substation, Creyke Beck substation extension area, BGS Borehole Logs
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The diagram shows the Bedrock Geology in the proposed area, including:
- Rowe Chalk Formation
- Flamborough Chalk Formation
- Welton and Burnham Chalk Formation

Regionally Important Geological Sites (RIGS) include:
- Barmston Mere nr Skipsea
- Skipsea Bail Mere
- Skipsea Low Mere


Figure 3.2b
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**Figure 3.2c**

**Legend**
- Proposed Onshore Cable Route
- Proposed Onshore Cable Corridor (1km)
- Regionally Important Geological Sites (RIGS)
  - Barmston Mere nr Skipsea
  - Skipsea Bail Mere
  - Skipsea Low Mere
- Bedrock Geology
  - Rowe Chalk Formation
  - Flamborough Chalk Formation
  - Welton and Burnham Chalk Formation

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**DRAWING NUMBER:** 9W0421/Phase1/3.2c

**REMARKS**
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**PROJECT TITLE:**

**DRAWN:** MCG

**DATE:** 20/08/2012

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Figure 3.2d

Legend

- Proposed Onshore Cable Route
- Proposed Onshore Cable Corridor (1km)
- Regionally Important Geological Sites (RIGS)
  - Barmston Mere nr Skipsea
  - Skipsea Bail Mere
  - Skipsea Low Mere

Bedrock Geology
- Rowe Chalk Formation
- Flamborough Chalk Formation
- Welton and Burnham Chalk Formation

Date Source:
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DATUM PROJECTION SCALE PLOT SIZE

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Figure 3.2d

Project Title
DOGGER BANK CREYKE BECK

Drawing Title

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Figure 3.2e

**LEGEND**
- Converter Station Study Area
- Proposed Onshore Cable Route
- Proposed Onshore Cable Corridor (1km)
- Creyke Beck Substation
- Creyke Beck substation extension area
- Regionally Important Geological Sites (RIGS)
  - Barmston Mere nr Skipsea
  - Skipsea Bail Mere
  - Skipsea Low Mere
- **BEDROCK GEOLOGY**
  - Rowe Chalk Formation
  - Flamborough Chalk Formation
  - Welton and Burnham Chalk Formation

**Data Source:**
Ordnance Survey © Crown copyright and database right, 2012
British Geological Society © copyright, 2012

**DRAWING NUMBER:**
9W0421/Phase1/3.2e

**PROJECT TITLE:**
DOGGER BANK CREYKE BECK

**DRAWING TITLE:**

**DATE:**
20/08/2012

**REMARKS:**
Checked

**DRAFTS:***
MCG

**SCALE:**
1:40,000

**PROJECTION:**
OSGB36

**UNIT:**
NGR

**NOTE:**
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Figure 4.1a

Legend

- Proposed Onshore Cable Route
- Proposed Onshore Cable Corridor (1km)
- Groundwater Level Boundaries
- Surface Water Quality Sampling Locations
- Groundwater Quality Sampling Locations
- Discharge Consents (numbered 1-11)

Licensed Abstractions

- Groundwater
- Surface Water
- Yorkshire Water - Groundwater
- Yorkshire Water - Surface Water
- Private Water Supplies (Groundwater)

Groundwater Source Protection Zones

- Inner Zone
- Outer Zone
- Total Catchment

Data Source:
Ordnance Survey © Crown copyright and database right, 2012

Drawn
MCG

Check
JA

PROJECT TITLE
DOGGER BANK CREYKE BECK

DRAWING TITLE

DRAWING NUMBER:
9W0421/Phase1/4.1a

Scale:
1:40,000
Datum:
OSGB36
Units:
Meters (M)

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Figure 4.1a
Figure 4.1c

Groundwater and Surface Water

Licensed Abstractions
- Groundwater
- Surface Water
- Yorkshire Water - Groundwater
- Yorkshire Water - Surface Water
- Private Water Supplies (Groundwater)

Groundwater Source Protection Zones
- Inner Zone
- Outer Zone
- Total Catchment

Data Source:
- Ordnance Survey © Crown copyright and database right, 2012

Legend

Proposed Onshore Cable Route
Proposed Onshore Cable Corridor (1km)
Groundwater Level Boreholes
Surface Water Quality Sampling Locations
Groundwater Quality Sampling Locations
Discharge Consents (numbered 1-11)
Sampling Sites

Drawn
MCG
JAJ

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**Figure 4.1d**

**Drawing Title:** DOGGER BANK CREYKE BECK

**Legend**

- **Proposed Onshore Cable Route**
- **Proposed Onshore Cable Corridor (1km)**
- **Groundwater Level Branched Lines**
- **Surface Water Quality Sampling Locations**
- **Groundwater Quality Sampling Locations**
- **Discharge Consents (numbered 1-11)**

**Datum:** Ordnance Survey © Crown copyright and database right, 2012

**Groundwater Source Protection Zones:** Environment Agency, 2011

**Private Water Supplies (Groundwater):**

**Licensed Abstractions:**

- Groundwater
- Surface Water
- Yorkshire Water - Groundwater
- Yorkshire Water - Surface Water
- Private Water Supplies (Groundwater)

**Groundwater Source Protection Zones:**

- Inner Zone
- Outer Zone
- Total Catchment

**Data Source:**

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**Drawn:** MCG

**Checked:** JA

**Scale:** 1:40,000

**Projection:** OSGB36

**Plot Size:** S90x40
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DOGGER BANK CREYKE BECK

Figure 4.1e

Legend

- Converter Station Study Area
- Proposed Onshore Cable Route
- Proposed Onshore Cable Corridor (20km)
- Creyke Beck Substation
- Creyke Beck substation extension area
- Groundwater Level Boundaries
- Surface Water Quality Sampling Locations
- Groundwater Quality Sampling Locations

Licensed Abstractions
- Groundwater
- Surface Water
- Yorkshire Water - Groundwater
- Yorkshire Water - Surface Water
- Private Water Supplies (Groundwater)

Groundwater Source Protection Zones
- Inner Zone
- Outer Zone
- Total Catchment

Data Source:
- Ordnance Survey © Crown copyright and database right, 2012
- Yorkshire Water - Groundwater
- Yorkshire Water - Surface Water
- Private Water Supplies (Groundwater)

BNGOSGB36A4 1:40,000 DATUM PROJECTION SCALE PLOT SIZE

Drawn MCG

DRAWING NUMBER: 9W0421/Phase1/4.1e

PROJECT TITLE

DOGGER BANK CREYKE BECK

DRAWING TITLE

Figure 4.1e

REMARKS Checked

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Figure 6.1b

Data Source:
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British Geological Survey. ©NERC. All rights Reserved

Legend

- Proposed Onshore Cable Route
- Proposed Onshore Cable Corridor (1km)
- Quarry
- Shaft (unspecified Quarry or Mine)
- Sheep Dip
- Tanks
- Electricity Substation
- Embankment
- Railway
- Roads
- Active Landfill
- Potential Landfills and infilled drains
- Historical Landfills
- Waste Management Facilities
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Legend

Onshore Cable Details and Converter Station Details

- Direct Current cable route (36m working width)
- Alternating Current cable route (38m working width)
- Primary Site Compound (100m x 90m)
- Intermediate Site Compound (28m x 28m)
- Onshore Development Footprint - 1km Buffer
- Converter stations site
- Indicative access point for construction traffic via existing public road onto haul road
- Major HDD entry and exit working areas (53m x 40m)
- Minor HDD entry and exist working areas (36m x 36m)
- Minor HDD or Trench entry and exist working areas (36m x 36m)
- Historical Landfills

Data Source: Ordnance Survey data © Crown copyright and database right, 2012

Figure 6.2

LEGEND

Onshore Cable Details and Converter Station Details

- Direct Current cable route (36m working width)
- Alternating Current cable route (38m working width)
- Primary Site Compound (100m x 90m)
- Intermediate Site Compound (28m x 28m)
- Onshore Development Footprint - 1km Buffer
- Converter stations site
- Indicative access point for construction traffic via existing public road onto haul road
- Major HDD entry and exit working areas (53m x 40m)
- Minor HDD entry and exist working areas (36m x 36m)
- Minor HDD or Trench entry and exist working areas (36m x 36m)
- Historical Landfills

Data Source: Ordnance Survey data © Crown copyright and database right, 2012
Land at Woodmansey Grange (standing on access road to Thorndyke Farm looking to the north west)

Land at Woodmansey Grange (standing on access road to Thorndyke Farm looking to the south west)
Access road to Thorndyke Farm facing west

Land at Woodmansey Grange facing east towards Thorndyke Farm
Access road to Thorndyke Farm facing east towards Land at Woodmansey Grange

Access road to Thorndyke Farm
Western boundary of land at Woodmansey Grange

Western boundary of Woodmansey Grange Land facing north
Western boundary of Woodmansey Grange land facing west

Western boundary of Woodmansey Grange land facing west
Northern boundary of land at Woodmansey Grange

Drain flowing west to east within land at Thorndyke Farm
Drain flowing west to east within land at Thorndyke Farm

Northern boundary of Thorndyke Farm, facing north towards Figham Common
Northern boundary of Thorndyke Farm facing east

Land at Thorndyke Farm. At the north east boundary facing south west
Land at Thorndyke Farm facing south towards a ‘wetland’ area
Eastern boundary of Thorndyke Farm facing north

Eastern boundary of Thorndyke Farm facing south towards the orchard
Pond at land within Woodmansey Grange
Fishing ponds near Brandesburton (NGR TA 097 487)
Appendix B
BGS Borehole Logs
<table>
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<th>NATURE OF STRATA</th>
<th>THICKNESS</th>
<th>DEPTH</th>
</tr>
</thead>
<tbody>
<tr>
<td>Top Soil &amp; Clay</td>
<td>28 0</td>
<td></td>
</tr>
<tr>
<td>Chalk</td>
<td>62 0 90</td>
<td>0</td>
</tr>
</tbody>
</table>
NATURE OF STRATA

| Soil        | 0.91 | 3 | 0 | 0.91 |
| Clay        | 0.46 | 1 | 6 | 4.6  |
| Sand        | 0.15 | 0 | 6 | 5.0  |
| Clay        | 2.13 | 7 | 0 | 12.0 |
| Sand        | 0.15 | 0 | 6 | 12.6 |
| Clay        | 4.42 | 1 | 4 | 27.0 |
| Chalk       | 0.61 | 2 | 0 | 24.0 |
| Sand        | 1.52 | 5 | 0 | 34.0 |
| Clay        | 4.57 | 1 | 5 | 49.0 |
| Chalk       | 12.19| 4 | 0 | 89.0 |

May 1938

Garage, Ruth

Total solid matter in solution 476.000 pts/million
Nitrites  Nil
Chlorine  30.000
Albuminoid Ammonia  0.080
Free Ammonia  0.050
Colonies per 1 M.L. after 48 hours  130
"  72 hours Liquitated.
E. Coli in 100 M.L. Neg. but:
E. Liquid+Cadens Fluorescens Positive.
In addition there is a yellow coloured sediment 179.3
consisting of Silicious matter 82.7, Iron and Aluminum Oxides
14.0, Chalk (Ca CO3) 135, Magnesium Carbonate (Mg CO3) 2.8
contaminated with surface drainage. Water unfit for drinking
or domestic supply.

J.A. Foster.
<table>
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<th>Nature of Strata</th>
<th>Thickness</th>
<th>Depth</th>
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<tr>
<td>Soil</td>
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<td>6</td>
</tr>
<tr>
<td>Peaty clay</td>
<td>7</td>
<td>6</td>
</tr>
<tr>
<td>Blue clay</td>
<td>6</td>
<td>15</td>
</tr>
<tr>
<td>Sand &amp; gravel</td>
<td>4</td>
<td>19</td>
</tr>
<tr>
<td>Boulder clay</td>
<td>26</td>
<td>15</td>
</tr>
<tr>
<td>Chalk bearings (little water)</td>
<td>3</td>
<td>48</td>
</tr>
<tr>
<td>Chalk with small flint pebbles (water)</td>
<td>12</td>
<td>60</td>
</tr>
<tr>
<td>Flint</td>
<td>1</td>
<td>61</td>
</tr>
<tr>
<td>Chalk with small flint back</td>
<td>24</td>
<td>85</td>
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(FLINT suggests Durham chalk; probably in Error; if not probably a local interlayer brought up by faulting.)

C. Godwin
1952
Brandeburton Lane, 1872.

2. Brandeburton Lane, 1872.

A. Hand pump. Hand water.

Name known to men only. Used for farming purposes only. The farm house is not the main supply.

B. There is also another hand pump on the farm, which is also used for farming purposes.

The well (present owner of farm July 1941) showed me the approximate site of a well which has now been filled in. Both are bone.

Surface 30' O.D.

Visited visited on 6" old field line 196 N.E.(W)

3/4.

Brandeburton Lane. Bedded clay down to the chalk ... 88 ft.

8th July 1872. (from copy G. Villiers, architect.)

Leeu Jan: P. H. Martin Cooper, Brandeburton Halling, 7th July 1900.

Refer to billing at M.E. May, 1901. Run in, 3.6 months.

Both pumps donated.

A. To use for car washing; not accessible for measurement unless pipes at surface are.

VAM 11.3.70

Purchased in

Page 105
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<th>Aquifer:</th>
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<tr>
<td>Chalk</td>
<td>Drift</td>
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<thead>
<tr>
<th>Address of Site:</th>
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<tr>
<td>FRMSITEHORSE</td>
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| Owner: | |
|--------||

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<tr>
<th>Borehole Depth:</th>
<th>Dia:</th>
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| Castings: | |
|-----------||

| Name: | |
|-------||

| Diameter: | |
|-----------||
|           | |

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